UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

PROJECT MANAGEMENT PLAN FOR THE ST. LUCIA ELECTRICITY SERVICES LTD 3 MW SOLAR FARM PROJECT

SIBYL DOSTALIE

FINAL GRADUATION PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE
MASTER IN PROJECT MANAGEMENT (MPM) DEGREE

CASTRIES, SAINT LUCIA

March 2024

UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

This Final Graduation Project was approved by the University as partial fulfillment of the requirements to opt for the Master in Project Management (MPM) Degree

Sophia Crawford
TUTOR

_____

Paula Villalta Olivares
REVIEWER No.1

_____

Mónica González Ortega
REVIEWER No.2

Sibyl Dostalie
STUDENT

DEDICATION

This Final Graduation Project (FGP) is dedicated to God the Almighty Father. I wish to thank Him for every opportunity and blessing and for the incessant support, strength, patience and knowledge bestowed upon me as I worked tirelessly to successfully complete this research project.

ACKNOWLEDGMENTS

To God be the glory, great things He has done! My deepest gratitude to God for providing me with this opportunity and for the knowledge and support bestowed upon me throughout this journey.

I wish to thank the UCI team, particularly my FGP tutor, Ms. Sophia Crawford for her continuous guidance during the development of this FGP. I express gratitude to the Organization of American States (OAS) for this research opportunity and to LUCELEC for allowing the theoretical research of its 3 MW Solar Farm Project.

Furthermore, I wish to thank my parents for always supporting my academic endeavours and for their unwavering support throughout this process. I am also grateful for the individuals who continuously encouraged me throughout the completion of this program.

ABSTRACT

The objective of this document is to develop a project management plan for the construction of a 3 MW (megawatt) PV (photovoltaic) solar farm project in Vieux Fort. The global energy crisis along with the United Nation's mandate to reduce carbon dioxide emissions created the urgent need for the St. Lucia Electricity Services Ltd to expand into the renewable energy sector. The solar farm project will produce about five per cent of Saint Lucia's electricity demand and reduce the yearly volume of fuel purchased by LUCELEC.

The final product of this project consists of plans to ensure the successful construction of the 3 MW solar farm. This study is made up of the final deliverables of the project that correspond to the charter and the management plans for scope, schedule, cost, quality, resources, communications, risks, procurement, stakeholders, and sustainability. A combination of quantitative and qualitative research methods will be used throughout the course of this study.

INDEX OF CONTENTS

INDEX OF FIGURES

INDEX OF CHARTS

ABBREVIATIONS AND ACRONYMS

AC	Actual Cost
CIC	Clinton Climate Initiative
COQ	Cost of Quality
CPI	Cost Performance Index
CV	Cost Value
DNV	Det Norske Veritas
EVM	Earned Value Management
FGP	Final Graduation Project
GPM	Green Project Management
ISO	International Organization for Standardization
KWH	Kilowatt
LUCELEC	St. Lucia Electricity Services Ltd
MW	Megawatt
NETS	National Energy Transition Strategy
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PMO	Project Management Office
PV	Planned Value
RACI	Responsible Accountable Consulted Informed
RBS	Risk Breakdown Structure
RMI	Rocky Mountain Institute
SDGs	Sustainable Development Goals
SPI	Schedule Performance Index
SV	Schedule Value
TCPI	The Complete Performance Index
UNDP	United Nations Development Program
UN	United Nations
WBS	Work Breakdown Structure

EXECUTIVE SUMMARY

Throughout the last decade, LUCELEC has sought to promote clean and affordable energy as mandated by the UN and has explored alternative methods of generating electricity by using renewable resources. One of the company's noteworthy renewable energy projects was the construction of a 3 MW solar farm in the south of the island. The purpose of this Final Graduation Project (FGP) is to develop a project management plan that integrates the knowledge areas of project management in order to guide the construction of the 3 MW solar farm in Vieux Fort. The FGP will allow for the systematic execution of the project, and covers several project management knowledge areas.

The construction of the 3 MW solar farm will help the organization fulfill its system enhancement objective of diversification and renewable energy. The solar farm will also provide a new method of generating electricity that keeps the company's electricity system up to date with current technological advancements. In addition, the development of the project management plan will provide an opportunity to add project documents to the company's archives. This plan can later be used by the organization's Special Projects team for other proposed solar farm projects in the future.

The general objective of the project is to develop a project management plan for the construction of a 3 MW Solar Farm Project in La Tourney, Vieux Fort. The specific objectives are to develop the project charter that defines the key input elements to develop the project management plan and to develop the scope management plan that ensures that the project includes all the work required to complete the project successfully. Other objectives include the development of a schedule management plan to manage the timely completion of the project; to develop the cost management plan to ensure that the project is completed within the approved budget and to develop the quality management plan that ensures the project met the desired quality standards. Furthermore, the FGP aims to develop the resource management plan that identifies, acquires, and manages the resources needed for the successful completion of the project; to develop the communication management plan to organize and document the process, types, and expectations of communications throughout the project and to develop the risk management plan that identifies, monitors and controls the project risks. Further objectives include the development of the procurement management plan to efficiently organize the purchases of goods and services required for the project; to develop the stakeholder management plan for effective management of the goals and expectations of stakeholders throughout the project; and to develop a sustainability management plan to achieve sustainability objectives.

The methodology for this research was qualitative and quantitative. Data was collected from various primary and secondary sources. The research methods included interviews, focus groups and forecasting content and SWOT analyses.

The project is validated in the fields of sustainable and regenerative development. The solar farm is sustainable because solar panels capture solar energy from the sun, a renewable

source of energy, to generate electricity. One opportunity to improve the project's sustainability is the recycling of solar panels to increase the lifespan of the solar farm. Additionally, there is also the opportunity to expand into the agricultural sector through agri-voltaics. This unique farming method allows the use of land for farming and solar photovoltaic energy generation. It is important to note that the dual use of the solar farm can promote farming that can ultimately improve food security in the community of La Tourney, Vieux Fort.

1 INTRODUCTION

1.1. Background

The St. Lucia Electricity Services Limited (LUCELEC) is the sole electricity provider in Saint Lucia. The company was established in 1964 and continues to expand its operations to meet the growing demand in Saint Lucia. The company is governed by a Board of Directors and managed by an appointed Managing Director. Over the last ten years, there has been a sharp focus on the renewable energy sector and the potential benefits of utilizing renewable resources to produce electricity. As a result, LUCELEC, like many other fuel-dependent companies, has formulated long-term strategies that are aligned with the United Nations (UN) Sustainable Development Goals (SDGs); specifically goal number 7 of "affordable and clean energy" that seeks to ensure access to affordable, reliable, sustainable and modern energy for all. (Goal 7: Affordable and Clean Energy - the Global Goals, 2023)

The company's main objective is to diversify its electricity product to achieve SDG goal number 7 and to align with the Government of St. Lucia's energy transition strategy. It also seeks to meet the needs of the environmentally conscious customer by providing a clean energy alternative to its current fuel-based electricity. The construction of the 3 MW solar farm is an important project undertaken to help achieve these objectives and expand into the renewable energy sector.

1.2. Statement of the Problem

The St. Lucia Electricity Services Limited has embarked on the construction of a 3 MW solar farm to fulfill the objective of system enhancement which includes fuel diversification and renewable energy and introducing new technologies where appropriate to keep the electricity system on the cutting edge. (LUCELEC, n.d.) This project presents an opportunity for the development of a project management plan to ensure the project's success. The project management plan will document and archive lessons learned for subsequent renewable energy projects.

Due to the absence of a project management plan, the FGP will seek to develop a plan to provide the necessary project framework and project management governance for the construction of the 3 MW solar farm. The development of a project management plan will provide guidelines for executing the project management knowledge areas to ensure that the successful completion of the project. The project management plan will be an important tool for the Special Projects Unit, and will serve as a blueprint for future solar farm projects undertaken by the organization. Additionally, as the Special Projects Unit undertakes more renewable energy projects, this can pave the way for the creation of a Project Management Office (PMO). This project management plan can ultimately provide a basis for future renewable energy projects undertaken by the organization.

1.3. Purpose

The purpose of this project is to develop a project management plan that integrates the knowledge areas of project management to guide the construction of a 3 MW solar farm in Vieux Fort. This FGP will allow for the systematic execution of the project, covering important areas that will help with the achievement of a successful outcome. The plan will identify the limitations and boundaries of the project and ensure clarity on the project's deliverables. Furthermore, it will ensure a transparent schedule development process by providing the team with clear information on the project's budget and timeline. The plan will also develop a sustainable management plan for the construction of the solar farm and will allow for the timely completion of project activities according to the established standards.

The FGP is important to establish the resource requirements for the solar farm by listing the essential human and physical resources required for the various activities. It will also provide a definition of done for the solar farm project thus preventing issues arising from unclear stakeholder expectations. Another important benefit of the FGP is the identification of the risks associated with the solar farm. The risk management plan will define and document the risk identification and management process, allowing the project team to respond to those risks appropriately. The risk management plan will also ensure that adequate resources are available to handle any unexpected risks that may arise. Furthermore, the FGP will outline the project's communication management that will assist with stakeholder engagement.

Overall, the development of a project management plan will allow the project manager to define the project's objectives thus keeping the team focused on the achievement

of the deliverable. This will ensure effective execution that will translate to a successful project. A successful project will generate stakeholder interest in the renewable energy projects, thus paving the way for more clean energy projects in the organization.

1.4. General Objective

To develop a project management plan for the construction of a 3 MW Solar Farm Project in La Tourney, Vieux Fort.

1.5 Specific Objectives

1. To develop the project charter in order to define the key input elements required to develop the project management plan.
2. To develop the scope management plan to ensure that the project includes all the work required to complete the project successfully.
3. To develop the schedule management plan to manage the timely completion of the project.
4. To develop the cost management plan to ensure that the project is completed within the approved budget.
5. To develop the quality management plan to ensure that the project meets the desired quality standards.
6. To develop the resource management plan to identify, acquire, and manage the resources needed for the successful completion of the project.

7. To develop the communication management plan to organize and document the process, types, and expectations of communications throughout the project.
8. To develop the risk management plan to identify, monitor and control project risks.
9. To develop the procurement management plan to efficiently organize the purchases of goods and services required for the project.
10. To develop the stakeholder management plan to effectively manage the goals and expectations of stakeholders throughout the project.
11. To develop a sustainability management plan to achieve sustainability objectives.

2 THEORETICAL FRAMEWORK

2.1 Company/Enterprise

Company/Enterprise Background

LUCELEC is the sole electricity provider in St. Lucia with approximately 71,000 customers. In the 1970's the company faced a rapid increase in demand for power as hotel development and banana production transformed the economy. Average demand grew by almost 30%, a doubling of capacity every three years, putting huge strains on man power and equipment resources. As a result, two new power stations were commissioned and the basic, and still existing, 11kV sub-transmission system was erected. (LUCELEC n.d., para. 5)

Today the demand for affordable renewable energy is increasing. As a result, the company has undertaken the construction of a 3 MW solar farm which will meet about five percent of its demand and reduce the volume of fuel purchased by approximately three

hundred thousand gallons per year. (LUCELEC, n.d., para. 6) The project management plan developed for the 3 MW solar farm will serve as an important guide to ensure the success of this project.

As an electricity company, one of the organization's objectives is to implement sustainably based strategies aligned with the United Nations (UN's) sustainable development goal number 7 of affordable and clean energy. The global environment is becoming more volatile and customers' needs are changing rapidly along with the changing environment. As a result, the business-as-usual philosophy no longer holds for organizations particularly those organizations that are fuel-dependent such as LUCELEC. Environmental, social, and legislative changes have prompted LUCELEC to employ a strategic business initiative to provide alternative means of electricity to consumers.

The 3 MW Solar Farm Project is one of the organization's most notable renewable energy projects undertaken to achieve its strategic goals. The Special Projects Unit has the responsibility for executing and overseeing the implementation of the 3 MW Solar Farm Project. In the absence of a comprehensive project management plan, an opportunity exists to develop and document a project management plan for the project. Consequently, this FGP will develop a project management plan to guide the successful execution of the project.

2.1.2 Mission and Vision Statements

Mission Statement

"We deliver efficient energy services that are safe, reliable, and environmentally responsible. We meet the expectations of our customers, shareholders and employees and we are a catalyst for social and economic development in St. Lucia." (LUCELEC, n.d.) The construction of the 3 MW solar farm is one of the environmentally responsible initiatives that the company has embarked on to reduce its total cost of fuel. It is also a small step in the direction of reducing the country's fuel emissions and meeting the UN's sustainable development goal number 7 of clean energy.

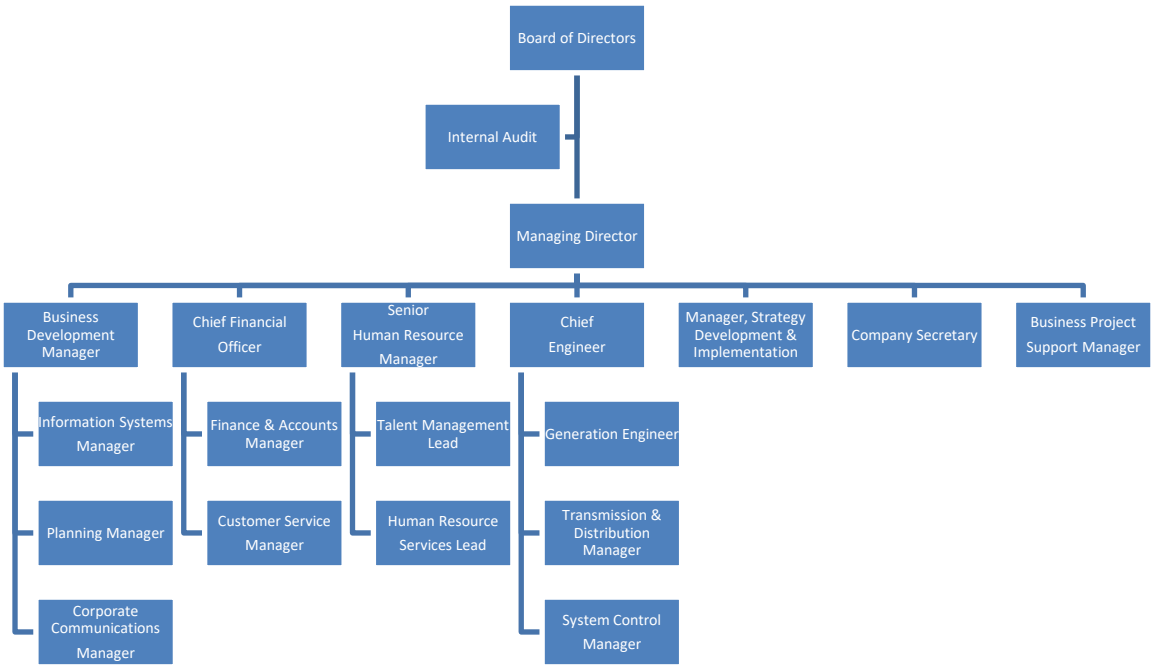
Vision Statement

The company's vision is to be the energy that powers our nation's success. (LUCELEC, n.d.)

The construction of the solar farm represents the move toward renewable energy generation that is essential for fueling the country's economic activity in a sustainable way.

2.1.3 Organizational Structure

Figure 1 Organizational Structure (Source: LUCELEC, n.d.)



St. Lucia Electricity Services Ltd is governed by a Board of Directors and managed by an appointed Managing Director. The Board of Directors oversees the Governance, Audit, Human Resource and Special Projects and Investment Committees. The Internal Auditor reports to the Audit Committee while the Business Development Manager, Chief Financial Officer, Senior Human Resources Officer, and the Chief Engineer report to the Managing Director. The Information Systems, Planning and Corporate Communications Managers report to the Business Development Manager. The Finance & Accounts, and Customer Service Managers report to the Chief Financial Officer.

The Managing Director oversees the roles of the Corporate Secretary, Business Support Manager and the Manager for Strategy Development & Implementation.

Furthermore, the Generation, System Control Engineers and the Transmission and Distribution Manager all report to the Chief Engineer. The Business Development Manager's role focuses on diversifying the company's current offerings and tapping into the renewable energy sector with sustainable projects that will reduce the company's fuel costs.

2.1.4 Products Offered

The St. Lucia Electricity Services Ltd is the sole electricity provider in the Saint Lucia thus its main offering is electricity generation and transmission. The company also provides other services which include:

- Electric car charging stations
- Meter installations
- Meter maintenance
- Installation and maintenance of transformers
- Maintenance of 66 KV lines
- Streetlight installing and maintenance
- Pole planting and relocation of lines and poles
- Maintenance of electrical infrastructure.

The dynamic global environment has created the need for the company to expand its product portfolio in order to remain relevant and meet the changing needs of its customers. The construction of the 3 MW solar farm is geared toward the production of clean energy and is a move that will expand the company's current sustainable energy program. The solar

farm project will generate clean energy and also encourage the shift toward sustainable energy practices in the country.

2.2 Project Management Concepts

2.2.1 Project

A project is a temporary endeavor undertaken to create a unique product, service, or result. (Project Management Institute, 2017, p.36) The objective of the FGP is to develop a project management plan for the construction of a 3 MW solar farm project in La Tourney, Vieux Fort. The FGP is a temporary endeavor with a duration of 3 months that seeks to develop a project management plan that is a unique product.

2.2.2 Project Management Principles

The Project Management Institute (2021) identifies twelve principles aligned with the values identified in the PMI Code of Ethics and Professional Conduct. (pg.21) These principles will be used to guide effective project management of the 3 MW Solar Farm Project and to ensure that the project is successful. The following principles outlined by the Project Management Institute (2021) are:

1. Stewardship: The project manager will be a diligent, respectful, and caring steward by gaining and maintaining the team's trust and fostering a collaborative environment. The project manager will be trustworthy and lead the project team with integrity and compliance.

2. Team: The project manager will be committed to the development of the project team members by treating them fairly and providing access to opportunities and ensuring that compensation is commensurate with their skills and qualifications.

3. Stakeholders: The project manager will engage stakeholders proactively and to the degree needed to contribute to project success and customer satisfaction.

4. Value: The project manager will continually evaluate and adjust the project alignment to business objectives and intended benefits and value.

5. Systems Thinking: The project manager will recognize, evaluate, and respond to the dynamic circumstances within and surrounding the project.

6. Leadership: During the implementation of the Project Management Plan, the project manager will demonstrate effective leadership by demonstrating honesty, integrity and ethical behaviours.

7. Tailoring: The developmental approach used will be tailored based on the context of the project its objectives, stakeholders, governance, and the environment using the adequate processes to achieve the desired outcome while maximizing value, managing cost, and enhancing speed.

8. Quality: The project manager will maintain a focus on quality that produces deliverables that meet the project objectives and align to the needs, uses, and acceptance requirements set forth by the stakeholders.

9. Complexity: The project manager will continually evaluate and navigate the project complexity so that approaches and plans enable the project team to navigate the project life cycle.

10. Risk: The project manager will continually evaluate exposure to risk, both opportunities and threats, to maximize positive impacts and minimize negative impacts to the project and its outcomes.

11. Adaptability and Resiliency: The project manager will adapt the project to changing conditions and build adaptability and resilience to recover from setbacks to advance the work of the project.

12. Change: The project manager will prepare the stakeholders and others affected for the adoption and sustainment of new and different behaviors and processes required for the transition from the current state to the intended future state created by the project outcomes.

2.2.3 Project Management Domains

The Project Management Institute (2021 p.) defines a project performance domain as a group of related activities that are critical for the effective delivery of project outcomes. Project performance domains are interactive, interrelated, and interdependent areas of focus that work in unison to achieve desired project outcomes. The following project performance domains as defined by the Project Management Institute (2021) will be vital for achievement of the project outcomes.

1. Stakeholder – This domain will address the activities and functions of the project stakeholders. It is important to note that effective stakeholder interaction contributes to successful project outcomes. The project manager will implement stakeholder engagement strategies and actions to promote productive involvement of stakeholders in project decision making and implementation.

2. Team – The team performance domain will address the activities and functions associated with the project team, who is responsible for producing project deliverables that realize business outcomes. The project manager will foster an environment, which supports the team in evolving into a high-performance team. This includes fostering team development, encouraging leadership behaviors from all project team members and sharing ownership for the project outcomes.

3. Development Approach & Life Cycle - The Development Approach & Life Cycle Performance Domain will address the activities and functions associated with the development approach, cadence and life cycle phases of the project. The project deliverables will determine the most appropriate development approach such as a predictive, adaptive, or hybrid approach.

4. Planning - The Planning Performance Domain will address the activities and functions associated with the initial, ongoing, and evolving organization and

coordination necessary for delivering project deliverables and outcomes. The project manager will plan, organize, elaborate, and coordinate work throughout the project.

5. Project Work - Project work domain is associated with establishing the processes and performing the work to enable the project team to deliver the expected value and outcomes. The project work will include communication, engagement, managing physical resources, procurements and other work to keep the project running smoothly.

6. Delivery - The delivery performance domain will address the activities and functions associated with delivering the scope and quality that the project was undertaken to achieve. The project delivery will focus on meeting requirements, scope, and quality expectations to deliver the expected outputs that will drive intended outcomes.

7. Measurement – Measurement will involve assessing the project performance and implementing appropriate responses to maintain optimal performance. The measurement performance domain will evaluate the degree to which the project deliveries and performance are meeting the intended outcomes.

8. Uncertainty - The uncertainty performance domain will address the activities and functions associated with risk and uncertainty. The project exists in an environment with varying degrees of uncertainty, and uncertainty presents threats and opportunities. As a result, the project manager must explore, assess, and then decide how to handle any uncertainty to ensure that the project is successful.

2.2.4 Predictive, Adaptive and Hybrid Projects

1. Predictive Projects

In predictive projects, the time, cost and scope, are determined through careful planning. According to The Project Management Institute (2021), in a predictive life cycle, each phase is only performed once, and each phase focuses on a particular type of work. (p.43) In this life cycle the project scope, time and cost are determined in the early phases of the life cycle. Predictive life cycles are applied when the project requirements are clear with predictable outcomes. Additionally, a predictive project is usually undertaken in an environment with low uncertainty where the project team has experience with similar projects. Predictive life cycles are referred to as waterfall cycles. The project manager is responsible for determining the project life cycle of the project. The project will follow a predictive life cycle because it must utilize a set template and must be completed within a set 3-month schedule.

2. Adaptive Projects

In adaptive projects, scope planning is constant, and the work done on the project is prioritized in the product backlog. According to the Project Management Institute (2021), adaptive life cycles are agile, iterative, or incremental. The detailed scope is defined and approved before the start of an iteration. These life cycles are also called agile or change-driven life cycles. Although the project utilizes a predictive approach to project management, it is recommended that the project life cycle needs to be flexible enough to deal with the various environmental and economic conditions that may be encountered during project execution. The project will be developed when more detailed and specific information becomes available through research and interviews. Therefore, the ability to evolve and adapt is particularly important in an environment in which change is constant and there is a high degree of uncertainty.

3. Hybrid Projects

Hybrid projects combine agile or adaptive and predictive methodologies. Agile methodologies are more flexible with emphasis on team cohesion, stakeholder engagement, and communication. Alternatively, predictive methodologies are more rigid with a strict project development path.

2.2.5 Project Management

Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. Project management is accomplished through the appropriate application and integration of the project management processes

identified for the project. It is essential because it enables organizations to execute projects effectively and efficiently. (Project Management Institute, 2017 p.521)

LUCELEC does not have a project management office to oversee its project operations, therefore, the project management plan for the 3 MW Solar Farm Project will ensure successful project management through:

1. Realistic project planning - The project manager will set realistic and attainable objectives and periods to ensure the project's success. Additionally, the Project Management Plan will cover the project management knowledge areas.

2. Clear focus and objectives - The project manager will set clear and specific objectives that will allow for the achievement of the project's general objective.

3. Strategic alignment - The project will be aligned with the organization's strategic direction and its long-term mission and vision.

4. Managed process - The project will be executed and managed according to the Project Management Plan framework and will follow the principles of the Project Management Institute guidelines.

5. Quality control - The project manager will ensure that the project deliverables meet the acceptance criteria defined during quality planning.

6. Reduced costs - The project manager will aim to reduce the costs associated with the project and strive to work within the stipulated budget.

2.2.6 Project Management Knowledge Areas and Processes

The project knowledge areas as defined by the Project Management Institute (2017) are:

1. Project integration management includes the processes and activities necessary to identify, define, combine, unify, and coordinate the various project management processes and activities within the Project Management Process Groups. (PMI, 2017, p.531) The Project Stakeholder Management processes include developing the project charter, developing the project management plan, directing and managing project work. This knowledge area also involves managing project knowledge, monitoring and controlling project work, and performing integrated change control. The phase concludes with closing the project or phase.

2. The project scope management is a component of the project management plan that describes how the scope will be defined, developed, monitored, controlled, and validated. (PMI, 2017, p.531) The scope management plan includes planning scope management, collecting the requirements and defining the scope. It also involves creating the work breakdown structure (WBS) as well as validating and controlling the scope.

3. Project Schedule Management includes the processes required to manage project completion on time. (PMI, 2017, p.531) The processes are planning schedule

management, defining activities, sequencing activities and estimating activity durations. Other processes include developing and controlling the schedule.

4. Project Cost Management includes the processes involved in planning, estimating, budgeting, financing, obtaining financing, managing and controlling costs so that the project is completed within the approved budget. (PMI, 2017, p.531) The Project Cost Management processes include planning cost management, estimating costs, determining the project budget and controlling costs.

5. Project Quality Management includes the processes for incorporating the organization's quality policy in terms of planning, managing and controlling project and product quality requirements to meet stakeholder objectives. (PMI, 2017, p. 531) The processes in this knowledge area are planning quality management, managing quality and performing quality control

6. Project Resource Management includes the processes for identifying, acquiring, and managing the resources necessary for the successful completion of the project. (PMI, 2017, p.531) The Project Resource Management processes include resource management planning, estimating the resources of the activities, acquiring the project resources, developing and managing the project team and controlling the project resources.

7. Project Communications Management includes the processes necessary to ensure that the information needs of the project and its stakeholders are met through the development of objects and the implementation of activities designed to achieve an effective exchange of information. (PMI, 2017, p.531) This knowledge area involves planning communications management as well as managing and monitoring communications.

8. Project Risk Management includes the processes for carrying out project risk management planning, identification, analysis, response planning, response implementation and monitoring. (PMI, 2017, p.531) The Project Risk Management processes include planning risk management, identifying risks and performing qualitative and quantitative risk analysis. Other processes include planning and implementing risk responses and monitoring risks.

9. Project Procurement Management includes the processes necessary to purchase or acquire products, services, or results that need to be obtained outside of the project team. (PMI, 2017, p.531) The Project Procurement Management processes include planning procurement management as well as carrying out and controlling acquisitions.

10. Project Stakeholder Management includes the processes required to identify individuals, groups, or organizations that may affect or be affected by the project, to

analyze stakeholder expectations and their impact on the project, and to develop management strategies to ensure effective stakeholder participation in project decisions and implementation. (PMI, 2017, p.531) The Project Stakeholder Management processes include identifying stakeholders, stakeholder engagement planning and managing and monitoring stakeholder engagement.

2.2.7 Group Processes

The Project Management Institute (2017) defines the five process groups as follows:

1. Initiating Process Group - The processes performed to define a new project or a new phase of an existing project by obtaining authorization to start the project or phase. (PMI, 2017, 532)

2. Planning Process Group - The processes required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve. (PMI, 2017, 532)

3. Executing Process Group - The processes performed to complete the work defined in the project management plan to satisfy the project requirements. (PMI, 2017, 532)

4. Monitoring and Controlling Process Group - The processes required to track, review, and regulate the progress and performance of the project; identify any areas

in which changes to the plan are required; and initiate the corresponding changes. (PMI, 2017, 532)

5. Closing Process Group - The processes performed to formally complete or close a project, phase, or contract. (PMI, 2017, 532)

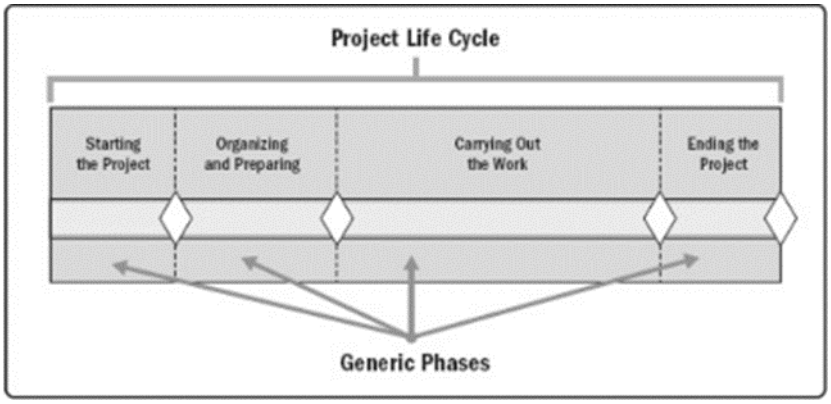
2.2.8 Project Life Cycle

According to the Project Management Institute (2021), a project life cycle is the series of phases that a project passes through from its start to its completion. A project phase is a collection of logically related project activities that culminates in the completion of one or more deliverables. The unique aspects of the organization, industry, development method can influence the project life cycle, or technology employed. While every project has a start and end, the specific deliverables and work that take place vary widely depending on the project. The life cycle provides the basic framework for managing the project, regardless of the specific work involved. Though projects vary in size and the amount of complexity they contain, a typical project can be mapped to the following project life cycle structure:

- Starting the project,
- Organizing and preparing,
- Carrying out the work, and
- Closing the project (pp. 526 – 527)

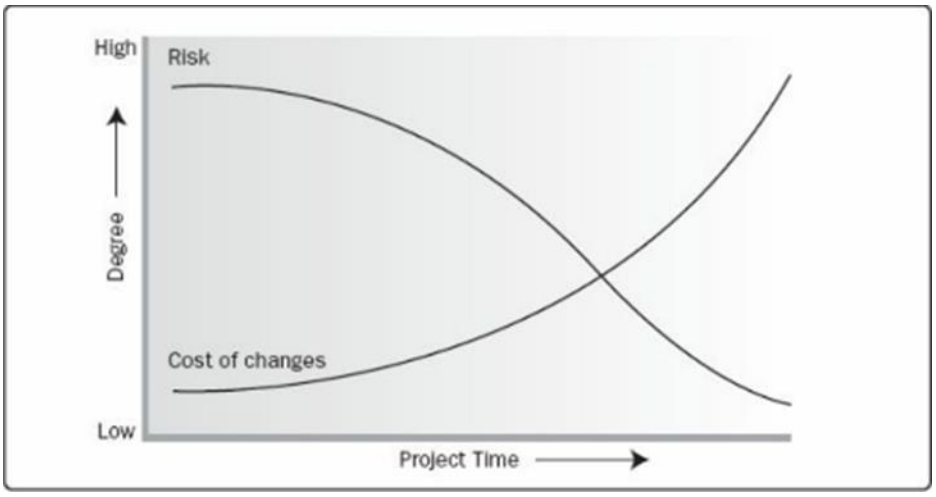
The project life cycle of the project management plan for the FGP, includes inception, feasibility, strategy, execution, post completion review and submission of the completed FGP.

Figure 2 Generic Depiction of a Project Life Cycle (Source: PMI, 2017)



Note: Graph depicting the generic phases of a project life cycle. Reprinted from the *Project Management Institute* (p.527), by Project Management Institute, 2017, Project Management Institute. Copyright 2017 by The Project Management Institute, Inc. Reprinted with permission.

Figure 3 Impact of Variables over Time (Source: PMI, 2017)



Note: Graph depicting the impact of variable over time. Reprinted from the *Project Management Institute* (p.528), by Project Management Institute, 2017, Project Management Institute. Copyright 2017 by The Project Management Institute, Inc. Reprinted with permission.

2.2.9 Company Strategy, Portfolios, Programs and Projects

The company has several strategies that will help achieve its sustainable energy objectives for the next ten years. According to LUCELEC (n.d.), its strategic focus involves:

- Excellence in Customer Care: improving the quality of service to and care for the customer.
- Care and Development of LUCELEC's Human Resources - continue to prepare the team for the new developments in the industry and changing work practices
- Excellence in Environmental Stewardship - develop and maintain modern Environmental Management Systems

- System Enhancement includes Network Improvement, Fuel Diversification, and Renewable Energy. This will ensure that the company expands, refurbishes, reinforces the generation and transmission and distribution infrastructure and introduces new technologies where appropriate to keep the electricity system on the cutting edge.
- Effective Risk Management System - Establish systems and processes that mitigate risks and establish an appropriate risk culture in the organization, including being ready for the changing regulatory environment.
- Cost Optimization - To manage costs for optimal efficiency.
- Corporate Diversification - Identify and implement new business opportunities.

2.2.10 Portfolios, Programs and Projects

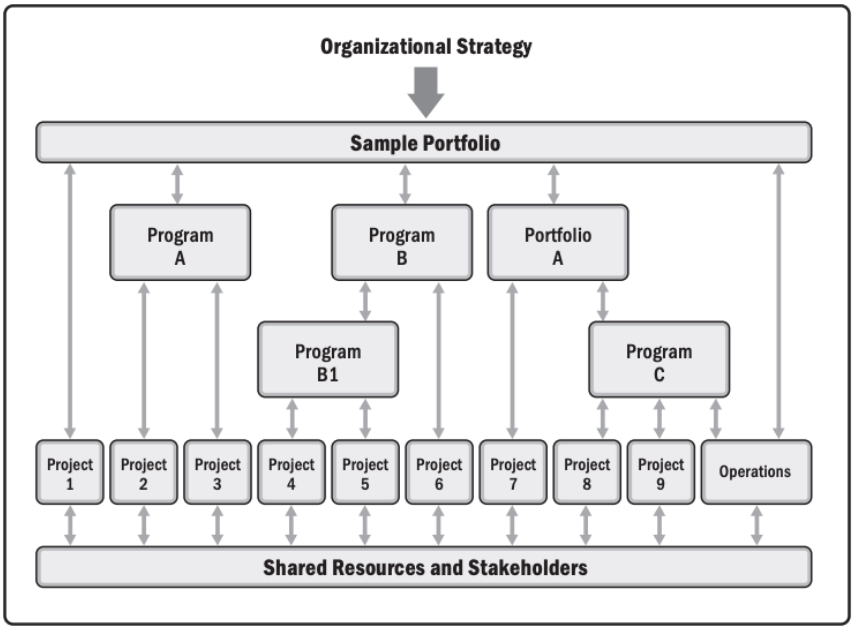
- Portfolio – Portfolios are defined as projects, programs, subsidiary portfolios, and operations managed in a coordinated manner to achieve strategic objectives. Portfolio management is the centralized management of one or more portfolios to achieve strategic objectives. (PMI 2017 pg. 522)

- A program is defined as related projects, subsidiary programs, and program activities managed in a coordinated manner to obtain benefits not available from managing them individually. Programs include program related work outside the scope of the discrete projects in the program. (PMI 2017, pg. 522)

- A project may be managed in three separate scenarios: as a stand-alone project (outside a portfolio or program); within a program; or within a portfolio. Project management has interactions with portfolio and program management when a project is within a portfolio or program. (PMI 2017 pg. 523)

The St. Lucia Electricity Services Ltd.'s strategy to diversify and produce clean energy has led the Special Projects Unit to consider various renewable energy projects. Without a Project Management Office or a Project Unit, future projects will be managed separately and not grouped under programs and portfolios.

Figure 4 Portfolios, Projects, Programs and Operations (Source: PMI, 2017)



Note: Graph depicting the organizational strategy. Reprinted from the *Project Management Institute* (p.43), by Project Management Institute, 2017, Project Management Institute. Copyright 2017 by The Project Management Institute, Inc. Reprinted with permission.

Figure 5 Overview of Portfolios, Programs and Projects (Source: PMI, 2017)

Comparative Overview of Portfolios, Programs, and Projects

Organizational Project Management			
	Projects	**Programs**	**Portfolios**
Definition	A project is a temporary endeavor undertaken to create a unique product, service, or result.	A program is a group of related projects, subsidiary programs, and program activities that are managed in a coordinated manner to obtain benefits not available from managing them individually.	A portfolio is a collection of projects, programs, subsidiary portfolios, and operations managed as a group to achieve strategic objectives.
Scope	Projects have defined objectives. Scope is progressively elaborated throughout the project life cycle.	Programs have a scope that encompasses the scopes of its program components. Programs produce benefits to an organization by ensuring that the outputs and outcomes of program components are delivered in a coordinated and complementary manner.	Portfolios have an organizational scope that changes with the strategic objectives of the organization.
Change	Project managers expect change and implement processes to keep change managed and controlled.	Programs are managed in a manner that accepts and adapts to change as necessary to optimize the delivery of benefits as the program's components deliver outcomes and/or outputs.	Portfolio managers continuously monitor changes in the broader internal and external environments.
Planning	Project managers progressively elaborate high-level information into detailed plans throughout the project life cycle.	Programs are managed using high-level plans that track the interdependencies and progress of program components. Program plans are also used to guide planning at the component level.	Portfolio managers create and maintain necessary processes and communication relative to the aggregate portfolio.
Management	Project managers manage the project team to meet the project objectives.	Programs are managed by program managers who ensure that program benefits are delivered as expected, by coordinating the activities of a program's components.	Portfolio managers may manage or coordinate portfolio management staff, or program and project staff that may have reporting responsibilities into the aggregate portfolio.
Monitoring	Project managers monitor and control the work of producing the products, services, or results that the project was undertaken to produce.	Program managers monitor the progress of program components to ensure the overall goals, schedules, budget, and benefits of the program will be met.	Portfolio managers monitor strategic changes and aggregate resource allocation, performance results, and risk of the portfolio.
Success	Success is measured by product and project quality, timeliness, budget compliance, and degree of customer satisfaction.	A program's success is measured by the program's ability to deliver its intended benefits to an organization, and by the program's efficiency and effectiveness in delivering those benefits.	Success is measured in terms of the aggregate investment performance and benefit realization of the portfolio.

Note: A comparison of portfolios, programs and projects, Reprinted from the *Project Management Institute* (p.44), by Project Management Institute, 2017, Project Management Institute. Copyright 2017 by The Project Management Institute, Inc. Reprinted with permission.

2.3 Other Applicable Theories/Concepts Related to the Project Topic and Context

2.3.1 Tailoring

The appropriate project management processes, inputs, tools, techniques, outputs, and life cycle phases should be selected to manage a project. This selection activity is known as tailoring project management to the project. (PMI, 2017, p.57) Tailoring the means that will be used to achieve the project outcomes is performed so that the methods are suited for the environment and the culture. The documents, templates, and other artifacts will be tailored for use and this will ensure the artifacts are appropriate for the project and the organization. (PMI, 2021, p.137) The methodology used will thus be tailored to the FGP in order to obtain optimal results.

2.3.2. Current Situation of the Problem or Opportunity in Study

The current global climate and an increase in consumer awareness have led many organizations to be more socially responsible in the provision of products and services to their consumers. This, coupled with post-pandemic global supply chain issues and wars between nations have made the economic and social environment more volatile, which means that companies cannot continue with the "business as usual" philosophy. Organizations must make important strategic and business changes to continue being profitable and maintain sustainability. The management of LUCELEC is cognizant of those changes and is exploring ways to become a more sustainable and energy efficient company. The 3 MW Solar Farm Project is an important step in the organization's move toward sustainable energy.

Additionally, the Government of Saint Lucia has embarked on a National Energy Transition Strategy to help with the country's transition by advocating the use of renewable energy sources. The legislative changes associated with this strategy have prompted a change in LUCELEC's business strategy, fueling the need to provide clean and affordable electricity to consumers.

Furthermore, the goal of the 3 MW Solar Farm Project is to assist LUCELEC with obtaining some of its short-term sustainable electricity goals. However, in the absence of a Project Management Office (PMO), it is important for the company to have a comprehensive and effective project management plan to support the execution of the project. As a result, the project management plan that will provide guidance to the project team in order to ensure successful construction of the 3MW solar farm. This 3 MW solar farm will ultimately assist in the achievement of LUCELEC's sustainable objectives.

2.3.3 Previous Research done for the Topic in Study

Research conducted for the topic in study includes:

- Interviews to obtain insight on whether a project management plan exists for the 3 MW solar farm project;
- Online research from published articles about the project;
- Articles from the LUCELEC's website;
- Use of the Project Management Institute Guide to obtain relevant information to assist with the development of the project management plans.

i. Other theories related to the topic in study

Other theories related to the topic of study include**:**

- The Global Energy Crisis
- St. Lucia's Energy Transition Strategy
- Sustainable Development and Regenerative

1. Global Energy Crisis

The global energy crisis has led to global supply chain issues, as many companies are coming to terms with post-pandemic inflation and supply shortages. Electricity companies are particularly vulnerable to the surging prices of fuel and some companies have failed because they were unprepared for this crisis. This global shift will create a domino effect that affects every business activity in the global economy, leading to further shortages and inflation. Despite these issues, the company can use this as an opportunity and a catalyst for the transition to renewable energy. Comprehensive forecasting has allowed LUCELEC to re-strategize and consider several renewable energy projects to reduce its reliance on imported fuel. Once implemented, these projects will ensure business continuity and generate revenue to support the company's future initiatives.

2. St. Lucia's Energy Transition

According to Bunker et al. (2017), in 2014, the Government of Saint Lucia increased previously announced energy targets, setting a renewable energy penetration target of 35 per cent by 2020. Although the transition provides several opportunities for LUCELEC, an expansion into the renewable energy sector contains many risks. The transition requires

technical expertise from international organizations who specialize in the implementation of renewable energy projects. This transition also requires in-depth evaluation and market research to determine whether the amount of electricity generated from those alternative sources will be lucrative and sustainable in the long term. Furthermore, changing regulations associated with the transition will have an impact on LUCELEC's processes and operations. As a result, the company must update its business strategies and objectives to align with the National Energy Transition Strategy (NETS).

3. Sustainable and Regenerative Development

One of LUCELEC's strategic objectives involves reducing its carbon footprint and achieving the sustainable development goal of clean and affordable energy by the year 2030. Management understands the importance of sustainable and regenerative development and seeks to incorporate those goals and targets into the organization's business strategy. Corporate social responsibility advocates organizational accountability through methods and processes that enhance and improve the physical and social environment. LUCELEC can expand its corporate social responsibility through sustainable practices such as reducing gas emissions and engaging consumers on the importance of efficient energy use. The use of wind, solar and geothermal power can provide clean electricity with a positive long-term impact on the environment. The company can also venture into regenerative development by further expanding current sustainable projects. For example, the solar farm project can incorporate farming through agri-voltaics. This will improve the sustainability of the country's agricultural sector and food security.

3 METHODOLOGICAL FRAMEWORK

3.1 Information Sources

An information source refers to any entity or medium that provides data, facts, knowledge, or insights on a particular topic. They are used to gather data to learn about specific subjects, support decision-making, and contribute to the understanding and advancement of various fields of study. (What Does Information Source Mean? n.d.)

3.2 Primary Sources

Primary sources of information are firsthand accounts of research or an event including original scholarly research results, raw data, testimony, speeches, historic objects or other evidence that provides unique and original information about a person or an event. These sources are created at the time which the observation or event occurred but can also be created later by an eyewitness. Primary sources allow researchers direct access to original ideas, events, and data. (LibGuides: Primary, Secondary, and Tertiary Sources of Information in the Sciences: Types of Information Sources, n.d.)

The primary sources of information used include:

- Archived project documents
- Interviews with project engineers
- Technical reports
- Speeches

3.3 Secondary Sources

Secondary sources analyze, synthesize, evaluate, and interpret primary sources (or other secondary sources). Secondary sources are created after an event has occurred and are written by someone who did not experience or observe the event firsthand. - (LibGuides: Primary, Secondary, and Tertiary Sources of Information in the Sciences: Types of Information Sources, n.d.)

The secondary sources of information used include:

- Journal articles
- Textbooks
- The PMBOK Guide (6th and 7th editions)
- Sustainable Project Management: The GPM Reference Guide
- Literature reviews
- Internet articles

Chart No. 1 Information Sources (Source: Author)

Objectives	**Information sources**	
	Primary	**Secondary**
To develop the project charter to define the key input elements to develop the project management plan.	▪ Technical reports ▪ Interviews ▪ Archived project documents	▪ PMBOK Guide ▪ Literature reviews
To develop the scope management plan to ensure	▪ Interviews	▪ PMBOK Guide ▪ Textbooks

Objectives	Information sources	
	Primary	**Secondary**
that the project includes all the work required to complete the project successfully.	▪ Technical Reports	
To develop the schedule management plan to manage the timely completion of the project.	▪ Interviews ▪ Technical reports	▪ PMBOK Guide ▪ Textbooks ▪ Literature reviews
To develop the cost management plan to ensure that the project is completed within the approved budget.	▪ Interviews ▪ Archived project documents	▪ Literature reviews ▪ PMBOK Guide
To develop the quality management plan to ensure that the project meets the desired quality standards.	▪ Technical reports ▪ Archived project documents ▪ Interviews	▪ PMBOK Guide ▪ Journal articles ▪ Literature reviews
To develop the resource management plan to identify, acquire, and manage the resources needed for the successful completion of the project.	▪ Technical reports ▪ Interviews ▪ Archived project documents	▪ PMBOK Guide ▪ Journal articles ▪ Literature reviews
To develop the communication management plan to organize and	▪ Interviews	▪ PMBOK Guide ▪ Textbooks

Objectives	Information sources	
	Primary	**Secondary**
document the process, types, and expectations of communications throughout the project.	▪ Archived project documents	
To develop the risk management plan to identify, monitor and control project risks.	▪ Archived project documents ▪ Speeches ▪ Interviews	▪ PMBOK Guide ▪ Journal articles ▪ Literature reviews ▪ Textbooks
To develop the procurement management plan to efficiently organize the purchases of goods and services required for the project.	▪ Archived project documents ▪ Interviews	▪ PMBOK Guide ▪ Literature reviews
To develop the stakeholder management plan to effectively manage the goals and expectations of stakeholders throughout the project.	▪ Interviews ▪ Archived project documents ▪ Speeches	▪ PMBOK Guide ▪ Journal articles ▪ Literature reviews
To develop a Sustainability Management Plan to achieve sustainability objectives.	▪ Speeches	▪ Sustainable Project Management: The GPM Reference Guide ▪ Internet articles

3.4 Research Methods

Research Methods refer to the techniques, procedures, and processes used by researchers to collect, analyze, and interpret data in order to answer research questions or test hypotheses. (Hassan, 2023)

3.4.1 Qualitative Research Methods

Qualitative research methods are used to collect and analyze non-numerical data. This type of research is useful when the objective is to explore the meaning of phenomena, understand the experiences of individuals, or gain insights into complex social processes. (Hassan, 2023)

The following qualitative methods used include:

- Interviews
- Focus Groups
- Forecasting
- Content Analysis
- SWOT Analysis

3.4.2 Quantitative Research Methods

Quantitative research methods are used to collect and analyze numerical data. This type of research is useful when the objective is to test a hypothesis, determine cause-and-effect relationships, and measure the prevalence of certain phenomena. (Hassan, 2023)

Quantitative Research Methods used in the FGP include:

- Surveys
- Secondary data analysis
- Trend analysis
- Variance analysis
- Estimating

Chart No. 2 Research Methods (Source: Author)

Objectives	**Research methods**	
	Qualitative	**Quantitative**
To develop the project charter in order to define the key input elements to develop the project management plan.	Information will be gathered from interviews and from meetings with stakeholders and Subject Matter Experts (SMEs)	N/A
To develop the scope management plan to ensure that the project includes all the work required to complete the project successfully.	Data gathering methods will be used to define project goals, tasks, deliverables, costs and deadlines.	Secondary data analysis will be used to develop the project scope.
To develop the schedule management plan to manage the timely completion of the project.	Information will be gathered from interviews with engineers to develop the project schedule.	Estimating methods will be used to gather information from similar past projects to

Objectives	Research methods	
	Qualitative	**Quantitative**
		develop the schedule management plan.
To develop the cost management plan to ensure that the project is completed within the approved budget.	Meetings will be held with experts who have valuable information to develop the cost management	Estimating methods will be used to gather information from similar past projects to estimate project costs.
To develop the quality management plan to ensure that the project meets the desired quality standards.	Information will be gathered from interviews with SMEs to develop the quality management plan.	Secondary data analysis techniques such as cost benefit analysis will be used to develop the quality management plan.
To develop the resource management plan to identify, acquire, and manage the resources needed for the successful completion of the project.	Meetings and expert judgement will be used to gather data on the resources needed to develop the resource management plan.	Estimating methods will be used to estimate the resources required to develop the resource management plan.
To develop the communication management plan to organize and document the process, types, and expectations of	Meetings and interviews will be held to gather information to develop the communication management plan.	N/A

Objectives	Research methods	
	Qualitative	**Quantitative**
communications throughout the project.		
To develop the risk management plan to identify, monitor and control project risks.	Interviews and risk review meetings will be used to gather data.	Secondary data analysis methods such as reserve analysis will be used to develop the risk management plan.
To develop the procurement management plan to efficiently organize the purchases of goods and services required for the project.	Information will be gathered from interviews with SMEs to develop the procurement management plan.	Secondary data analysis will be used to procure goods and services in the development of the procurement management plan.
To develop the stakeholder management plan to effectively manage the goals and expectations of stakeholders throughout the project.	Stakeholder analysis and meetings will be used to develop the stakeholder management plan.	N/A
To develop a Sustainability Management Plan to	Information will be gathered from past projects and SMEs to develop the	N/A

Objectives	Research methods	
	Qualitative	Quantitative
achieve sustainability objectives.	sustainable development plan.	

3.5 Tools

Tools are templates, devices, systems or techniques used to collect, interpret, present and organize data. (Research Tools and Techniques, n.d.)

The following tools will be used:

- Interviews – Interviews will be conducted with subject matter experts to gather valuable information to assist with the development of the project management plan.
- Expert Judgement – The expert judgement of the technical team will assist in the development of the schedule and cost management plan.
- Decision Making – This will involve evaluating alternatives, weighing the project risks, and making informed choices to ensure that the project is completed on time and within budget.
- Meetings – Meetings will be held with the team to provide project status updates.

Chart No. 3 FGP Tools (Source: Author)

Objectives	**Tools**
To develop the project charter in order to define the key input elements to develop the project management plan.	Interviews, expert judgement and meetings
To develop the scope management plan to ensure that the project includes all the work required to be completed successfully	Expert judgement, meetings and alternatives analysis
To develop the schedule management plan to manage the timely completion of the project.	Forecasting, analogous estimating and expert judgement
To develop the cost management plan to ensure that the project is completed within the approved budget.	Earned value analysis, reserve analysis, cost of quality and expert judgement
To develop the quality management plan to ensure that the project meets the desired quality standards.	Benchmarking, meetings, cost benefit analysis, testing and inspection planning
To develop the resource management plan to identify, acquire, and manage the resources needed for the successful completion of the project.	Expert judgement, decision making, analogous estimating, Work Breakdown Structure and Resource Breakdown Structure
To develop the communication management plan to organize and document the process, types, and expectations of communications throughout the project.	Communication technology, project reporting and meetings

Objectives	Tools
To develop the risk management plan to identify, monitor and control project risks.	Expert judgement, SWOT analysis, checklists and assumptions and constraint analysis
To develop the procurement management plan to efficiently organize the purchases of goods and services required for the project.	Bidder conferences, cost and selection analysis, data analysis and inspections
To develop the stakeholder management plan to effectively manage the goals and expectations of stakeholders throughout the project.	Stakeholder analysis, kick-off meeting, status update meetings and feedback
To develop a Sustainability Management Plan to achieve sustainability objectives.	Expert judgement and meetings

3.6 Assumptions and Constraints

3.6.1 Assumptions

An assumption is a factor that is considered to be true, real, or certain, without proof or demonstration. (PMI, 2021, pg. 174)

3.6.2 Constraints

A constraint is a limiting factor that affects the execution of a project, program, portfolio, or process. (PMI, 2021, pg. 174)

Chart No. 4 FGP Assumptions and Constraints (Source: Author)

Objectives	Assumptions	Constraints
To develop the project charter in order to define the key input elements to develop the project management plan.	There is available project information to develop the project charter.	The project charter must meet established requirements.
To develop the scope management plan to ensure that the project includes all the work required to be completed successfully.	The project scope is well defined and documented.	Changes in the project scope may lead to scope creep.
To develop the schedule management plan to manage the timely completion of the project.	The project will be completed within schedule.	The project should not surpass the established schedule.
To develop the cost management plan to ensure that the project is completed within the approved budget.	The project will be implemented within the stipulated budget.	Unexpected costs may cause the project to surpass the budget.
To develop the quality management plan to ensure that the project	The project team will work to meet the established quality standards.	Quality requirements may change during the project without justification.

Objectives	Assumptions	Constraints
meets the desired quality standards.		
To develop the resource management plan to identify, acquire, and manage the resources needed for the successful completion of the project.	There will be adequate resources to complete the project.	There are not sufficient employees to be allocated to the project team on a full-time basis.
To develop the communication management plan to organize and document the process, types, and expectations of communications throughout the project.	The stakeholders and team are informed of the project expectations.	Frequent interruptions of the internet supply may disrupt virtual meetings
To develop the risk management plan to identify, monitor and control project risks.	The project risks have been identified and are understood by the team.	There are insufficient resources to manage project risks.
To develop the procurement management plan to efficiently organize the purchases of goods and	The goods and services required for the project are available.	Global supply chain issues may delay the delivery of equipment and materials required for the project.

Objectives	Assumptions	Constraints
services required for the project.		
To develop the stakeholder management plan to effectively manage the goals and expectations of stakeholders throughout the project.	The stakeholders are engaged, and their needs identified.	The stakeholders' interest may change during project implementation.
To develop a Sustainability Management Plan to achieve sustainability objectives.	The sustainable objectives are identified and documented.	The project must be guided by sustainable development principles.

3.7 Deliverables

A deliverable is defined as any unique and verifiable product, result, or capability to perform a service that must be produced to complete a process, phase, or project. (PMI, 2017, pg. 305)

Chart No. 5 FGP Deliverables (Source: Author)

Objectives	Deliverables
To develop the project charter in order to define the key input elements for the project management plan.	During the development of the project charter the project manager will define the project's scope, goals and objectives. The deliverables from this

Objectives	Deliverables
	process will be the project charter and the assumptions log. These deliverables will be used to develop the project management plan.
To develop the scope management plan to ensure that the project includes all the work required to be completed successfully.	The scope development will produce the scope and requirements management plan. The process will involve collecting requirements, defining the scope, creating the WBS as well as validating and controlling the scope. The deliverables will include the scope statement, WBS, WBS dictionary and the requirement traceability matrix. The stakeholders will validate the scope through the formal acceptance of the project deliverables. The process will be controlled by managing changes to the scope baseline.
To develop the schedule management plan to manage the timely completion of the project.	The development of the schedule will involve defining activities, sequencing activities and estimating activity durations. It will also involve analyzing resource requirements and schedule constraints.

Objectives	Deliverables
	Schedule development will produce the schedule management plan, the activity list, milestone list, activity attributes and change requests. The schedule will be controlled by monitoring the status of the project and updating the schedule baseline.
To develop the cost management plan to ensure that the project is completed within the approved budget.	Developing the cost management plan will involve planning cost management, estimating costs and determining the project budget. The deliverables of this process will include the cost management plan, cost estimates, basis of estimates, cost forecasts, and change requests. Controlling costs will involve monitoring the status of the project, updating the project costs and managing changes to the cost baseline.
To develop the quality management plan to ensure that the project meets the desired quality standards.	Developing quality management on the project will involve planning quality management, managing and controlling quality. The deliverables from this process will include the quality management

Objectives	Deliverables
	plan, quality metrics, quality reports and quality control measurements. The quality control process will monitor record the results of executing the quality management activities, assessing the project performance, taking corrective action to ensure that the established quality requirements are met and the stakeholders are satisfied.
To develop the resource management plan to identify, acquire, and manage the resources needed for the successful completion of the project.	Developing the resource management plan involves planning resource management, estimating activity resources, acquiring resources as well as developing and managing the project team. The deliverables from the process will include the resource management plan, team charter, resource requirements, basis of estimates, resource calendars and team assignments. The project will be controlled by ensuring the proper allocation of resources and monitoring the use of resources and taking corrective actions to address deviations.

Objectives	Deliverables
To develop the communication management plan to organize and document the process, types, and expectations of communications throughout the project.	Developing communication management will produce the communication management plan. The process involves planning, managing, and monitoring communication on the project. Other deliverables from this process will include project communications, project document updates and change requests. Project communication will continuously be monitored to ensure that there is an effective flow of information on the project.
To develop the risk management plan to identify, monitor and control project risks.	Developing risk management will involve planning risk management, identifying risks and performing qualitative and quantitative risk analysis. Additionally, the project manager will plan and implement risk responses and monitor the project risks. These deliverables for these processes will include the risk management plan, the risk register, risk report, work performance information and change requests.

Objectives	Deliverables
	The project manager will monitor risks by tracking, identifying and analyzing risks and ensuring that the risk process is effectively executed throughout the project.
To develop the procurement management plan to efficiently organize the purchases of goods and services required for the project.	Developing procurement management will involve planning, conducting and controlling procurement. The deliverables will include the procurement management plan, bid documents, procurement statement of work and make or buy decisions. Controlling procurement will allow the project manager to manage relationships with vendors, monitor contract performance, and make any changes and take corrections to close those contracts.
To develop the stakeholder management plan to effectively manage the goals and expectations of stakeholders throughout the project.	Developing stakeholder management involves identifying stakeholders, planning, managing and monitoring stakeholder engagement. The deliverables of these processes include the stakeholder register, stakeholder management plan, work performance information, change

Objectives	Deliverables
	requests and updates to the project management plan. Managing and monitoring stakeholder management will involve communicating and working with the project stakeholders and modifying the strategies and plans to maintain their support.
To develop a Sustainability Management Plan to achieve sustainability objectives.	Developing sustainability management will produce the sustainability management plan. It will include the purpose and the approach of the SMP, the roles and responsibilities of the project manager, project team and the Sustainability Impact owner. Additionally, the budget for the various sustainability related items will be developed. The plan will also identify the key performance indicators to measure sustainability and outline the potential impact on the sustainability of scope exclusions. The review and reporting measures will be identified and the P5 Impact Analysis will be developed.

4. RESULTS

4.1 Develop Project Charter

According to the Project Management Institute (2017), development of the project charter involves developing a document that formally authorizes the existence of a project and provides the project manager with the authority to apply organizational resources to project activities. Develop Project Charter is also the first process in the Initiating process group.

One of the specific objectives of the FGP is to develop a project charter to define the key input elements to develop the project management plan. The project charter also provides the project manager with the authority to apply organizational resources to project activities. The template provided by UCI was used to develop the project charter for the construction of the 3 MW Solar Farm Project.

Project Charter

	Project Charter
Project Name	Project Management Plan for the St. Lucia Electricity Services Ltd 3 MW Solar Farm Project.
Project Number	001
Document ID	001-LUCE-PC
Document Owner	LUCELEC
Issue Date	
Last Saved Date	
File Name	Project Charter

Version	**Issue Date**	**Changes**
1.0		Release

Role	**Name**	**Signature**	**Date**
Project Sponsor	LUCELEC		
Project Manager	TBD		

4.1.1 Introduction

The construction of a 3 MW solar farm in Vieux Fort is a renewable energy project undertaken by LUCELEC with regulatory support from the Government of Saint Lucia. The completed solar farm will reduce the company's fuel costs, and allow the company to achieve its sustainable business targets. The project team will obtain technical consultation and guidance from the Clinton Climate Initiative and the Rocky Mountain Institute. Grupotec, an international firm with extensive experience in the development of solar farms will undertake engineering and assist with procurement and construction of the project.

4.1.2 Purpose

The purpose of this project is to develop a project management plan that integrates the knowledge areas of project management to guide the construction of a 3 MW solar farm in Vieux Fort.

4.1.3 Scope

The construction of the 3 MW solar farm will include design and engineering, obtaining the requisite permits, financing and procurement. The proposed project will reduce LUCELEC's yearly fuel costs while providing an alternative source of electricity to consumers. The project is based on a fixed-price contract with a commitment estimate of XCD $20,000,000 dollars. The project will consist of the following milestones:

1. Preparation of the project site that will consist of a site survey, levelling of the site, marking of the mounting structure, drilling holes for the foundation, installing the inverters and solar panels and laying cables.

2. Construction of access roads.
3. Fencing of the project site.
4. Surveying
5. Grading
6. Utility Interconnection
7. Commissioning (functional testing)

4.1.1 Intended Audience

The intended audience of the construction of the 3 MW Solar Farm Project charter are the project sponsor LUCELEC, the Saint Lucia Government, and other stakeholders which include engineers from Grupotec and technical consultants from the Rocky Mountain Institute and the Clinton Climate Initiative.

4.1.2 Overview

Project Title

Project Management Plan for the St. Lucia Electricity Services Ltd 3 MW Solar Farm Project

Project Sponsor

St. Lucia Electricity Services Limited

Project Stakeholder

Government of St. Lucia

Project Manager

TBD

Location

La Tourney, Vieux Fort, St. Lucia

Project duration

15 Months

Budget

$20 million XCD

4.1.6 Project Description

To construct a 3 megawatt (MW) solar farm in La Tourney, Vieux Fort. This will reduce LUCELEC's fuel consumption and carbon dioxide emissions while allowing the organization to achieve its sustainable business objectives.

4.1.7 Business Case

LUCELEC is a socially responsible company that seeks to align its strategic goals in order to successfully navigate the dynamic economic and global environment. Over the last decade, companies were urged to reduce fossil fuel use and explore more sustainable renewable energy sources. Additionally, post-pandemic inflation coupled with the global oil crisis has emphasized the need for LUCELEC to reduce its yearly fuel costs. The construction of the solar farm will be an important step in reducing the company's fuel costs while providing an alternative means of electricity to consumers.

Additionally, the Government of Saint Lucia is seeking to reduce electricity costs and ensure energy independence through increased adoption of renewable energy and energy efficiency. As a result, renewable energy penetration targets have been set and it is a legal requirement for a certain amount of electricity to be produced using renewable energy sources. Furthermore, the United Nations continues to highlight the impact of carbon emissions from the use of fossil fuels. As 2030 approaches, LUCELEC must ensure that it lessens its carbon emissions as it seeks to accomplish SDG goal number 7 of clean energy while transitioning to a more sustainable company.

Finally, changes in consumers' electricity consumption have created the need for LUCELEC to explore renewable energy alternatives to provide a more affordable and environmentally friendly product to consumers.

4.1.8 Pre-assigned Resources and Main Requirements

Pre-assigned resources are an advance of physical team resources towards a project. This can happen particularly if the project is the result of specific resources identified as part of a competitive proposal or if the project is dependent upon the expertise of particular people.

The preassigned resources for the project are listed in the table below:

Chart No. 6 Project Resources (Source: Author)

Resource Name	Type of Resource
Contractors	Labour
Technical Team (Engineers & Specialists)	Labour
Project Management Team	Labour
Permits	Compliance
Electricians	Labour
Solar Panels	Material
Equipment	Equipment
Non-Labour (Land)	Land
Non-Labour (Insurance)	Compliance
Suppliers	Procurement
$20,000,000 XCD	Capital
Construction workers	Labour

4.1.9 Project Objectives

1. To construct a 3 MW solar farm in La Tourney, Vieux Fort.
2. To provide a clean and sustainable source of electricity to St. Lucian consumers.
3. To reduce LUCELEC's fuel dependency and high fuel costs.

4.1.10 Project Deliverables

The following are the deliverables of the 3 MW Solar Farm Project:

1. Feasibility Reports
2. Technical Reports
3. Financial Reports
4. Land register and deed of sale
5. Design plans and blueprints
6. Environmental, construction and electrical permits
7. Tenders and contract documents
8. Work safety policies
9. Completed construction works
10. Completed electrical works
11. Installed solar panels
12. Installed inverters
13. Installed SCADA and camera systems
14. Grid Interconnection map
15. Testing and commissioning reports
16. A 3 MW Solar Farm

4.1.11 Project Risks, Constraints and Assumptions

4.1.11.1 Risks

1. Saint Lucia is a small Caribbean island, prone to severe weather systems particularly during the hurricane season. Bad weather such as flooding and strong winds can delay the construction of the solar farm.

2. The inability for the company and landowner to come to an agreement on the sale of the land required for the solar farm can cancel the plans for the project. The solar farm requires various permits and approvals from various government ministries. There is the risk that the permits and approvals are not granted in a timely manner leading to delays that can affect the project schedule.

3. The technical team may not have adequate knowledge to provide training to the team and to oversee the project implementation.

4. Global supply chain issues may cause a delay in the procurement of the solar panels and other equipment required for the project. This delay can extend the project schedule.

5. The vendors may provide poor quality solar panels and materials that could compromise the performance of the solar farm.

6. High inflation rates can increase project costs and inflate the budget.

4.1.11.2 Constraints

1. The project has a fixed deadline and must be executed within a 15-month period.
2. The project must be executed within a $20 million-dollar budget.
3. The project team must produce the solar farm to meet all stakeholders' expectations.
4. The project must be completed by a small team of technicians and engineers.
5. This is the first solar farm project executed by the LUCELEC team.

4.1.11.3 Assumptions

1. The engineers will have expert knowledge of solar farm construction.
2. There will be sufficient resources to complete the project successfully.
3. The project will be completed within schedule and budget.
4. The project owner, sponsor and consultants are ready to collaborate and sign all agreements and contracts.
5. The permits and approvals will be granted on time to facilitate the project.
6. There will be no delay in the procurement of equipment and supplies for the project.
7. The Government of St. Lucia will support the construction of the solar farm through regulatory and policy implementation.

4.1.12 Roles & Responsibilities

Chart No. 7 Stakeholders Roles & Responsibility (Source: Author)

Name	Role	Responsibility
LUCELEC	Sponsor	Provide project funding and approval.
Government of Saint Lucia	Stakeholder	Provides regulatory support for the project.
Grupotec	Engineering Contractor	Assist with planning and execution of the construction of the solar farm to ensure that it meets established international standards.
Clinton Climate Initiative	Technical Consultants	Provide technical support for the successful completion of the solar farm.
Rocky Mountain Institute – Carbon War Room	Technical Consultants	Provide technical support for the successful completion of the solar farm.
United Nations Development Programme	Donor	Provide financial support for the project.
Norwegian Agency for Development Cooperation	Donor	Provide financial support for the project.
Global Environment Facility	Donor	Provide financial support for the project.
Project Manager	TBD	Lead and manage the project team, oversee project activities and take necessary corrective actions to ensure that the project is successfully completed.
Project Team	TBD	Supports the project manager and executes project activities to complete the project on time and within budget.

_____ **Date: _____**

(Project Sponsor)

(Project Sponsor Title)

4.2 Develop Scope Management Plan

4.2.1 Scope Management

Project Scope Management includes the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully. (PMBOK, 2017). Its purpose is to document the scope management approach and processes as well as the roles and responsibilities of the stakeholders in those processes. (Igberaese, 2022) The scope management plan for the 3 MW solar farm project will provide the framework which will serve as a guide for how the project scope will be defined, detailed, developed, validated, monitored and controlled. Furthermore, the project scope will comprise of all the work required and only the work required to successfully complete the 3 MW solar farm project.

Scope Management Plan

	Project Scope Tracking
Project Name	Project Management Plan for the St. Lucia Electricity Services Ltd 3 MW Solar Farm Project.
Project Number	001
Document ID	001-LUCE-SMP
Document Owner	LUCELEC
Issue Date	
Last Saved Date	
File Name	Scope Management Plan

Version	Issue Date	Changes
1.0		Release

Role	Name	Signature	Date
Project Sponsor	LUCELEC		
Project Manager	TBD		

4.2.2 Scope Management Approach

The scope management approach is based on the information in the Project Management Body of Knowledge (2017). The project manager will develop the scope management plan by evaluating the project charter, requirements documents, project inclusions and organizational policies and procedures.

a. The project charter will formally authorize the project and outline the objectives, high-level requirements and the project deliverables.
b. Requirements documentation will be examined for all the requirements applicable to the 3 MW solar farm and will include stakeholder requirements, the features and functions of the solar farm, as well as permits and regulations.
c. The project manager will specify scope inclusions. Project inclusions are the work that is necessary to deliver the solar farm with the relevant features and functions.
d. Organizational process assets will provide information from any previous projects such as templates, reports, financial information and processes.

4.2.3 Scope Statement

The project will produce a 3 MW utility-scale solar farm that will meet 5% of St. Lucia's electricity demand. It will reduce the volume of fuel purchased by LUCELEC by about 300 thousand gallons per year. The solar farm will be constructed on 14, 900 acres of land in La Tourney, Vieux Fort and will generate approximately 7 million kWhs of electricity per year. LUCELEC will be the owner and sponsor of the project, however some financial assistance will be provided by the UNDP and GEF.

4.2.4 Project Requirements

Project requirements are the necessary conditions and functions for the project to be deemed successful. The requirements for the 3 MW solar farm project are outlined below:

1. The solar farm will be constructed on 14,900 acres of flat land with low risk of flooding.
2. 15,000 solar panels will used for the solar farm.
3. The project budget will be $20,000,000 dollars.
4. The project team will comprise of several technical staff from across the organization.
5. Weekly progress update meetings will be held with the project team.
6. The project manager will review change requests and submit them to the project sponsor for approval.
7. There will be collaborative approval of project designs by the sponsor and engineering team.

8. The solar farm will be near a suitable grid connection point with the capacity to accept its output.
9. The solar farm will contain fencing around the perimeter of the site.
10. The solar farm will have road access.
11. The solar farm will have a water collection system.
12. The site will contain a proper drainage system.
13. The solar farm will contain a CCTV System.
14. The solar farm will contain a SCADA System.
15. The solar farm will contain a lightning arrestor.
16. There will be external lighting on the premises.
17. The solar farm will contain the necessary grounding equipment.

Requirements Traceability Matrix

Chart No. 8 Requirements Traceability Matrix: (Source: Author)

Project Name	Project Management Plan for the St. Lucia Electricity Services Ltd 3 MW Solar Farm Project	**Date**	
Project Number	01	**Document Number**	RTM-01
Project Manager	Sibyl Dostalie	**Project Owner/Client**	St. Lucia Electricity Services Ltd

ID Number	Source	Requirement Description	Business Objective	Assigned To	WBS ID	Status
001	Project Manager	The solar farm will be constructed on 14,900 acres of flat land with low risk of flooding.	The 3 MW solar farm requires flat land to maximize energy output.	Project Sponsor	1.2.1	In Progress
002	Project Manager	15,000 solar panels will used for the solar farm.	The 3 MW solar farm requires approximatel y 15 thousand panels to maximize efficiency.	Project Sponsor	1.3.1	In Progress
003	Project Manager	The project budget will be 20 million XCD.	The project sponsor has budgeted 20 million XCD for the project.	Project Sponsor	1.1.3	In Progress
004	Project Sponsor	The project team will be comprised of several technical staff across the organization	Technical staff with sufficient knowledge of renewable energy have been selected to work on the project.	Project Manager	1.1.1	In Progress

ID Number	Source	Requirement Description	Business Objective	Assigned To	WBS ID	Status
005	Project Sponsor	Weekly progress update meetings will be held with the project team.	Weekly reports are a requirement from the Project Manager	Project Manager	1.1	In Progress
006	Project Manager	Change requests will be reviewed by the project manager approved by the sponsor	Change requests will be approved by the project sponsor.	Project Sponsor	1.1	In Progress
007	Project Manager	There will be collaborative approval of project designs by the sponsor and engineering team	The project sponsor and engineering team must approve a project aligned with the Government of St. Lucia's renewable energy initiative.	Engineering Team Project Sponsor	1.3	In Progress
008	Project Manager	The solar farm will be near a	A grid connection is necessary for	Technical Team	1.2.1	In Progress

ID Number	Source	Requirement Description	Business Objective	Assigned To	WBS ID	Status
		suitable grid connection point with the capacity to accept its output	the solar farm.			
009	Project Manager	The solar farm will contain fencing around the perimeter of the site	Fencing is a requirement to prevent trespassing.	Construction Team	1.6.7	In Progress
010	Project Manager	The solar farm will have road access	Road access is a requirement to ensure site accessibility.	Construction Team	1.6.3	In Progress
011	Project Manager	The solar farm will have a water collection system	The solar farm must incorporate sustainable and regenerative principles.	Construction Team	1.6.6	In Progress
012	Project Manager	The site will contain a proper drainage system	The solar farm must incorporate sustainable and regenerative principles	Construction Team	1.6.5	In Progress

ID Number	Source	Requirement Description	Business Objective	Assigned To	WBS ID	Status
013	Project manager	The solar farm will contain a CCTV System	The solar farm must have 24/7 security.	Technical Team	1.7.3	In Progress
014	Project Manager	The solar farm will contain a SCADA System	The SCADA System is a requirement of the solar farm.	Technical Team	1.7.4	In Progress
015	Project Manager	The solar farm will contain a lightning arrestor	The solar farm requires protection from lightning.	Electrical Team	1.7.5	In Progress
016	Project Manager	There will be external lighting on the premises	The solar farm must be well lit.	Electrical Team	1.7.6	In Progress
017	Project Manager	The solar farm will contain grounding equipment	The farm must contain proper grounding to prevent damage to electrical equipment and injuries.	Electrical Team	1.7.7	In Progress
019	Project Manager	There will be an available	A three-phase connection is	Electrical Team	1.7	In Progress

ID Number	Source	Requirement Description	Business Objective	Assigned To	WBS ID	Status
		three-phase connection near the site.	required for the solar farm.			

4.2.5 Define Scope

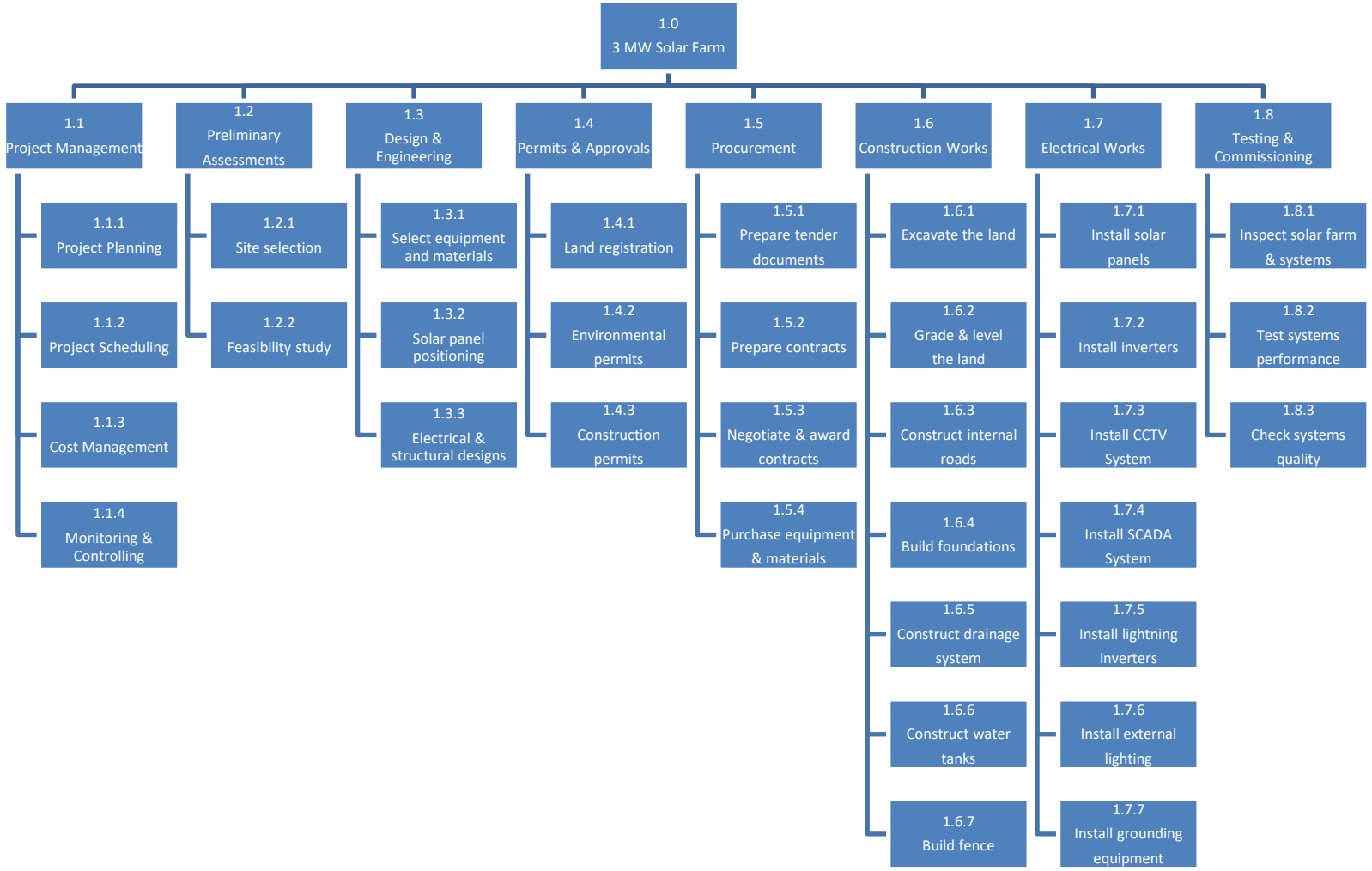
The project will produce a 3 MW utility-scale solar farm that will meet 5% of St. Lucia's electricity demand. Defining the project scope is a critical task that allows for proper management of a project. The purpose of defining the scope of the Solar Farm Project is to describe and gain agreement on the logical boundaries of the project. The scope statement defines what is within the boundaries of the Solar Farm Project and the activities that are outside the project's boundaries. It allows for the stakeholders and project team to be aware of project inclusions and exclusions, thus avoiding scope creep. This allows the project manager to manage stakeholders' expectations and effectively plan the project's resources.

4.2.6 Project Exclusions

The project exclusions clarify the activities that are not included in the scope. Exclusions minimize ambiguity and conflict on the project and ensures that the stakeholders know what to expect and helps to effectively manage their expectations. The following are the project exclusions for the 3 MW solar farm project:

1. The construction of the solar farm will not include construction of a control room and substation.
2. The construction of the solar farm will not include a battery system.
3. Maintenance of the solar farm will not be included in the project.
4. Work on-site is from Monday to Friday from 8 a.m. to 5 p.m.

Figure 6 Work Breakdown Structure: (Source: Authour)



WBS Dictionary for the 3 MW Solar Farm Project

Chart No. 9 WBS Dictionary: (Source: Author)

WBS Level	WBS Code	Element Name	Description of Work	Deliverables	Committed Resources
1	1.0	3 MW Solar Farm	All activities required in the construction of the solar farm.	A 3 MW Solar Farm	Financial Resources Human Resources Equipment and Materials
2	1.1	Preliminary Assessments	Identifying the best site for the solar farm and assessing the factors that could impact the project's feasibility.	Site Assessment Report	Project Sponsor Project Manager Technical Team Stakeholders
3	1.1.1	Site Selection	Selection of an appropriate lot of land for the solar farm.	Land Suitability Report	Project Sponsor Stakeholders Project Manager Technical team
3	1.1.2	Feasibility Study	Evaluation of the site’s economic viability.	Technical Report Environmental Impact Report	Technical Team Project Manager

WBS Level	WBS Code	Element Name	Description of Work	Deliverables	Committed Resources
				Financial Report	
2	1.2	Design and Engineering	Assessment of the site's technical and physical characteristics.	Design plans and blueprints	Project Manager Technical Team
3	1.2.1	Select Solar Panels and Materials	Providing the specifications for solar panels, inverters, batteries, transformers, and other equipment.	Solar panel and material size and quantity specifications	Project Manager Technical Team
3	1.2.2	Solar Panel Positioning	Determining the orientation and positioning of the panels on the land.	Solar Panel orientation and tilting specifications	Project Manager Technical Team
3	1.2.3	Electrical and Structural Design	Planning the electrical layout, solar farm sizing & connection and integration to the grid.	Electrical and structural plans	Project Manager Technical Team
2	1.3	Permits and Approvals	Obtaining the requisite permits and approvals.	Approved permits and signed agreements	Project Manager Government Departments Legal Team
3	1.3.1	Land Registration	Purchase and registration of land	Deed of Sale and Land Register	Project Manager

WBS Level	WBS Code	Element Name	Description of Work	Deliverables	Committed Resources
					Government Departments Legal Team
3	1.3.2	Environmental Permits	Obtaining the environmental permits to begin the project.	Approved environmental permit	Project Manager Government Departments
3	1.3.3	Construction Permits	Obtaining the permits from the Development Control Authority to begin construction.	Approved construction permit	Project Manager Government Departments
2	1.4	Procurement	Contract negotiation, bidding, vendor selection and management.	Tenders and contract documentation	Project Manager Procurement Team
3	1.4.1	Prepare Tenders	Preparation of tenders	Final tenders documents	Project Manager Procurement Team
3	1.4.2	Prepare Contracts	Preparation of contracts.	Contract documents	Project Manager Procurement Team Legal Team

WBS Level	WBS Code	Element Name	Description of Work	Deliverables	Committed Resources
3	1.4.3	Negotiate and Award Contracts	Negotiating and awarding contracts to selected vendors and contractors.	Signed contracts and agreements	Project Manager Procurement Team Legal Team
2	1.5	Construction Works	Carrying out civil and general works to prepare the site.	Completed civil works	Construction Team Technical Team Project Manager
3	1.5.1	Site Preparation	Excavation, leveling and grading of the land	Flat and leveled construction site	Construction Team Project Manager
3	1.5.2	Road Construction	Process of building access roads to the solar farm.	Constructed access roads	Construction Team Project Manager
3	1.5.3	Foundations	Installing foundations for the various systems	Installed foundations	Construction Team Project Manager
3	1.5.4	Drains and Trenches	Construction of the drainage system and trenches.	Completed drains and trenches	Construction Team

WBS Level	WBS Code	Element Name	Description of Work	Deliverables	Committed Resources
					Project Manager
3	1.5.5	Fencing	Construction of fence around the perimeter of the site.	Completed fence	Construction Team Project Manager
2	1.6	Electrical Works	Running lines and installing the electrical structure.	Completed electrical works	Electrical Team Project Manager
3	1.6.1	Solar Panels	Installation of the solar panels.	Installed solar panels	Electrical Team Technical Team Project Manager
3	1.6.2	Inverters	Process of installing the inverters	Installed inverters	Electrical Team Technical Team Project Manager
3	1.6.3	Three phase connection and cables	Installation of three phase connection and laying of cables	Installed three phase connection and cable lines	Electrical Team Technical Team

WBS Level	WBS Code	Element Name	Description of Work	Deliverables	Committed Resources
					Project Manager
3	1.6.4	CCTV System	Providing specifications and installing the camera system	Installed cameras	Electrical Team Technical Team Project Manager
3	1.6.5	SCADA System	Installation of the SCADA System	Installed SCADA System	Electrical Team Technical Team Project Manager
3	1.6.6	Lightning Arrestors	Installation of the lightning arrestor equipment.	Installed Lightning Arrestors	Electrical Team Technical Team Project Manager
3	1.6.7	External Lighting	Electrical works to install lights on the property.	Completed external lighting	Electrical Team Technical Team Project Manager

WBS Level	WBS Code	Element Name	Description of Work	Deliverables	Committed Resources
3	1.6.9	Grounding Equipment	Equipment for proper electrical grounding	Completed electrical grounding	Project Manager Electrical Team Technical Team
2	1.7	Testing & Commissioning	Process of testing and commissioning the completed solar farm.	Commissioned solar farm	Project Manager Technical Team Electrical Team
3	1.7.1	Inspections	Assessing the solar farm to ensure there are no defects or issues.	Inspection Report	Project Manager Technical Team Electrical Team
3	1.7.2	Systems Performance Testing	Testing the output of the solar panels to verify that they are functioning as intended.	Performance Report	Project Manager Technical Team Electrical Team
3	1.7.3	Quality Compliance	Ensuring that the solar farm complies with	Compliance Report	Project Manager

WBS Level	WBS Code	Element Name	Description of Work	Deliverables	Committed Resources
			industry standards.		Technical Team Electrical Team
2	1.8	Project Management	Project management activities	Project Management Plan Project Schedule	Project Manager Project Sponsor Project Stakeholders
3	1.8.1	Project Planning	Project planning activities	Project Management Plan Project Charter	Project Sponsor Project Manager Project Team
3	1.8.2	Project Scheduling	Project scheduling activities	Schedule Management Plan Scope Statement	Project Manager Project Team
3	1.8.3	Cost Management	Activities related to determining, monitoring and controlling project costs.	Cost Management Plan Budget Financial Report	Project Manager Project Team

WBS Level	WBS Code	Element Name	Description of Work	Deliverables	Committed Resources
3	1.8.4	Monitoring and Controlling	Activities related to ensuring that the project remains within budget and is completed on time.	Updated Project Documents Status Reports Change Requests	Project Manager Project Team

4.2.7 Validate Scope

Validating the scope involves the project sponsor formally accepting the completed deliverables and signing off on them. During scope validation, the project manager will evaluate the project deliverables to determine whether the solar farm is completed and whether it satisfies the project objectives by evaluating the success criteria. Inspection and decision-making (voting) techniques will be used to evaluate the deliverables. During inspection, the project manager will measure and examine work performance data, project documents and the project management plan. Scope validation will also involve validating the quality of the project deliverables, providing monthly reviews and walkthroughs.

The outputs of the process include change requests for defect repairs of the rejected deliverables, updating the lessons learned register, requirements documentation and other project documents. It will also provide information about the progress of the project, the deliverables that have been accepted and rejected and the reasons for acceptance or rejection of those deliverables. The information obtained from validating the scope can serve as historical information that can be referenced in the event that the project is abandoned. This will provide

important information to the project team on the progress of the project if it is resumed in the future.

4.2.8 Control Scope

This process involves all the activities involved in monitoring the status of the project scope and managing changes to the scope baseline. The project manager will monitor the project scope to ensure that the project remains within the approved scope baseline and control any changes to the scope through the project's Integrated Change Control system. Additionally, the project manager will use expert judgement to thoroughly review and analyze the impact of proposed changes on the project schedule and cost and conduct a risk assessment of the scope change. Upon receipt of the change requests, the project sponsor will determine whether the requested changes have merit before approval.

Once approved, the WBS and WBS directory will subsequently be updated by the project manage. It is important to note that scope creep can easily derail the project, thus unapproved change requests will not be implemented.

The following are the requirements for Integrated Change Control:

a) Submit all change requests in writing.
b) Any stakeholder may submit a change request.
c) All change requests must be submitted to the project manager who will track and document each request on the change request log.

The following Change Request Form will be used to record requested changes on the project:

Chart No. 10 Change Request Form (Source: MyPM, LLC, 2022)

Project Name		**Date**	
Project Number		**Requestor**	
Project Manager		**Project Owner**	
Project Name		**Date**	
Project Number		**Requestor**	
Project Manager		**Project Owner**	
Describe the Reason for the Request			
Risk Identification/Analysis			
Impact Analysis			
Work Products to be Modified			Version Number
1.			
2.			
3.			
Describe the impact of the suggested change to work that is already complete.			
Quality Impact			
Additional Quality Assurance or Quality Control Activities			
1.			
2.			
3.			
Describe the impact of the change to quality assurance activities and quality control activities.			
Schedule Impact			

New Deliverables Description	Effort Hours	Date Required	Impact to Other Delivery Dates
1.			
2.			
3.			
Based on the impact, state the estimated date for implementing the requested change. State the new estimated project completion date.			

Budget Impact			
New Deliverables Description	Lessen or Eliminate Other Expenses? Please describe	Cost of New Deliverable	Total
1.			
2.			
3.			
Describe the overall impact to budget/cost.			

Decision				
		Approved		Rejected
		Approved with modifications		Deferred

Justifications
Additional Comments

Approver's Printed Name Date

_____

Title

_____

Signature

Chart No. 11 Change Request Log (Source: MyPM, LLC, 2022)

Project Name		Date	
Project Number		Document Number	
Project Manager		Project Owner/Client	

Change Request Number	**Date Received**	**Requestor**	**Change Request Name and Description**	**If approved, approved by**	**Implementation Due Date, if Applicable**	**Requirement Or WBS Number, if Applicable**	**Status**

Roles & Responsibilites

Chart No. 12 Roles & Responsibilities (Source: Author)

Name	Role	Responsibility
St. Lucia Electricity Services Ltd.	Project Sponsor	Provides high-level scope definition. Approves the scope management plan. Reviews escalated scope issues and provides direction for resolution of those issues. Approves major scope change requests. Has the overall decision-making responsibility for scope management issues and activities.
Grupotec	Engineering Team	Plan, schedule, predict, and manage all the technical tasks of the project to assure accuracy, proper resources, and quality from start to finish. Provide engineering, construction and procurement services to ensure the project is completed according to standards.
Sibyl Dostalie	Project Manager	Oversees the development of the scope management plan. Oversees the scope change control process. Approves scope change requests that are within his/her authority and escalate others to the project sponsor. Ensures that the approved scope changes are recorded and the relevant project documents are updated.

Name	Role	Responsibility
Project Team	Project Team Members	Help in the development of the project scope statement. Submit scope change requests. Reviews scope change requests when assigned and provides feedback to the project manager.
Government of St. Lucia	Stakeholder (Member of the Board)	Provides legislative support for the project.
Rocky Mountain Institute Clinton Climate Imitative	Technical Team	Provide technical assistance for the solar farm. Provide an independent analysis and review of the project scope, management practices, monitor scope changes and provide the project manager with necessary feedback. Support bid evaluation and contract negotiations.
Det Norske Veritas (DNV)	Engineering Consultants	Provide engineering assistance for the construction of the solar farm.
Project Team	Project Team Lead	Help develop the project scope statement. Provides guidance and instruction to the project team as it relates to scope development.
United Nations Development Programme Global Environment Facility Norwegian Agency for Development Corporation	Donors	Provide financial assistance for the solar farm.
Construction Team	Construction Team	Complete the civil and electrical works on the project.

4.2.9 Project Acceptance Criteria

The solar farm will be constructed on flat land with proper drainage, a fenced boundary and access roads leading to the site. The project will be considered a success when the farm is fully operational. Having the solar panels and electrical structures in place and linked to the power grid to start generating clean electricity is the basis for success.

4.2.9.1 Project Constraints

1. The project has a fixed deadline and must be executed within a 15-month period.
2. The project must be executed within a $20 million-dollar budget.
3. The project team must produce the solar farm to meet all stakeholders' expectations.
4. The project must be completed by a small team of technicians and engineers.
5. Global supply chain issues may affect the availability of solar panels.

4.2.9.2 Project Assumptions

1. The engineers will have expert knowledge on solar farm construction.
2. There will be sufficient resources to complete the project successfully.
3. The project will be completed within schedule and budget.
4. The project owner, sponsor and consultants are ready to collaborate and sign all agreements and contracts.
5. The necessary permits will be obtained to facilitate the project.
6. There will be no delay in the procurement of equipment for the project.
7. The Government of St. Lucia will approve the construction of the solar farm.
8. The system will be cost effective with a minimum of 25-year manufacturer’s warranty available on the solar panels.

4.3 Develop Schedule Management Plan

The schedule management plan provides details on how the schedule will be developed, monitored and controlled throughout the project. It will be developed with input from the project team responsible for carrying out the activities to complete the project. These activities are obtained from decomposing the work packages in the work breakdown structure. During the scheduling process, the project manager will plan schedule management, define activities, sequence activities, estimate activity durations and develop the project schedule.

Schedule Management Plan

	Project Schedule Tracking
Project Name	Project Management Plan for the St. Lucia Electricity Services Ltd 3 MW Solar Farm Project.
Project Number	001
Document ID	001-LUCE-SMP
Document Owner	LUCELEC
Issue Date	
Last Saved Date	
File Name	Schedule Management Plan

Version	**Issue Date**	**Changes**
1.0		Release

Role	**Name**	**Signature**	**Date**
Project Sponsor	LUCELEC		
Project Manager	TBD		

Chart No. 12 Roles & Responsibilities (Source: Author)

Name	Role	Responsibilities
LUCELEC	Project Sponsor	- Approves change requests submitted by the project manager - Evaluates the need for schedule changes - Accepts completed deliverables
Sibyl Dostalie	Project Manager	- Plans and develops the schedule - Assigns project resources - Uses the relevant tools and techniques to keep the schedule on track. - Updates project documents
Grupotec RMI	Technical Team	- Request schedule change requests - Communicates change to the project manager
Construction Team Electrical Team Procurement Team	Project Team	- Request schedule change requests - Communicate changes to the project manager
Government of St. Lucia	Stakeholder	- Request schedule change requests - Communicate changes to the project manager

4.3.1 Plan Schedule Management

The schedule management plan establishes and documents the policies, processes and procedures for planning, developing, executing, monitoring and controlling the project schedule. (PMI, 2017) The schedule management plan will guide and direct all other time management activities throughout the project. Additionally, it will guide the team and stakeholders on handling schedule change requests. The project manager will utilize the project management plan, the project charter and enterprise environmental factors such as the organizational culture and organizational infrastructure as input into this process. Additionally, organizational process assets such as schedule control templates and change and risk control procedures will be inputs for the plan the project schedule.

4.3.2 Define Activities

Define activities is the process of decomposing the work packages in the WBS into schedule activities where the basis for estimating, scheduling, executing and monitoring and controlling the work of the solar farm project is easily supported and accomplished. The project manager will use the WBS to identify the activities that are required to produce the project deliverables. The process will document the activities required to fulfill the deliverables in the WBS and to create a milestone list. Decomposition and expert judgement will be the main tools used to define the project activities.

4.3.3 Tools & Techniques

Chart No. 13 (*Source: Activity Planning—From WBS to Project Schedule | The Project Planning Process Group | Pearson IT Certification*. (n.d.).)

Inputs	Tools and Techniques	Outputs
Enterprise environmental factors	Decomposition	Activity list
Organizational process assets	Templates	Activity attributes
Project scope statement	Expert judgement	Milestone list
Work breakdown structure		Requested changes
WBS dictionary		
Project management plan		

The following activity and milestone lists will be developed from decomposition of the WBS:

Chart No. 13 Activity List – Solar Farm Project (Source: Author)

Activity ID	Activity Description	Estimated Duration	Preceding Activities	Activity Owner
A1	Plan the project	15 days	-	Project Manager
A2	Schedule the project	10 days	-	Project Manager
A3	Manage costs	10 days	-	Project Manager

Activity ID	Activity Description	Estimated Duration	Preceding Activities	Activity Owner
A4	Monitor & control the project	15 days	-	Project Manager
A5	Select the project site	30 days	A1	Project Sponsor
A6	Conduct a feasibility study	30 days	A5	Technical Team
A7	Determine solar panel & material specifications	5 days	A6	Technical Team
A8	Determine solar panel positioning	5 days	A7	Technical Team
A9	Prepare electrical and structural designs	25 days	A7, A8	Technical Team
A10	Register the land	10 days	A5, A6	Project Manager
A11	Obtain construction permits	20 days	A9	Project Manager
A12	Obtain environmental permits	30 days	A9	Project Manager
A13	Prepare tender documents	15 days	A12	Procurement Team
A14	Prepare contract documents	15 days	A13	Procurement Team
A15	Negotiate & award contracts	30 days	A14	Procurement Team
A16	Purchase equipment & materials	90 days	A15	Procurement Team
A17	Excavate the land	20 days	A11	Construction Team
A18	Grade and level the land	10 days	A17	Construction Team
A19	Construct internal roads	5 days	A17, A18	Construction Team
A20	Build foundations	35 days	A18, A19	Construction Team

Activity ID	Activity Description	Estimated Duration	Preceding Activities	Activity Owner
A21	Construct drainage system	14 days	A18	Construction Team
A22	Construct water collection tanks	10 days	A21	Construction Team
A23	Build fence	17 days	A19	Construction Team
A24	Install solar panels	15 days	A20	Technical Team
A25	Install inverters	2 days	A24	Technical Team
A26	Install CCTV System	3 days	A25	Technical Team
A27	Install SCADA System	5 days	A25, A26	Technical Team
A28	Install lightning arresters	4 days	A27	Electrical Team
A29	Install external lighting	12 days	A23, A28	Electrical Team
A30	Install grounding equipment	12 days	A29	Electrical Team
A31	Inspect solar farm & equipment	10 days	A30	Project Manager Technical Team
A32	Test system performance	5 days	A31	Project Manager Technical Team Construction
A33	Check system quality	5 days	A32	Project Manager

Chart No. 14 Project Milestones (Source: Author)

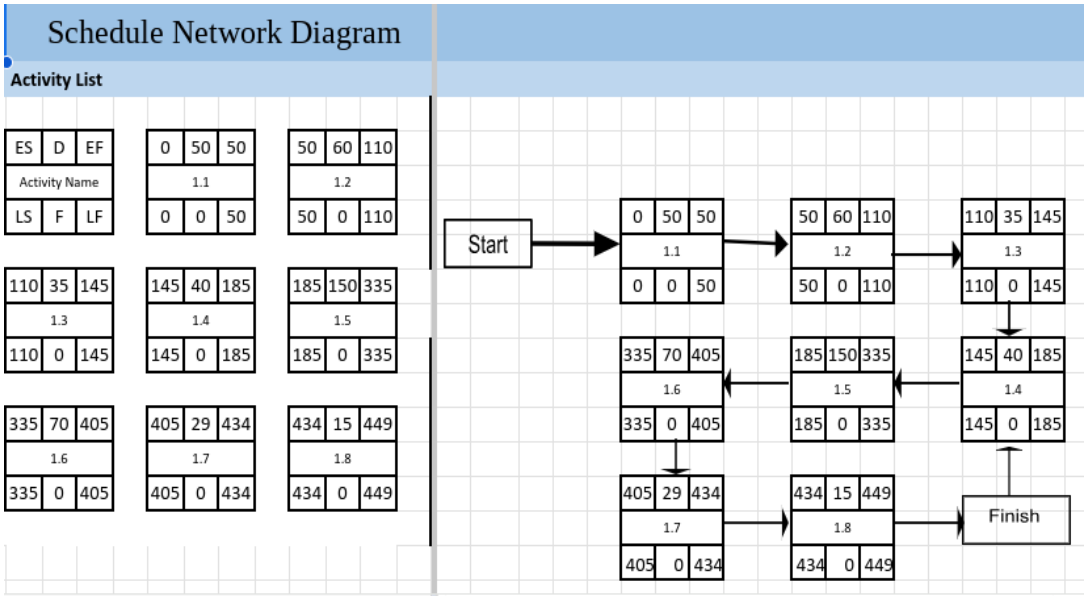
Milestone	Description	Estimated Completion Date
Planning complete	All planning activities are completed	12/12/2023
Feasibility study approved	The feasibility study is completed and approved by the project sponsor.	04/03/2024
Blueprints complete	Project blueprints are generated from technical and structural designs.	22/04/2024
Obtain permits and approvals	The permits and approvals are obtained from the relevant government entities.	17/06/2024
Equipment and materials available	The materials and equipment for the solar farm are purchased and available for installation.	13/01/2025
Construction works complete	The civil works are completed.	15/04/2025
Electrical works complete	The electrical works are completed.	30/05/2025
Project completed	The solar farm is tested and commissioned.	20/06/2025

4.3.4 Sequence Activities

During this process, the activities from the activity list will be arranged in a sequential manner. While some activities will be accomplished at any time throughout the project, others will depend on other activities to be completed before they could begin. For example, during construction works, the land needs to be excavated and leveled before the foundations for the solar panels and other systems are built. The sequence activities process identifies all the relationships between the project activities and notes the restrictions that are imposed on the relationships between these activities.

The following schedule network diagram provides a graphical view of the activities in the WBS and how they are related during the project execution.

Figure 7 Schedule Network Diagram (Source: Author)



4.3.5 Estimate Activity Duration

During the estimate activity duration process the project manager will assign the number of work periods which were required to complete schedule activities. Each estimate assumes that the necessary resources are available to be applied to each work package when needed. The inputs for this process include environmental process factors, organizational process assets, the scope statement, activity list and the project management plan. The project manager will obtain the assistance of experts and utilize three-point estimates to estimate activity resources for the Solar Farm Project. For the three-point estimating technique, the project manager will use three estimate values for each project activity:

- Most likely - the duration most likely to occur;
- Optimistic - the duration of the activity if everything went as planned, or better and;

- Pessimistic - the duration of the activity in a worst-case scenario. This was used to compute the expected duration and variance of each activity.

4.3.6 Develop Project Schedule

The 3 MW Solar Farm Project schedule was created using Google Project scheduling tool, Gantter. The project schedule is displayed in the Gantt chart below.

Figure 8 Gantt Chart (Source: Author)

gantter™

Project Name **3 MW Solar Farm Project**

		Name	Duration	Start	Finish	Predecessors	Resources
1		1.0 3 MW Solar Farm Construction	175days	10/03/2023	06/03/2024		
2		Feasibility study approved	0day	03/04/2024	03/04/2024		
3		**1.1 Project Management**	**50days**	**10/03/2023**	**12/11/2023**		
4		1.1.1 Plan project	15days	10/03/2023	10/23/2023		
5		1.1.2 Project scheduling	10days	10/24/2023	11/06/2023	4	
6		1.1.3 Manage costs	10days	11/07/2023	11/20/2023	5	
7		1.1.4 Monitoring & control	15days	11/21/2023	12/11/2023	5,6	
8		Planning Complete	0day	12/12/2023	12/12/2023		
9		**1.2 Preliminary Assessments**	**65days?**	**12/12/2023**	**03/11/2024**	3	
10		1.2.1 Select project site	30days	12/12/2023	01/22/2024	4	
11		1.2.2 Define feasibility requirements	5days?	01/23/2024	01/29/2024	10	
12		1.2.3 Conduct feasibility study	30days	01/30/2024	03/11/2024	11	
13		**1.3 Design & engineering**	**35days**	**03/12/2024**	**04/29/2024**	**9**	
14		1.3.1 Determine solar panel & equipment specifications	5days	03/12/2024	03/18/2024	12	
15		1.3.2 Determine solar panel positioning on the land	5days	03/19/2024	03/25/2024	14	
16		1.3.3 Prepare structural & electrical designs and blue prints	25days	03/26/2024	04/29/2024	14,15	
17		Blueprints complete	0day	04/19/2024	04/19/2024		
18		**1.4 Obtain permits & approvals**	**40days?**	**04/30/2024**	**06/24/2024**	**13**	
19		1.4.1 Register the land	10days	04/30/2024	05/13/2024	16	
20		1.4.2 Prepare permit documentation	3days?	05/14/2024	05/16/2024	19	
21		1.4.3 Obtain environmental permit	20days	05/17/2024	06/13/2024	20	
22		1.4.4 Obtain construction permit	30days	05/14/2024	06/24/2024	19	
23		1.4.5 Develop safety policies for construction and electrical works	1day?	04/30/2024	04/30/2024		
24		Obtained permits and approvals	0day	06/17/2024	06/17/2024		
25		**1.5 Procurement**	**150days**	**06/25/2024**	**01/20/2025**	**18**	
26		1.5.1 Prepare tenders	15days	06/25/2024	07/15/2024	18	
27		1.5.2 Prepare contracts	15days	07/16/2024	08/05/2024	26	
28		1.5.3 Negotiate & award contracts	30days	08/06/2024	09/16/2024	27	
29		1.5.4 Purchase equipment & materials	90days	09/17/2024	01/20/2025	28	
30		Equipment & materials available	0day	01/13/2025	01/13/2025		
31		**1.6 Construction Works**	**70days**	**01/21/2025**	**04/28/2025**	**25**	
32		1.6.1 Excavate the land	20days	01/21/2025	02/17/2025	25	
33		1.6.2 Grade and level the land	10days	02/18/2025	03/03/2025	32	
34		1.6.3 Construct internal road	5days	03/04/2025	03/10/2025	33	
35		1.6.4 Build foundations	35days	03/11/2025	04/28/2025	33,34	
36		1.6.5 Construct drainage system	14days	03/11/2025	03/28/2025	34	
37		1.6.6 Construct water tank	10days	03/31/2025	04/11/2025	36	
38		1.6.7 Build fence	17days	03/31/2025	04/22/2025	34,36	
39		Construction works complete	0day	04/15/2025	04/15/2025		
40		**1.7 Electrical Works**	**29days**	**04/29/2025**	**06/06/2025**	**31**	
41		1.7.1 Install solar panels	15days	04/29/2025	05/19/2025	31	
42		1.7.2 Install inverters	2days	05/20/2025	05/21/2025	41	
43		1.7.3 Install CCTV System	3days	05/22/2025	05/26/2025	41,42	
44		1.7.4 Install SCADA System	5days	05/22/2025	05/28/2025	41,42	
45		1.7.5 Install lightning arrestors	4days	05/22/2025	05/27/2025	41,42	
46		1.7.6 Install external lighting	12days	04/29/2025	05/14/2025	31	
47		1.7.7 Install grounding equipment	12days	05/22/2025	06/06/2025	41,42,46	
48		Electrical works complete	0day	04/29/2025	04/29/2025		
49		**1.8 Testing & Commissioning**	**15days**	**06/09/2025**	**06/27/2025**	**31,40**	
50		1.8.1 Inspect solar farm and equipment	10days	06/09/2025	06/20/2025	31,40	
51		1.8.2 Test system performance	5days	06/23/2025	06/27/2025	50	
52		1.8.3 Check system quality	5days	06/23/2025	06/27/2025	50	
53		Project Complete	0day	06/09/2025	06/09/2025		

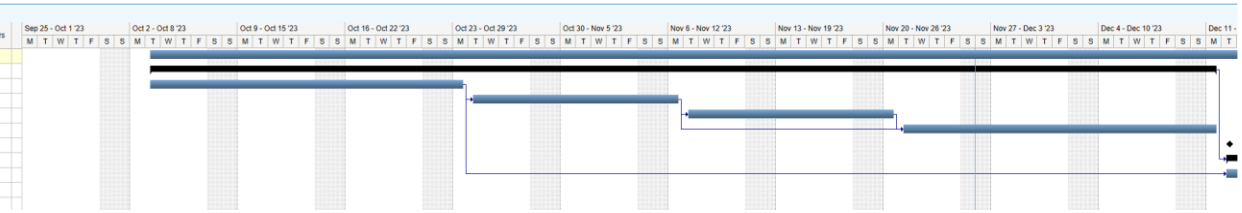
PNG Generated On: 3/23/2024, 11:40:35 PM

gantter™

Project Name **3 MW Solar Farm Project**

	Name	Duration	Start	Finish	Predecessors
1	1.0 3 MW Solar Farm Construction	449days	10/03/2023	06/20/2025	
2	**1.1 Project Management**	**50days**	**10/03/2023**	**12/11/2023**	
3	1.1.1 Plan project	15days	10/03/2023	10/23/2023	
4	1.1.2 Project scheduling	10days	10/24/2023	11/06/2023	3
5	1.1.3 Manage costs	10days	11/07/2023	11/20/2023	4
6	1.1.4 Monitoring & control	15days	11/21/2023	12/11/2023	4,5
7	Planning Complete	0day	12/12/2023	12/12/2023	
8	**1.2 Preliminary Assessments**	**60days**	**12/12/2023**	**03/04/2024**	**2**
9	1.2.1 Select project site	30days	12/12/2023	01/22/2024	3
10	1.2.2 Conduct feasibility study	30days	01/23/2024	03/04/2024	9
11	Feasibility study approved	0day	03/04/2024	03/04/2024	

Sep 25 - Oct 1 '23 | Oct 2 - Oct 8 '23 | Oct 9 - Oct 15 '23 | Oct 16 - Oct 22 '23 | Oct 23 - Oct 29 '23 | Oct 30 - Nov 5 '23 | Nov 6 - Nov 12 '23 | Nov 13 - Nov 19 '23 | Nov 20 - Nov 26 '23 | Nov 27 - Dec 3 '23 | Dec 4 - Dec 10 '23 | Dec 11 -



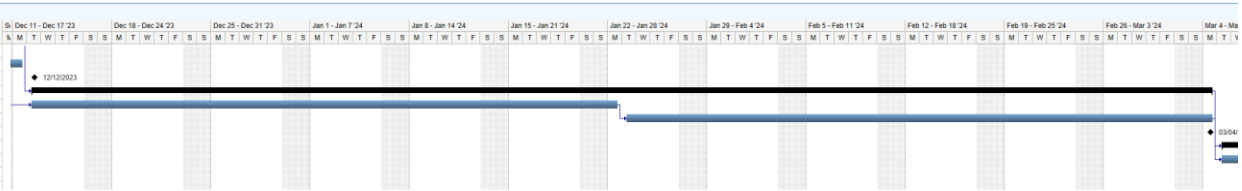
gantter™

Project Name **3 MW Solar Farm Project**

	Name	Duration	Start	Finish	Predecessors	Re:
5	1.1.3 Manage costs	10days	11/07/2023	11/20/2023	4	
6	1.1.4 Monitoring & control	15days	11/21/2023	12/11/2023	4,5	
7	Planning Complete	0day	12/12/2023	12/12/2023		
8	**1.2 Preliminary Assessments**	**60days**	**12/12/2023**	**03/04/2024**	**2**	
9	1.2.1 Select project site	30days	12/12/2023	01/22/2024	3	
10	1.2.2 Conduct feasibility study	30days	01/23/2024	03/04/2024	9	
11	Feasibility study approved	0day	03/04/2024	03/04/2024		
12	**1.3 Design & engineering**	**35days**	**03/05/2024**	**04/22/2024**	**8**	
13	1.3.1 Determine solar panel & equipment specifications	5days	03/05/2024	03/11/2024	10	
14	1.3.2 Determine solar panel positioning on the land	5days	03/12/2024	03/18/2024	13	
15	1.3.3 Prepare structural & electrical designs	25days	03/19/2024	04/22/2024	13,14	

Dec 11 - Dec 17 '23 | Dec 18 - Dec 24 '23 | Dec 25 - Dec 31 '23 | Jan 1 - Jan 7 '24 | Jan 8 - Jan 14 '24 | Jan 15 - Jan 21 '24 | Jan 22 - Jan 28 '24 | Jan 29 - Feb 4 '24 | Feb 5 - Feb 11 '24 | Feb 12 - Feb 18 '24 | Feb 19 - Feb 25 '24 | Feb 26 - Mar 3 '24 | Mar 4 - Ma

12/12/2023



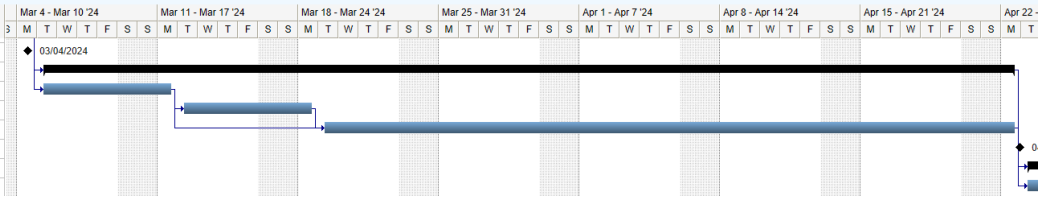
gantter™

Project Name **3 MW Solar Farm Project**

	Name	Duration	Start	Finish	Predecessors	Re:
11	Feasibility study approved	0day	03/04/2024	03/04/2024		
12	**1.3 Design & engineering**	**35days**	**03/05/2024**	**04/22/2024**	**8**	
13	1.3.1 Determine solar panel & equipment specifications	5days	03/05/2024	03/11/2024	10	
14	1.3.2 Determine solar panel positioning on the land	5days	03/12/2024	03/18/2024	13	
15	1.3.3 Prepare structural & electrical designs	25days	03/19/2024	04/22/2024	13,14	
16	Blueprints complete	0day	04/22/2024	04/22/2024		
17	**1.4 Obtain permits & approvals**	**40days**	**04/23/2024**	**06/17/2024**	**12**	
18	1.4.1 Register the land	10days	04/23/2024	05/06/2024	15	

Mar 4 - Mar 10 '24 | Mar 11 - Mar 17 '24 | Mar 18 - Mar 24 '24 | Mar 25 - Mar 31 '24 | Apr 1 - Apr 7 '24 | Apr 8 - Apr 14 '24 | Apr 15 - Apr 21 '24 | Apr 22 -

03/04/2024



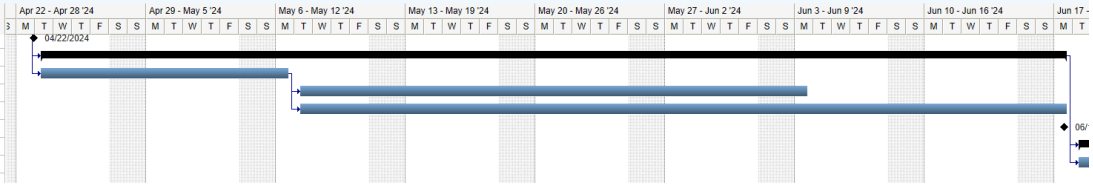
gantter™

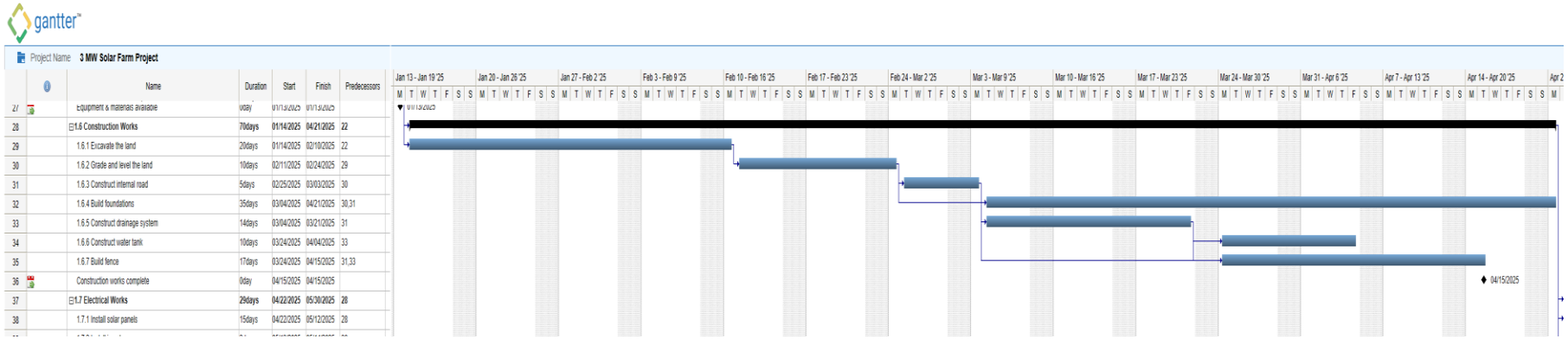
Project Name **3 MW Solar Farm Project**

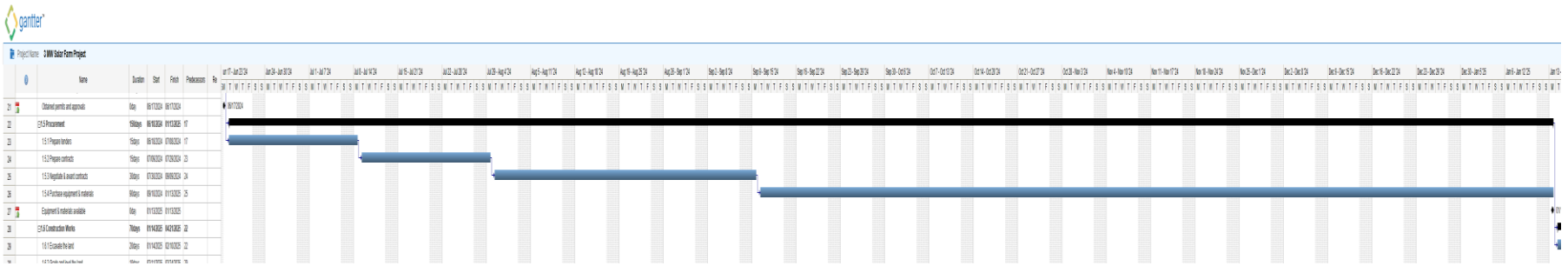
	Name	Duration	Start	Finish	Predecessors	Re:
16	Blueprints complete	0day	04/22/2024	04/22/2024		
17	**1.4 Obtain permits & approvals**	**40days**	**04/23/2024**	**06/17/2024**	**12**	
18	1.4.1 Register the land	10days	04/23/2024	05/06/2024	15	
19	1.4.2 Obtain environmental permit	20days	05/07/2024	06/03/2024	18	
20	1.4.3 Obtain construction permit	30days	05/07/2024	06/17/2024	18	
21	Obtained permits and approvals	0day	06/17/2024	06/17/2024		
22	**1.5 Procurement**	**150days**	**06/18/2024**	**01/13/2025**	**17**	
23	1.5.1 Prepare tenders	15days	06/18/2024	07/08/2024	17	
24	1.5.2 Prepare contracts	15days	07/09/2024	07/29/2024	23	

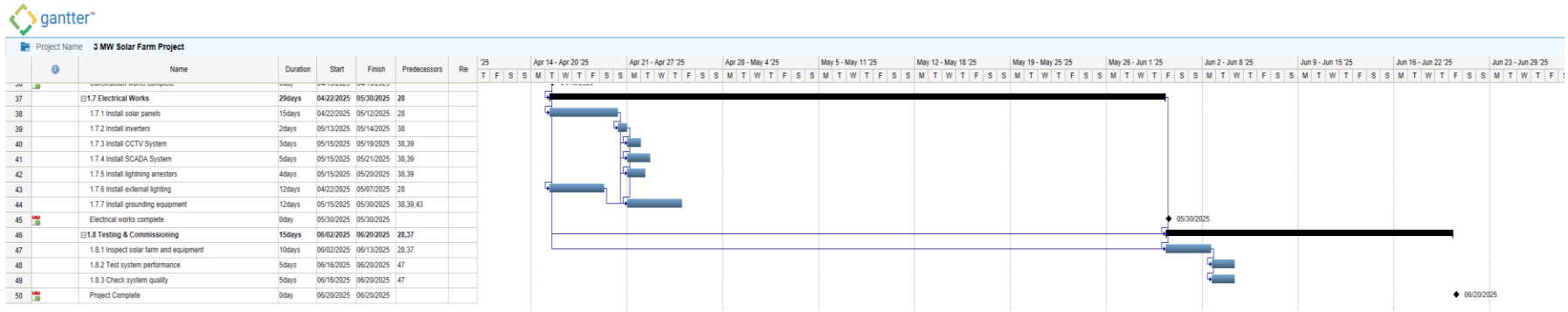
Apr 22 - Apr 28 '24 | Apr 29 - May 5 '24 | May 6 - May 12 '24 | May 13 - May 19 '24 | May 20 - May 26 '24 | May 27 - Jun 2 '24 | Jun 3 - Jun 9 '24 | Jun 10 - Jun 16 '24 | Jun 17 -

04/22/2024




gantter
Project Name 3 MW Solar Farm Project
Name Duration Start Finish Predecessors
27 Equipment & materials available 0day 01/13/2025 01/13/2025
28 1.6 Construction Works 70days 01/14/2025 04/21/2025 22
29 1.6.1 Excavate the land 20days 01/14/2025 02/10/2025 22
30 1.6.2 Grade and level the land 10days 02/11/2025 02/24/2025 29
31 1.6.3 Construct internal road 5days 02/25/2025 03/03/2025 30
32 1.6.4 Build foundations 35days 03/04/2025 04/21/2025 30,31
33 1.6.5 Construct drainage system 14days 03/04/2025 03/21/2025 31
34 1.6.6 Construct water tank 10days 03/24/2025 04/04/2025 33
35 1.6.7 Build fence 17days 03/24/2025 04/15/2025 31,33
36 Construction works complete 0day 04/15/2025 04/15/2025
37 1.7 Electrical Works 29days 04/22/2025 05/30/2025 28
38 1.7.1 Install solar panels 15days 04/22/2025 05/12/2025 28
Jan 13 - Jan 19 '25
Jan 20 - Jan 26 '25
Jan 27 - Feb 2 '25
Feb 3 - Feb 9 '25
Feb 10 - Feb 16 '25
Feb 17 - Feb 23 '25
Feb 24 - Mar 2 '25
Mar 3 - Mar 9 '25
Mar 10 - Mar 16 '25
Mar 17 - Mar 23 '25
Mar 24 - Mar 30 '25
Mar 31 - Apr 6 '25
Apr 7 - Apr 13 '25
Apr 14 - Apr 20 '25
04/15/2025


gantter


gantter
Project Name 3 MW Solar Farm Project
Name Duration Start Finish Predecessors Re
37 1.7 Electrical Works 29days 04/22/2025 05/30/2025 28
38 1.7.1 Install solar panels 15days 04/22/2025 05/12/2025 28
39 1.7.2 Install inverters 2days 05/13/2025 05/14/2025 38
40 1.7.3 Install CCTV System 3days 05/15/2025 05/19/2025 38,39
41 1.7.4 Install SCADA System 5days 05/15/2025 05/21/2025 38,39
42 1.7.5 Install lightning arrestors 4days 05/15/2025 05/20/2025 38,39
43 1.7.6 Install external lighting 12days 04/22/2025 05/07/2025 28
44 1.7.7 Install grounding equipment 12days 05/15/2025 05/30/2025 38,39,43
45 Electrical works complete 0day 05/30/2025 05/30/2025
46 1.8 Testing & Commissioning 15days 06/02/2025 06/20/2025 28,37
47 1.8.1 Inspect solar farm and equipment 10days 06/02/2025 06/13/2025 28,37
48 1.8.2 Test system performance 5days 06/16/2025 06/20/2025 47
49 1.8.3 Check system quality 5days 06/16/2025 06/20/2025 47
50 Project Complete 0day 06/20/2025 06/20/2025
Apr 14 - Apr 20 '25
Apr 21 - Apr 27 '25
Apr 28 - May 4 '25
May 5 - May 11 '25
May 12 - May 18 '25
May 19 - May 25 '25
May 26 - Jun 1 '25
Jun 2 - Jun 8 '25
Jun 9 - Jun 15 '25
Jun 16 - Jun 22 '25
Jun 23 - Jun 29 '25
05/30/2025
06/20/2025

4.3.7 Control Schedule

Schedule control involves monitoring the progress of the schedule against the baseline. The project manager must ensure that the schedule was tightly controlled to ensure that the project proceeded as planned. This also involves determining the status of the project schedule, assessing whether there have been any changes and managing changes to the schedule. Controlling the schedule will also allow the project manager to manage the expectations of the stakeholders. The critical path method and reserve analysis will be the techniques used to monitor and control the 3 MW Solar Farm Project schedule.

4.3.8 Critical Path Analysis

Critical path analysis involved mapping out every task that was necessary to complete the project. As a result, the project manager was able to detect and control any problems on the critical path that would cause the project to be delayed. By analyzing the critical path, the project manager determined the job activities that were critical in their effect on total project time. It also allowed for the most efficient scheduling of the project activities to meet the deadline without surpassing the project budget.

The critical path is 1.1-1.2-1.3-1.4-1.5-1.6-1.7-1.8 as seen in **Chart No. 7**.

4.3.9 Reserve Analysis

According to PMI (2017), reserve analysis is an analytical technique used to determine the essential features and relationships of components in the project management plan to establish a reserve for the schedule duration, budget, estimated cost, or funds for a project. Schedule reserves provided a means of managing the risks associated with the project schedule. The solar farm was constructed during the hurricane season and extended into the December holidays. As a result, the project manager added reserve days to the schedule to manage the possibility of inclement weather and the holiday work breaks.

4.3.10 Schedule Reserve

Chart No. 15 Schedule Reserve (Source: Author)

WBS ID	Description	Duration	Additional Days	Total Days
1.5	Procurement	150	+ 45	195
1.6	Construction Work	70	+ 30	110
1.7	Electrical Work	29	+ 20	49

4.4 Develop Cost Management Plan

Project cost management is the process of allocating, estimating, and controlling project costs. The project manager was tasked with estimating, managing and controlling the project's $20 million-dollar budget. Cost management will allow the project management to control project spending thus lowering the chances of surpassing the budget.

Cost Management Plan

	Project Cost Tracking
Project Name	Project Management Plan for the St. Lucia Electricity Services Ltd 3 MW Solar Farm Project.
Project Number	001
Document ID	001-LUCE-CMP
Document Owner	LUCELEC
Issue Date	
Last Saved Date	
File Name	Cost Management Plan

Version	**Issue Date**	**Changes**
1.0		Release

Role	**Name**	**Signature**	**Date**
Project Sponsor	LUCELEC		
Project Manager	TBD		

4.4.1 Plan Cost Management

According to the Project Management Institute (2017), plan cost management is the process of defining how the project costs will be estimated, budgeted, managed, monitored, and controlled. This process is important because it provides the project team with the necessary guidance and direction on how to manage project costs. The costs associated with constructing the solar farm includes the cost of resources such as land for the project site, the equipment and materials and labour costs. During the planning process, the project manager will establish the units of measure for the various project activities, determine the accuracy levels and control thresholds, and establish the reporting formats and rules of performance measurements.

The solar farm project will cost 20 million EC dollars to construct and will be primarily funded by LUCELEC. The GEF & UNDP will also provide financial assistance for the project. The project also has the support of key renewable energy advocates such as the Government of St. Lucia. The government's goal is to change the trajectory of St. Lucia's energy landscape by implementing the necessary legislation in order to support renewable energy initiatives that would reduce the country's fuel dependency.

4.4.2 Estimate Costs

In estimating costs, the project manager must determine the approximate cost of the resources required to complete the project. Thus, cost estimation will therefore determine the approximate monetary value of the project activities. The construction of the 3 MW solar farm involves the procurement of solar panels, equipment and other materials. Additionally, there are various labour costs for the construction and electrical team. Wages for the electrical team will be based on the average salary of a St. Lucian contractor and electrician. The project manager

will use a quantitative assessment to determine the cost of the project activities and three-point estimating to determine the costs of labour on the project.

Chart No. 16 Cost Table Work Packages (Source: Author)

WBS Code	Description	Cost ($XCD)
1.2.1	Site selection	12,000
1.2.2	Conduct feasibility study	40,000
1.3.1	Determine solar panels and materials specifications	3,500
1.3.2	Determine solar panel positioning	2,000
1.3.3	Prepare electrical and structural designs	50,000
1.4.1	Land registration (purchase of land)	12,500,000
1.4.2	Environmental permits	2,000
1.4.3	Construction permits	2,200
1.5.1	Prepare Tenders	4,500
1.5.2	Prepare Contracts	7,550
1.5.3	Negotiate and Award Contracts	9,000
1.5.4	Purchase equipment & materials	6,900,000
1.6.1	Excavate the land	15,000
1.6.2	Grade the land	35,000
1.6.3	Road Construction	51,000
1.6.4	Foundations	60,750
1.6.5	Drainage system	35,000
1.6.6	Construct water tanks	12,000
1.6.7	Fencing	14,500
1.7.1	Install solar panels	55,700
1.7.2	Install inverters	45,800
1.7.3	Install CCTV System	21,000

WBS Code	Description	Cost ($XCD)
1.7.4	Install SCADA System	27,000
1.7.5	Install lightning arresters	15,000
1.7.6	Install external lighting	17,000
1.7.7	Install grounding equipment	17,500
1.8.1	Inspect solar farm and equipment	20,000
1.8.2	Test system performance	15,000
1.8.3	Test system quality	10,000

- **Parametric Estimating**

Parametric estimating will be used when a unit rate was available for project activities such as contracting and electrical work, which require payment per square foot of land or work done per day. For example, the cost to excavate the land was $1000 per day; for 15 days of work the total cost was $15,000.

- **Analogous Estimating**

Analogous estimating will be used when the project manager had recorded information on costs for similar activities from prior projects. For example, the cost of preparing tenders, contracts and obtaining permits will be obtained from historical project documents.

- **Contingency Reserve**

A contingency reserve of 8% of the estimated costs will be established for procurement, construction works, electrical works and design & engineering. A 2% contingency reserve will be calculated for testing & commissioning, preliminary assessment and permits & approvals. The contingency reserve for the solar farm project is estimated at $843,928.00.

Chart No. 17 Contingency Plan (Source: Author)

WBS ID	Description	Cost ($XCD)	Contingency Reserve	
			%	Amount ($XCD)
1.2	Preliminary Assessments	52,000	2%	1040
1.3	Design & Engineering	55,500	8%	4440
1.4	Permits & Approvals	12,504,200	2%	250,084
1.5	Procurement	6,921,050	8%	553,684
1.6	Construction Works	223,250	8%	17,860
1.7	Electrical Works	199,000	8%	15,920
1.8	Testing & Commissioning	45,000	2%	900
Total		**20,000,000**		**843,928**

- **Management Reserve**

A management reserve will respond to unknown and unaccounted risks so that these risks do not compromise the project cost and schedule. The management reserve will be 5% of the total cost estimate for the project and is calculated at $1,000,000.

Chart No. 18 Management Reserve (Source: Author)

WBS ID	Description	Cost ($XCD)	Management Reserve	
			%	Amount ($XCD)
1.2	Preliminary Assessments	52,000	5%	2600
1.3	Design & Engineering	55,500	5%	2775
1.4	Permits & Approvals	12,504,200	5%	625,210
1.5	Procurement	6,921,050	5%	346,052.50
1.6	Construction Works	223,250	5%	11,162.50
1.7	Electrical Works	199,000	5%	9,950

WBS ID	Description	Cost ($XCD)	Management Reserve	
1.8	Testing & Commissioning	45,000	5%	2,250
Total				**1,000,000**

4.4.3 Determine Budget

The project budget is calculated in **Charts 20 & 21**.

Chart No. 19 Project Budget (Source: Author)

Description	Value
Estimate	20,000,000
Contingency Reserve	843,928
Cost Baseline	20,843,928
Management Reserve	1,000,000
Total Project Budget	**21,843,928**

Chart No. 20 Project Budget (Source: Author)

3 MW Solar Farm Project	
Preliminary Assessments	52,000
Design & Engineering	55,000
Permits & Approvals	12,504,200
Procurement	6,921,050
Construction Works	223,250
Electrical Works	199,000
Testing & Commissioning	45,000
Management Reserve	1,000,000
Cost Baseline	20,843,928
Total Project Budget	**21,843,928**

4.4.4 Control Costs

Project expenses will be closely monitored and managed throughout the course of the project. Cost control involves gathering, accumulating, analyzing, monitoring, reporting and managing the project costs on an ongoing basis. Earned Value Management (EMV) will assist with cost forecasting, monitoring and controlling the project's time and cost.

Earned Value Management comprises of:

- Planned Value (PV): the budgeted cost of the work scheduled.
- Earned Value (EV): the budgeted cost of the work performed.
- Actual Cost (AC): the actual cost of the work performed.

The following example provides a demonstration of how Earned Value Management will be used to monitor and control the 3 MW Solar Farm Project costs. The Solar Farm project is planned for 15 months with a $20,000,000 budget. The project is scheduled for 45% of the project work to be completed in 9 months. During the cost control process, the project manager noticed that after the ninth month 42% of the project was completed and $ 9,605,200 was spent.

The PV, EV and AC are calculated below:

- EV = $20,000,000 x 42%
  = $20,000,000 x 0.42
  = $ 8,400,000
- PV = $20,000,000 x 45%
  = $20,000,000 x 0.45
  = $9,000,000
- AC = $9,605,200

From the calculations, the actual cost (AC) of the project will be $9,605,000 with an earned value (EV) of $8,400,000. Since the actual cost is greater than the earned value, the project will be spending more, which meant that the project costs will be higher than originally planned for the current progress status. Thus, it can be concluded from these calculations the project will be over budget and the necessary measures must be implemented to get the project back on budget. Further analysis will be used to obtain the schedule variance, cost variance, schedule performance index and cost performance index. Schedule Variance (SV) analyzes the performance of the project and to give an indication of the project's performance as it relates to the schedule.

Schedule Variance

SV= EV – PV

SV = $8,400,000 - $9,000,000

SV = - $ 600,000

Since the PV is less than 0, the project will be delayed, and the project manager needs to take action to get the project back on schedule.

Cost Variance

CV = EV – AC

= $8,400,000 - $9,605,000

= - $1,205,000

Since the cost variance is less than zero; this signifies that the project is spending more than planned for its current progress.

Schedule Performance Index

SPI = EV/PV

= $8,400,000 / $9,000,000

= 0.93

The SPI is 0.93 < 1, therefore the project is delayed.

Cost Performance Index

CPI = EV/AC

= $8,400,000 / $9,605,000

= 0.87

The CPI of 0.87 < 1 is a negative result. Therefore, the project is spending more than planned for its current progress.

The project manager will also analyze The Complete Performance Index (TCPI) to provide an indication of how much cost performance must improve for the Solar Farm Project to finish as planned according to the stipulated budget.

TCPI = (BAC – EV) / (BAC – AC)

= ($20,000,000 - $8,400,000) / ($20,000,000 - $9,605,000) = 1.11

Therefore, it can be determined that for the project to finish at the estimated budget at completion of $20,000,000, the cost performance needs to improve from the CPI of 0.87 to a TCPI of 1.11 for the remaining work.

4.5 Develop Quality Management Plan

During quality management, the project manager will continuously measure the quality of all the project activities and take the necessary corrective actions to achieve the established quality standards. The quality management processes enable the project manager to control project costs, establish standards for the project and determine the steps to achieve standards.

The quality management plan defines the project's quality policies, procedures and criteria for project activities and outlines the roles and responsibilities of the project team in managing quality.

4.5.1 Key Factors Related to Quality

The key factors related to quality must be understood by the project team to ensure the successful achievement of the project's quality deliverables.

1. **Quality**

   ISO 9000:2014 defines quality as the degree to which a set of inherent characteristics of an object fulfills requirements, where an object is anything perceivable or conceivable.

2. **Grade**

   Grade refers to a category or ranking system used to classify deliverables that fulfill the same functional quality but have different features. Those features may be desirable to the customer or end-user based on what they want from the deliverable. (Cspo, 2021)

3. **Prevention over Inspection**

   This concept states that quality is planned, designed and built in rather than inspected in. The cost of preventing mistakes is usually much less than the cost of correcting them when they are found by inspection.

4. Customer Satisfaction

The project team must understand, evaluate, define, and manage expectations so that customer requirements are met. This requires a combination of conformance to requirements to ensure the project produces what it intended to deliver and its fitness for use.

5. Cost of Quality

The cost of quality (COQ) includes all costs incurred over the life of the product by investment in preventing nonconformance to requirements, appraising the product or service for conformance to requirements and failing to meet requirements (rework). (PMI, 2017)

6. Cost of Conformance

a) Prevention costs to build a quality product and include training, document processes and equipment.
b) Appraisal costs to assess the quality of the project and include testing and inspections.

7. Cost of Non-conformance

a) Internal failure costs - failures found by the project and includes rework and scrap.
b) External failure costs - failures found by the customer and include liabilities, warranty work and lost business.

Quality Management Plan

	Project Quality Tracking
Project Name	Project Management Plan for the St. Lucia Electricity Services Ltd 3 MW Solar Farm Project.
Project Number	001
Document ID	001-LUCE-QMP
Document Owner	LUCELEC
Issue Date	
Last Saved Date	
File Name	Quality Management Plan

Version	**Issue Date**	**Changes**
1.0		Release

Role	**Name**	**Signature**	**Date**
Project Sponsor	LUCELEC		
Project Manager	TBD		

4.5.2 Plan Quality Management

According to The International Organization for Standardization (ISO), quality is defined as the degree to which a set of inherent characteristics fulfills requirements. The project manager's role involves ensuring that the quality defined by the stakeholders is maintained throughout the project. This will ensure that the 3 MW Solar Farm Project fulfills the needs for which it was undertaken. Technical experts with extensive knowledge of the quality systems will

guide the project and establish the quality measurements and quality control required for the project to meet international standards.

In planning for quality, the project manager will:

- Ensure the project quality standards are well defined, and the project team understands the project requirements, quality needs, expectations and standards;
- Identify other projects to obtain a comparable of quality;
- Conduct planning meetings with the team;
- Conduct a cost-benefit analysis to ensure quality activities are cost effective;
- Determine the tests and inspections to be performed.

Roles & Responsibilities

Chart No. 21 Roles and Responsibilities (Source: Author)

Role	**Responsibility**
Project Sponsor	Identifies project standards and approves quality change requests.
Project Manager (LUCELEC)	Develops the quality management plan and assigns responsibility to the project team.
Chief Engineer	Identifies the design and structural standards and ensures the delivery of the solar farm according to those standards.
Technical Consultant	Identifies the construction and electrical standards and ensures the delivery of the solar farm according to those standards.

The Quality Metrics for the 3 MW Solar Farm are defined in **Chart No. 23**.

Chart No. 22 Metrics & Quality Baseline (Source: Author)

Quality Objective	Metric	Metric Definition	Expected Outcome/ Results	Measurement Frequency	Responsible
Complete 100% of project structural and architectural blueprints before construction	The average time an engineer takes to complete structural and architectural blueprints.	The blueprints are a defined format for construction and electrical work. The number of blueprints produced will determine whether construction is ready to begin.	It is expected that the blueprints will meet architectural requirements.	Bi-weekly; the chief engineer scheduled bi-weekly meetings with the engineering team to obtain updates on the progress of blueprint drawings.	Chief Engineer
Increase solar farm capacity factor by 95% within the first month of project completion.	The actual output of energy produced by the solar farm against the maximum output	An increase in solar farm output recorded within the first month of project completion means that the output requirement would have been achieved.	It is expected that the solar farm will increase energy output within the first month.	Weekly; weekly energy output evaluations will be conducted.	Technical Consultant
Increase energy production by 98% within two months of project completion.	The total amount of electricity in kilowatt hours (kwh) generated by the solar panels	An increase In electricity generated within two months of project completion	It is expected that the solar farm will increase electricity production within the two months.	Bi-weekly; Meetings will be conducted with the electrical technical team every two weeks to obtain data on energy production.	Project Manager

Quality Objective	Metric	Metric Definition	Expected Outcome/ Results	Measurement Frequency	Responsible
		means that the energy production requirement would have been achieved.			
Customer retention rate of 90% for the year after project completion.	The total number of customers connected to the grid.	A customer retention rate of 90% indicates that the solar farm met stakeholder requirements.	It is expected that 90% of customers will be retained after the first year of project completion	Quarterly – Customer retention tracking every four months.	Project Manager

4.5.3 Manage Quality

The Project Management Institute (2017) defines manage quality as the process of translating the quality management plan into executable quality activities that incorporate the organization's quality policies into the project. The project manager, project team, project sponsor and stakeholders are all responsible for managing the quality of the 3 MW Solar Farm Project. The project team will utilize a quality activities matrix to ensure that quality objectives and metrics are achieved.

Chart No. 23 Quality Activities Matrix (Source: Author)

Deliverable	Requirement	Manage Activities	Frequency	Responsible
Preliminary Assessment Report	Feasibility study and site selection conducted by technical team	Define feasibility study requirements for the project	Once	Technical Team

Deliverable	Requirement	Manage Activities	Frequency	Responsible
Design & Engineering Report	Blueprints drawn by engineers	Create blueprint templates using solar farm specifications and orientation	Once	Chief Engineer
Approvals Report	Land register, construction and environmental permits submitted to the government ministries	Prepare permit documentation for submission	Once	Project Manager
Construction Report	Construction works completed by the construction team	Create a safety policy for construction works completed on the project Define a checklist that covers all	Monthly	Construction Team
Electrical Report	Electrical works completed by the electrical team	Create a safety policy for electrical works completed on the project	Monthly	Electrical Team
System Testing Report	Solar farm functionality and performance tested by the technical team	Identify the metrics to be used to measure the performance of the solar farm	Once	Technical Team

4.5.4 Control Quality

In controlling the quality of the project, the project manager and team, monitored and recorded the results, the quality management activities "in order to assess performance and ensure the project outputs were complete, correct, and meet customer expectations." (PMI, 2017, pg. 302) The process verified that the project deliverables met stakeholders' quality requirements and that the outputs worked as intended. A quality control checklist was an important tool for controlling the quality of the project.

Chart No. 24 Quality Control Checklist (Source: Author)

Project Name	Project Management Plan for the St. Lucia Electricity Services Ltd 3 MW Solar Farm Project.	**Date**	
Project No	001	**Document ID**	001-LUCE-QC
Reviewer 1		**Signature**	
Reviewer 2		**Signature**	

ID	Description	Inspection Criteria	Responsible	Comments
QC-1	Site Accessibility	The project site has road access that allows for smooth transportation of equipment and materials.	Construction Team	
QC-2	Solar Panel Orientation	The solar panels are positioned to generate 580,000 kwh per month	Technical Team	
QC-3	Safety	Project activities comply with project safety policy.	Project Manager	
QC-4	Land Registration	The property is legally registered at	Legal Team	

ID	Description	Inspection Criteria	Responsible	Comments
		the Land Registry (Department of Housing)		
QC-5	Construction Works	All construction activities meet specifications in the construction plans and designs.	Construction Team	
QC-6	Electrical Works	Electrical activities meet electrical designs specification	Electrical Team	
QC-7	Solar Farm Testing	The solar farm has 3 MW capacity	Technical Team	

4.6 Develop Resource Management Plan

Resource Management Plan

	Project Resource Tracking
Project Name	Project Management Plan for the St. Lucia Electricity Services Ltd 3 MW Solar Farm Project.
Project Number	001
Document ID	001-LUCE-RMP
Document Owner	LUCELEC
Issue Date	
Last Saved Date	
File Name	Resource Management Plan

Version	**Issue Date**	**Changes**
1.0		Release

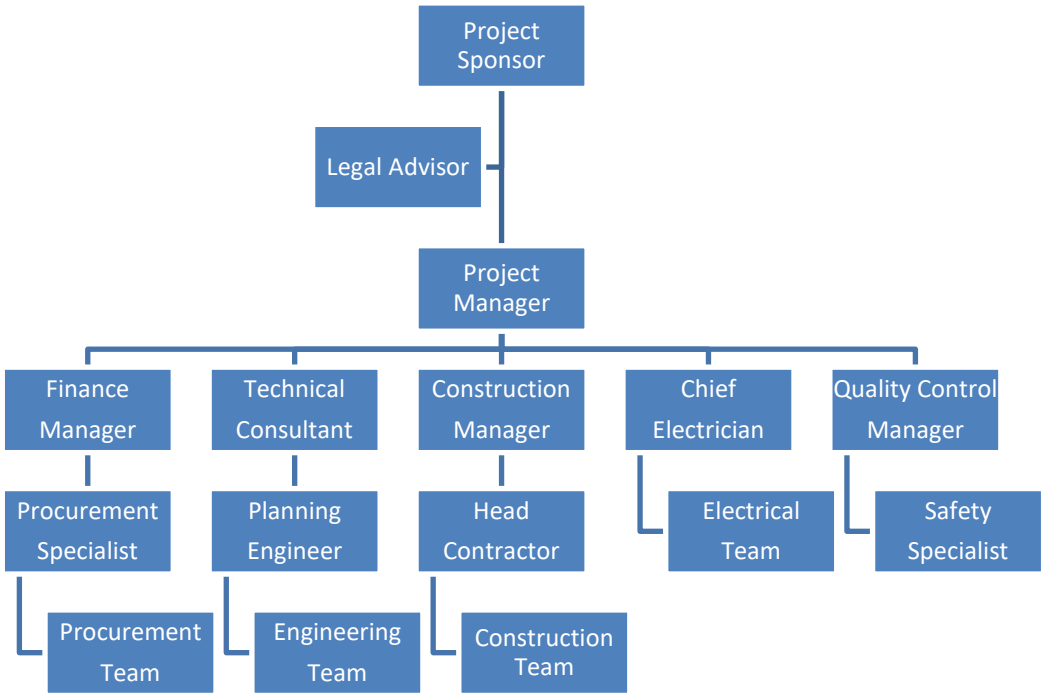
Role	**Name**	**Signature**	**Date**
Project Sponsor	LUCELEC		
Project Manager	TBD		

4.6.1 Plan Resource Management

In this process the project manager defines how to estimate, acquire, manage, and use the team, equipment, material and supplies on the project. This will determine the approach and level of management effort required to manage the project resources based on the type of project and how complex it is to complete. (PMI, 2017)

The Organizational Structure for the 3 MW Solar Farm is displayed in **Figure No. 9**

Figure 9 Project Organizational Chart (Source: Author)



The **RACI Matrix** below provides an indication of the roles and responsibilities for the group of activities in WBS level 1.

R: responsible – The person who performs the work

A: accountable – The persons who is accountable for the result

C: consult – Anyone who must be contacted before a decision is made

I: inform – People who must be kept in the loop after a decision is made or task completed

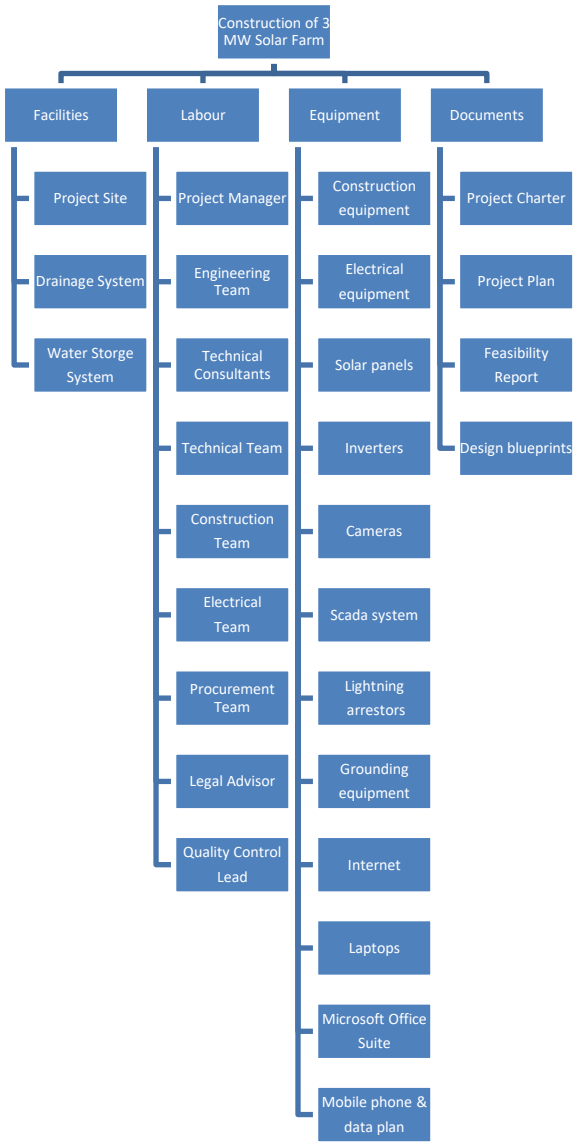
Chart No. 25 RACI Matrix (Source: Author)

Activity	Sponsor	Project Manager	Technical Consultant	Planning Engineer	Construction Manager	Chief Electrician	Procurement Specialist	Quality Control Manager
Preliminary Assessments	I	A	C	R	I	I	I	I
Design and engineering	C	A	R	R	I	I	I	I
Obtain permits and approvals	I	A	C	C	R	R	I	I
Prepare bid and contract documents and procure supplies	C	A	C	I	I	I	R	I
Construction Work	I	A	C	C	R	I	I	I
Electrical Work	I	A	C	C	I	R	I	I
Testing and Commissioning	C	A	C	C	I	I	I	R

4.6.2 Estimate Activity Resources

Estimate Activity Resources is the process of estimating team resources and the type and quantities of material, equipment, and supplies necessary to perform project work. (PMI, 2017, pg. 322) The process allows the project manager to identify and quantify the resources required for each project activity. The resource breakdown structure in **Figure No. 10** provides a hierarchical representation of the project resources by type.

Figure 10 Resource Breakdown Structure (Source: Author)


Construction of 3 MW Solar Farm
Facilities
Labour
Equipment
Documents
Project Site
Drainage System
Water Storge System
Project Manager
Engineering Team
Technical Consultants
Technical Team
Construction Team
Electrical Team
Procurement Team
Legal Advisor
Quality Control Lead
Construction equipment
Electrical equipment
Solar panels
Inverters
Cameras
Scada system
Lightning arrestors
Grounding equipment
Internet
Laptops
Microsoft Office Suite
Mobile phone & data plan
Project Charter
Project Plan
Feasibility Report
Design blueprints

Resource Estimation

Chart No. 26 3 MW Solar Farm Resource Estimation (Source: Author)

Resource	Category	Start Time	Finish Time	Remaining Work
Project Site	Facilities	10/03/2023	06/20/2025	1500 hours
Drainage System	Facilities	01/14/2025	04/21/2025	1500 hours
Water Storage System	Facilities	01/14/2025	04/21/2025	1500 hours
Project Manager	Project Team	10/03/2023	06/20/2025	5120 hours
Chief Engineer	Project Team	10/03/2023	06/20/2025	5120 hours
Technical Consultant	Project Team	10/03/2023	06/20/2025	5120 hours
Construction Team	Project Team	01/14/2025	04/21/2025	2500 hours
Electrical Team	Project Team	04/22/2025	05/30/2025	2500 hours
Technical Team	Project Team	10/03/2023	06/20/2025	5120 hours
Procurement Team	Project Team	10/03/2023	06/20/2025	3100 hours

Resource	Category	Start Time	Finish Time	Remaining Work
Legal Team	Project Team	10/03/2023	06/20/2025	3100 hours
Project Quality Lead	Project Team	03/05/2024	06/20/2025	1500 hours
Construction Materials	Equipment	01/14/2025	04/21/2025	2500 hours
Electrical Materials	Equipment	04/22/2025	05/30/2025	3500 hours
Solar panels	Equipment	04/22/2025	05/30/2025	2200 hours
Inverters	Equipment	04/22/2025	05/30/2025	2200 hours
CCTV cameras	Equipment	04/22/2025	05/30/2025	1000 hours
Lights	Equipment	04/22/2025	05/30/2025	1200 hours
SCADA System	Equipment	04/22/2025	05/30/2025	750 hours
Lightning arrestors	Equipment	04/22/2025	05/30/2025	750 hours
Grounding equipment	Equipment	04/22/2025	05/30/2025	500 hours
Internet	Equipment	10/03/2023	06/20/2025	5120 hours
Laptops	Equipment	10/03/2023	06/20/2025	5120 hours
Mobile phones	Equipment	10/03/2023	06/20/2025	5120 hours

Resource	Category	Start Time	Finish Time	Remaining Work
Microsoft Office Suite	Equipment	10/03/2023	06/20/2025	5120 hours
Project Charter	Document	10/03/2023	06/20/2025	1200 hours
Project Plan	Document	10/03/2023	06/20/2025	5120 hours
Feasibility Report	Document	12/12/2023	03/04/2024	1700 hours
Design blueprints	Document	03/19/2024	06/20/2025	1700 hours

4.6.3 Acquire Resources

In this process, the project manager's role involves collecting the various human resources, facilities, tools, equipment, supplies and materials required to deliver the project. This process was iterative throughout the project as resources came and went based on project necessity and needs. The following tools will be utilized to acquire the project's resources.

a) Pre-assignment

Specific technical staff or subject matter experts from across various departments were promised and assigned as part of the conditions of the project. The staff members identified were in the project charter.

b) Negotiation

The project manager will discuss staff availability with the functional managers to ensure that the technical staff are available when they are needed to work on the project. The second aspect of negotiating for team members involves ensuring that the most technically competent team members are selected for the project. This involves negotiating for subject matter experts and team members who have the right personality and technical skills to get the job done.

c) Acquisition

This technique helps with the acquisition of foreign technical consultants who have the requisite knowledge and skills in the construction and implementation of solar farms.

The roles and responsibilities of the project team as it relates to the management of the project's resources are outlined in **Chart No. 28** below.

Chart No. 27 Roles & Responsibilities (Source: Author)

Name	**Role**	**Responsibilities**
LUCELEC	Project Sponsor	Negotiate project funding. Provide the resources for the project team. Approves change requests. Reviews changes to the project environment.
Sibyl Dostalie	Project Manager	Assess the progress of the project. Records and reviews change requests. Adapts the project schedule and resources as challenges arise. Establishes, communicates and tracks metrics.
Grupotec	Engineering Team	Prepares structural and structural blueprints.

Name	Role	Responsibilities
		Provides an estimate of resources for engineering activities. Records change requests.
Rocky Mountain Institute	Technical Team	Proposes scope changes. Records change requests. Provides training to the project team. Provides an estimate of resources for technical activities.
Construction Team	Project Team	Executes the design and structural blueprints. Provides an estimate of resources for construction activities. Requests scope changes. Records change requests.
Electrical Team	Project Team	Executes electrical designs. Provides an estimate of resources for electrical work.
Procurement Team	Project Team	Acquires materials, supplies and equipment. Records material and supply requests from project team. Prepares tenders. Negotiates contracts.
Legal Advisor	Legal Team	Provides legal counsel for various project activities. Assists with drafting procurement contracts.

4.6.4 Develop Team

In developing the project team, the project manager will encourage an open and encouraging environment that allows the team to perform as an effective, functional and coordinated group. The minimization of conflict and increased harmony among the team members will lead to a well-executed project.

The following tools and techniques will be used to develop the most efficient and effective team for the 3 MW Solar Farm Project.

a) Training

Grouptec engineers, experts in the field of solar energy will provide training to ensure that the project team acquires the technical skills to execute the project seamlessly.

b) Ground Rules

The project manager will establish the expectations for appropriate behavior on the project. This includes reporting issues immediately via the appropriate medium and being punctual for meetings.

c) Co-location

The project team will work on the project site to allow them to function more effectively and to avoid time wasted associated with being at different locations. Co-location will allow for punctual start and end to meetings.

d) Recognition and Rewards

The team members will be compensated for their work and training opportunities and time off will be provided.

4.6.5 Manage Team

This is the process of tracking team member performance, providing feedback, resolving issues and managing changes to optimize project performance. (PMI, 2017) This will be done by:

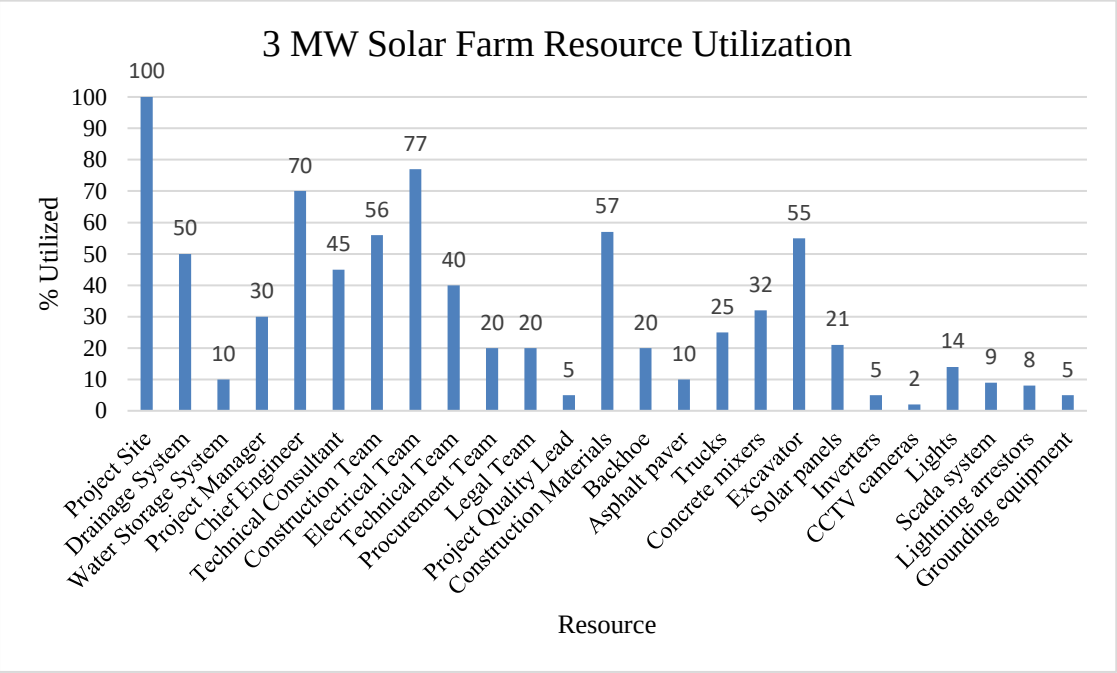
- Tracking and influencing team performance
- Providing feedback
- Managing conflict and resolving issues
- Initiating changes to optimize project performance

The project manager will observe the performance of team members and have conversations with them on areas which require improvement. Additionally, a performance-based appraisal system will manage the team's performance. The system clarifies the roles and responsibilities of the team members and provides feedback on their performance on the project. Conflict resolution methods will resolve issues that may arise among team members. The project team will collaborate to gain consensus on issues and compromise in other conflict situations to allow the project to move forward.

4.6.6 Control Resources

This process involves controlling the physical resources of the Solar Farm Project. This includes the project site, equipment, and materials that were used on the project. **Figure No. 11** portrays the resource utilization of the 3 MW Solar Farm Project.

Figure 11 Resource Utilization (Source: Author)



4.7 Develop Risk Management Plan

Project risk management is the process of identifying, analyzing and responding to any risk that arises over the life cycle of a project to help the project remain on track and meet its goal. (Schwartz, 2023) The project manager should not assume a reactive position towards the project risks. Instead, risk management must begin during project planning to identify the various risks that may affect the project and to have risk mitigation measures in place to manage those risks if they occur. According to the Project Management Institute (2017), project risk management serves to increase the probability and/or impact of positive risks and to decrease the probability and/or impact of negative risks, to optimize the chances of project success.

4.7.1 Plan Risk Management

When planning risk management, the project manager will define how to conduct risk management activities for the project to create the risk management plan. The risk management plan will describe how risk management is defined in the project. The project manager will utilize the following tools to plan risk management.

a) Expert Judgement

   The technical consultants who have significant knowledge in solar farm construction will provide their expertise in identifying the types of risks that may be encountered. The consultants will also tailor risk management for the specific needs of the project.

b) Meetings

The project sponsor, technical consultants, project manager, engineers, project team and other key stakeholders will discuss and establish the risk management plan for the project during the project kickoff meeting. One of the objectives of this meeting is to have an unbiased discussion on important aspects of the risk approach.

Risk Management Plan

	Project Risk Tracking
Project Name	Project Management Plan for the St. Lucia Electricity Services Ltd 3 MW Solar Farm Project.
Project Number	001
Document ID	001-LUCE-RMP
Document Owner	LUCELEC
Issue Date	
Last Saved Date	
File Name	Risk Management Plan

Version	**Issue Date**	**Changes**
1.0		Release

Role	**Name**	**Signature**	**Date**
Project Sponsor	LUCELEC		
Project Manager	TBD		

4.7.2 Identify Risks

Risk identification involves documenting the risks that could pose a threat to the project's success. This will allow the project team to implement the appropriate risk response to the various risks that may occur throughout the project. The process will also allow the project team to identify and maximize opportunities arising during the project. It is more economical to avoid risks and mitigate them where possible rather than to deal with risk outcomes. Thus, an efficient risk identification process will allow for an updated risk register and an effective action plan to handle the project risks.

4.7.2.1 Risk Breakdown Structure

The project risks will be grouped by sources of risks using a Risk Breakdown Structure (RBS). An RBS is a source-oriented grouping of project risks that organizes and defines the total risk exposure of the project. (PMI, 2017) Each descending level represents an increasingly detailed definition of sources of risk to the project. The RBS will ensure that all the sources of project risks are considered during the risk identification process. The lowest level of the risk breakdown structure generates a prompt list for individual project risks. The RBS for the 3 MW Solar Farm Project is displayed in **Chart No. 29** below.

Chart No. 29 Risk Breakdown Structure (Source: Author)

RBS Level 0	RBS Level 1	RBS Level 2
0. All Sources of Project Risks	1. Technical	1.1 Power Quality
		1.2 Performance and Reliability
		1.3 Solar Farm Capability
	2. External	2.1 Weather
		2.2 Contractors and Suppliers
		2.3 Customers
		2.4 Compliance
		2.5 Permits
	3. Organizational	3.1 Resources
		3.2 Revenue
		3.3 Budget
		3.4 Prioritization
	4. Project Management	4.1 Estimating
		4.2 Planning
		4.3 Controlling
		4.4 Communication

4.7.3 Perform Qualitative Risk Analysis

According to the Project Management Institute (2017), Perform Qualitative Risk Analysis is the process of prioritizing individual project risks for further analysis or action by assessing their probability of occurrence and impact as well as other characteristics. This analysis will allow the project manager to focus on high priority risks and implement the

appropriate risk response strategy. The project team will use a probability and impact matrix to evaluate the likelihood and impact of the various project risks.

4.7.3.1 Probability & Impact Matrix

This method will determine whether a risk is acceptable or unacceptable based on both its probability of occurrence and its potential severity if it occurs.

Chart No. 30 Probability and Impact Matrix (Source: Author)

Probability						
	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	**2**	**3**	**4**	**5**

Impact

	High Risk
	Medium Risk
	Low Risk

Chart No. 31 Probability Impact Assessment (Source: Author)

Risk Description	Probability	Impact	Risk Score (PxI)	Risk Rating
Technical staff not adequately skilled in solar panel installation	2	5	10	Medium
Tropical storms, hurricanes and flooding	4	5	20	High
Poor estimation of the amount of capital required for the project	2	4	8	Medium
Incomplete or abandoned project	1	5	5	Low
Delay in the shipment of solar panels and equipment	3	3	9	Medium
Poor quality solar panels	2	3	6	Medium
Implementation of the National Utilities Regulatory Commission to oversee renewable energy projects	3	5	15	High
Unable to obtain permits and government approval	2	5	10	Medium
Unable to acquire land for the project because of land disputes or contract issues	2	5	10	Medium

Risk Description	Probability	Impact	Risk Score (PxI)	Risk Rating
High interest in renewable energy and customers seeking lower bills	4	4	16	High
Funding from international agencies	3	4	12	High
Change in renewable energy policy	1	5	5	Low
Technology that enhances the capacity of solar panels	3	4	12	High
Experts from Rocky Mountain Institute provide project assistance	2	3	6	Medium
High transportation costs	3	3	9	Medium
Inflation and increase in the exchange rates	3	5	15	High
Poor quality of solar panels	3	4	12	High
Limited security measures to secure materials	2	4	8	Medium

The project manager will use the risk register to monitor and track the risks that might affect the project. The risk register for the 3 MW Solar Farm Project is displayed in **Chart No. 32** below.

Chart No. 32 Risk Register (Source: Author)

RBS Code	Risk	Cause	Consequence	Probability	Impact	Risk Rating	PxI	Risk Response Strategy	Risk Owner
R01	Insufficient technical skills	Technical staff not adequately skilled in solar panel installation	Faster power degradation, electrical safety hazards, and catastrophic failures of the solar PV systems	2	5	Medium	10	Mitigate: Provide training during project planning	Project Manager
R02	Weather	Natural disasters Flooding	Delay in the completion of the project	4	5	High	20	Transfer: Obtain insurance protection for damage to the solar farm by natural disasters	Project Manager
R03	Budget	Poor estimation of the amount of capital required for the project	Inadequate funding to complete the project	2	4	Medium	8	Mitigate: Prioritize identified risks based on their potential impact on the project budget	Project Manager
R04	Revenue	Incomplete or abandoned project	Unable to generate revenue and recover project costs.	1	5	Low	5	Mitigate: Utilize cost-saving strategies	Project Manager

								such as bulk purchasing.	
R05	Procurement	Delay in the shipment of solar panels and materials	Project delay due to procurement issues.	3	3	Medium	9	Mitigate: Provide the procurement team with the project timeline to ensure that they work within the project schedule	Project Manager
R06	Customer	Poor quality solar panels installed	Customer dissatisfaction due to frequent power interruptions	2	3	Medium	6	Mitigate: Conduct quality control through visual inspection and electrical performance testing of the solar panels	Procurement Team Engineers
R07	Compliance	Implementation of the National Utilities Regulatory Commission to oversee renewable energy projects	New policies and laws that could delay the project	3	5	High	15	Mitigate: Ensure the project complies with policies implemented by the National Utilities Regulatory Commission	Project Manager

R08	Permits	Unable to obtain permits and government approval	Delay in the start of the project and possibly abandoning of the project	2	5	Medium	10	Mitigate: Submit all necessary information for the permit approval process Request updates from the government approving authority on the status of the permits	Project Manager
R09	Land Acquisition	Unable to acquire land for the project because of land disputes or contract issues	Project is abandoned	2	5	Medium	10	Mitigate: Engage the residents of the community by conducting town hall meetings before the project begins	Project Manager Engineers
R10	Demand for solar energy	High interest in renewable energy and customers seeking lower bills	Increase in the demand for solar powered electricity	4	4	High	16	Exploit: Utilize the high demand for renewable energy to assist with project	Project Manager

								decision making	
R11	Funding from international bodies	Project capital offered by the Clinton Foundation	Ability to acquire more land and expand capacity	3	4	High	12	Enhance: Utilize additional project funding to expand the project	Project Manager
R12	Changes in renewable energy policy	A change in the policy that restricts the number of providers of solar powered electricity	Limited competition means increased revenue	1	5	Low	5	Enhance: The legal team should monitor the renewable energy environment for opportunities that will assist with project decision making	Legal Advisor
R13	New technology	Technology that enhances the capacity of solar panels	Cost and schedule benefits	3	4	High	12	Enhance: Assess new technologies and evaluate its compatibility with the existing infrastructur e, potential benefits, and implementati	Project Manager

								on challenges	
R14	Additional Technical Resources	Experts from Rocky Mountain Institute provide project assistance	Project completion ahead of schedule	2	3	Medium	6	Exploit: Evaluate current resources and accept additional resources where possible	Project Manager
R15	High transportation costs	Increase in the price of fuel	Insufficient finances to complete the project	3	3	Medium	9	Mitigate Assess the project budget and scope to identify potential areas for cost reduction or optimization	Project Manager
R16	Volatile economic conditions	Inflation and increase in the exchange rates	Project financial losses	3	5	High	15	Mitigate: Conduct a thorough analysis of the economic conditions and trends in the project's target market	Project Manager
R17	Poor quality	Poor material quality solar panels	Reduced operational lifespan which leads to poor performance	3	4	High	12	Mitigate: Conduct research before	Project Manager

			and frequent replacement					procuring equipment and supplies. Implement a rigorous vendor selection process to ensure the procurement of high-quality solar panels.	
R18	Theft of materials	Limited security measures to secure materials	Additional costs for replacement and project delay	2	4	Medium	8	Mitigate: Secure panels and materials as soon as they arrive on project site Site security assessment: Conduct a thorough assessment of the project site's security vulnerabilities Identify potential areas of risk and develop strategies to address them, such as installing	Engineers

								security cameras, fencing, and access control measures	

4.7.4 Perform Quantitative Risk Analysis

Perform Quantitative Risk Analysis is the process of numerically analyzing the combined effect of identified individual project risks and other sources of uncertainty on overall project objectives. (PMI, 2017) This risk assessment tool will not be used on this project; instead, qualitative risk analysis will be the primary risk assessment tool used for analyzing the project risks.

4.7.5 Plan Risk Responses

The project manager will ensure effective risk management by developing and implementing a solid risk response to the identified risks. These risk responses will describe how the project team will monitor and respond to unexpected and uncertain events that could impact the project. The negative risks identified during the construction of the 3 MW Solar Farm Project will be managed using the following risk response strategies.

1. **Avoidance**

The project manager will change the project plan to eliminate the risk and to limit its impact on the project cost and schedule. This will be achieved by modifying the scope, adding contingency to the project plan as additional time for critical path activities or adding resources. Threats such as the delay in obtaining permits and new energy regulations, which arise early in the project, will be avoided by clarifying requirements from the relevant government bodies. The legal advisor will clarify and resolve ambiguous legal issues that may hinder the project's progress.

2. Escalate

An escalation strategy will be used when the project team or the project sponsor agrees that an opportunity is outside the scope of the project or that the proposed response would exceed the project manager's authority. (PMI, 2021) A risk such as issues with the sale of the property for the project site will be escalated to the project sponsor and the legal team.

3. Mitigate

Risk mitigation will reduce the probability and/or impact of an adverse risk event to an acceptable threshold. When prompt action is taken, this will reduce the probability and or impact of a risk and is often more effective than trying to repair the damage after the risk has occurred. The risk of severe weather will be mitigated by using composite materials for the panel frames and racks to add an extra layer of protection.

4. Transfer

This strategy will shift the impact of a threat to a third party through insurance, performance bonds, warranties, guarantees, incentive/disincentive clauses and time and cost contracts. The transfer risk response will be used providing that the price for the risk transfer can be supported by the project's cash flow.

5. Accept

The project manager will accept a risk if it is not possible to eliminate the risk from or if the cost in time or money of the response is not warranted by the potential impact of the risk. For example, a contingency reserve will include time, money, or resources to handle

risks related to the cost and schedule. The project manager will also accept positive risks or opportunities that may occur during the project. Additionally, several strategies will respond to positive risks or opportunities that may occur throughout the project. The project manager will either exploit, share or enhance those opportunities.

1. **Exploit**

With exploitation, the project team will ensure that an opportunity occurs. Exploiting a risk can involve reducing the amount of time it takes to complete the project by hiring technical personnel to oversee the construction of the 3 MW Solar Farm.

2. **Share**

This strategy involves assigning the risk to a third-party owner who is best able to bring about the opportunity the risk event presents. For example, LUCELEC collaborated with the Rocky Mountain Institute and the Clinton Foundation for technical, bid evaluation and contract negotiations for the solar PV Farm project.

3. **Enhance**

The enhance strategy is used to increase the probability and/or the positive impacts of an opportunity. (Project Management Institute, 2017) This will entail seeking and emphasizing risk triggers as well as identifying the root causes of the risk to help enhance its impact or probability.

4.8 Develop Procurement Management Plan

The materials for the project will be obtained from both local and international suppliers. The procurement team with the necessary support of the legal advisor will be responsible for bidding, contract negotiation and vendor selection on the 3 MW Solar Farm Project. Technical experts from outside the company will be hired on a contractual basis to assist with and oversee the construction of the solar farm.

4.8.1 Key Concepts for Project Procurement Management

The Project Management Institute (2017, pg. 448-449) identifies several key concepts for project procurement management.

1. The project manager is typically not authorized to sign legal agreements binding the organization. This task is reserved for the legal team and others who have the authority to do so.

2. The Project Procurement Management processes involve agreements that describe the relationship between the buyer and the seller. Agreements can be simple or complex and the contract should reflect the simplicity or complexity of the deliverables or required effort and should be written in a manner that complies with local, regional and international laws regarding contracts.

3. A contract should clearly state the deliverables and results expected, including any knowledge transfer from the seller to the buyer. The effect of culture and local law on contracts must be considered when working internationally.

4. The project management team is responsible for verifying that all procurements meet the specific needs of the project while working with the procurement office to ensure organizational procurement policies are followed.

5. The contracts will be subject to review by the legal department to ensure that the contract adequately describes the products, services, or results that the seller is agreeing to provide, while being in compliance with the laws and regulations regarding procurements.

Procurement Management Plan

	Project Procurement Tracking
Project Name	Project Management Plan for the St. Lucia Electricity Services Ltd 3 MW Solar Farm Project.
Project Number	001
Document ID	001-LUCE-PMP
Document Owner	LUCELEC
Issue Date	
Last Saved Date	
File Name	Procurement Management Plan

Version	**Issue Date**	**Changes**
1.0		Release

Role	**Name**	**Signature**	**Date**
Project Sponsor	LUCELEC		

Project Manager	TBD		

4.8.2 Plan Procurement Management

Plan procurement management is the process of documenting project procurement decisions, specifying the approach, and identifying potential sellers. (Project Management Institute, 2017, pg. 447) During this process, the procurement team will identify the goods and services purchased from outside of the organization. Since most of the equipment and materials for the Solar Farm Project are not available in country, they will be purchased from international vendors. The procurement management plan will be based on the project's scope and schedule and will guide the procurement-related processes. It will also address make or buy decisions and ensure that the project resources are available as needed.

4.8.2.1 Roles and Responsibilities

The roles and responsibilities of the project stakeholders are necessary to plan procurement on the 3 MW Solar Farm Project. The roles and responsibilities are outlined in **Chart No. 33**.

Chart No. 33 Procurement Management Roles and Responsibility (Source: Author)

Role	Responsibility
Project Sponsor	Provide funding and project approval. Provide guidance and support to ensure that the procurement process runs smoothly so that the project is delivered on time and within budget.
Technical Consultants	Recognizes the demands and needs of the engineering team. Supports bid evaluations.

Role	Responsibility
	Provides technical documents to support the development of the procurement management plan. Supports the procurement team at bidding and contract negotiation meetings.
Engineers	Recognizes the demands and needs of the engineering team. Provides design and structural information to the procurement team. Supports bid evaluations.
Finance Manager	Prepares a quarterly and annual budget based on the procurement plan. Develops, manages and controls all aspects of contract formation, negotiation, and management and leads and supports the procurement life cycle for the purchase of goods and services.
Procurement Team	Advises the project team on procurement methods and practices. Implements the procurement plan. Advises the team on procurement lead time and costs. Updates the procurement plan.
Legal Advisor	Reviews bids and contracts. Advises the procurement team.
Contractors	Review specifications and provide a detailed breakdown of costs for the project. Timely delivery of goods and materials purchased for the project.
Project Manager	Describes and initiates procurement requirements. Seeks technical assistance in procurement planning activities where necessary.

Role	Responsibility
	Submit the procurement work plan to the procurement team for implementation. Updates the stakeholders throughout the procurement process.

Meetings and source selection analysis will be used to plan procurement on the 3 MW Solar Farm Project.

1. **Meetings**

Meetings will be held with the project manager, procurement team, legal advisor and technical personnel to determine the strategy or managing and monitoring project procurement.

2. **Source Selection Analysis**

The quality-based/highest technical proposal score will be utilized to select a vendor among the proposals received. The selected firm will submit a proposal with both technical and cost details. An invitation will follow to negotiate the contract if the technical proposal proves acceptable. (PMI, 2017 pg. 460) Using this method, technical proposals for the construction of the solar farm will be evaluated based on the quality of the technical solution offered.

4.8.2.2 Procurement Strategy

The procurement strategy will determine the project delivery method, the type of legally binding agreement, and how the procurement will advance through the procurement phases.

1. The turnkey delivery method will be used for the construction of the 3 MW Solar Farm Project.

2. Firm fixed-price contracts will set the terms of the project and establish the price of goods and services. These contracts will specify what the sellers are required to do and their obligations for a firm price.

4.8.3 Conduct Procurements

According to the Project Management Institute (2017), Conduct Procurements is the process of obtaining seller responses, selecting a seller, and awarding a contract. This process allows for the selection of a qualified seller and implements the legal agreement for delivery of the goods and services. A bidder conference and negotiation will be used to conduct procurement on the 3 MW Solar Farm Project.

1. **Bidder Conference**

A bidder conference will be held once with all the potential vendors and they will be allowed the opportunity to bid. The conference will be arranged by the project manager and will be held with prospective buyers or sellers that occur prior to the completion of their response proposal. The purpose of the bidder conference is to allow prospective vendors to

meet with the organization's procurement team to ask questions and clarify issues they have regarding the project and the request for proposal (RFP).

2. **Negotiation**

During this process, the vendor and the procurement team, guided by the legal advisor will negotiate the terms of the contract. The two parties will define the contractual terms as they discuss price, regulations, responsibilities and the project approach. The parties will also negotiate the technical terms of the project and service level agreements (SLAs). The parties will sign and execute the contracts after they complete negotiations and reach an agreement.

The following vendor agreement will be utilized during the procurement process.

Figure 12 Vendor Agreement (Source: Easy Legal Docs, 2023)

VENDOR AGREEMENT

This Vendor Agreement (hereinafter referred to as the "Agreement") shall commence on [COMMENCEMENT DATE],

BY AND BETWEEN:	**[CLIENT NAME]**, hereinafter referred to as the "Client".
AND:	**[VENDOR NAME]**, hereinafter referred to as the "Vendor", collectively referred to as the "Parties".

This Agreement will be considered agreed and valid upon signature by both parties. In consideration of the mutual promises and covenants in this Agreement, the Parties further agree to the terms as follows

Scope of Engagement

The Vendor hereby agrees to supply the following goods or services at the Client's place of business, located at [CLIENT ADDRESS], in accordance with the terms of this Agreement:

(Amend and list any additional items or services here. Be as specific as possible specifying the brand, model, and any unique features).

Payment Terms

The Client will receive monthly invoices, and after verifying that the charges are accurate, issue payment within 30 days. All payment matters should be addressed to the Client's accounts payable department.

Representation and Warranties

The Parties mutually represent and warrant that they have the capacity and qualifications necessary to abide by the terms and conditions of this Agreement.

The Vendor represents that it is a legally registered entity or individual with the legal capacity to enter into this Agreement and fulfill its obligations herein.

Furthermore, the Vendor represents that it possesses the expertise, experience, licenses, and certifications required to provide the goods or services specified in the "Scope of Engagement" section.

The Vendor also warrants its commitment to compliance with all applicable laws, regulations, and industry standards while providing the goods or services outlined in this Agreement.

Liability and Indemnification

The Vendor will take responsibility and cover any losses or damages that the Client and its representatives may experience.

In addition, the Client agrees to protect the Vendor from any loss or damage, except in the case of extreme carelessness or recklessness by the Vendor or its representatives.

Insurance

The Vendor is obligated to source suitable insurance for the duration of the contract and upon request will provide verification of such insurance to the Client.

If the Vendor fails to provide proof of insurance, the Client will treat this as a violation of the vendor Agreement and it will be cause for termination.

Independent Contractor

The Vendor will be regarded as a self-employed individual. This Agreement does not establish an employer-employee relationship, and such an Agreement will never be formed in the future.

Termination

This vendor Agreement can be terminated by either party with 10 days written notice. All unpaid debts must be paid to the Vendor within 30 days of the termination.

Entire Understanding

This vendor Agreement, along with any associated documents, constitutes the complete Agreement and shall supersede any previous Agreements, both written and spoken.

Legal Fees

In the event of any legal action, the victorious party is eligible to receive compensation for expenses such as lawyer fees, court costs, and transportation costs.

Notices

All communication regarding this vendor Agreement must be done in writing and either sent by mail or delivered in person.

Delays

Should either of the parties become aware of any issue that may postpone any part of the contract, they must inform the other side within five days in a written report that includes all relevant details.

Signatures

In signing this Agreement, the Vendor confirms their familiarity with the conditions of operating with the Client, and pledges to adhere to these terms at all times.

CLIENT	**VENDOR**
_____	_____
Signed (signature)	Signed (signature)
_____	_____
Print Name	Print Name
_____	_____
Address	Address
_____	_____
Date	Date

4.8.4 Control Procurements

Control Procurements is the process of managing procurement relationships; monitoring contract performance, and making changes and corrections as appropriate; and closing out contracts. (PMI, 2017) The process ensures that there is effective and efficient project spending. It will also ensure the organization and seller's performance meet the project's requirements according to the terms of the legal agreement. (PMI, 2017)

4.8.4.1 Tools Used to Control Procurements

Performance reviews and inspection will be used to control procurement on the 3 MW Solar Farm Project.

- **Performance Reviews**

According to the Project Management Institute (2017), performance reviews for contracts measure, compare, and analyze quality, resource, schedule, and cost performance against the agreement. This includes identifying work packages that are ahead or behind schedule, over or under budget, or have resource or quality issues. The project manager will

be responsible for ensuring that the vendors adhere to the terms of the agreement. This will involve verifying the quality of the equipment and materials and ensuring that procurement costs remain on budget. Additionally, the project manager along with the project team will ensure that equipment and supplies are purchased early enough so that shipments arrive in time and delays do not compromise the project schedule.

- **Inspection**

Inspection will involve a physical walkthrough of the solar farm led by the project manager and accompanied by the technical team, engineering team and contractors. The walkthrough will allow the team to identify any issues that require addressing and will provide a mutual understanding of the work in progress.

4.9 Develop Communication Management

The communications management plan will outline the communication strategy for engaging stakeholders for the 3 MW Solar Farm project. The plan will guide the project team on how to plan, structure, implement, and monitor the effectiveness of the communication strategy (Project Management Institute, 2021)**.** It will define the project's objectives and will identify the project stakeholders throughout the project lifecycle. A detailed plan for communication will be developed based on each stakeholder's relationship to the project.

4.9.1 Objectives of the Communications Management Plan

1. To inform stakeholders of the intent to carry out the construction of a 3 MW Solar Farm in La Tourney, Vieux Fort.
2. To open a communication channel between the technical consultants and stakeholders to facilitate the exchange of knowledge and data.
3. To engage stakeholders and maintain their interest in the project by providing continuous updates.

Communication Management Plan

	Project Communication Tracking
Project Name	Project Management Plan for the St. Lucia Electricity Services Ltd 3 MW Solar Farm Project.
Project Number	001
Document ID	001-LUCE-CMP
Document Owner	LUCELEC
Issue Date	
Last Saved Date	
File Name	Communication Management Plan

Version	**Issue Date**	**Changes**
1.0		Release

Role	**Name**	**Signature**	**Date**
Project Sponsor	LUCELEC		
Project Manager	TBD		

4.9.2 Key Concepts for Project Communications Management

1. Identify the Target Audience

   The first step in developing the communication plan will be to identify the target audience. This will involve defining the stakeholders and determining whether they are internal or external to the organization.

2. Determine the Frequency of Communication

   With the audience defined, the project manager will decide on the frequency of communication with the project stakeholders. Meetings can be weekly, bi-weekly or monthly.

3. Establish the Communication Method

   The project manager will determine the communication methods for the project. Hybrid meetings will be held to accommodate both in-person and remote attendees. The project manager will forward reports to stakeholders for review via e-mail and general project information will be updated to the organization's website.

4.9.3 Plan Communications Management

The project manager must have a keen understanding of the importance of effective communication on producing a successful project. Therefore, the right approach, tools and techniques will be used to effectively plan project communications to get the desired outcome. According to the Project Management Institute (2017), plan communications management is the process of developing an appropriate approach and plan for project communications activities based on the information needs of each stakeholder or group, available organizational assets, and the needs of the project. This will ensure that communication is effective, timely, relevant and fosters stakeholder confidence.

The project manager must be emotionally intelligent and have the appropriate interpersonal skills to maintain the communication flow on the project. **Charts No 34** & **35** classify the stakeholders of the 3 MW Solar Farm Project.

Chart No. 34 Stakeholder Classification (Source: Author)

	Stakeholders	**Interests**
1	Project Sponsor	Supports the project team and provides the funding for the project.
2	Technical Consultants	Support project team with oversight and leadership of project to meet business objectives.
3	Engineers	Support the project team on the feasibility study and design of the 3 MW Solar Farm.
4	Legal Advisor	Provides the project sponsor and team with legal support.
5	Environmentalists	Support for protection of the existing ecosystem in La Tourney, Vieux Fort.
6	Financial Institutions	Support project finances so it can meet desired outcomes and return on investment.
7	International NGOs	Provides additional funding and support for the project.
8	Residents of La Tourney	Support for safeguarding public health and safety with proper construction of the solar farm.
9	Government of Saint Lucia	Support for transitioning to renewable energy in the country.

Chart No. 35 Stakeholder Power/Interest Matrix

Stakeholders	Position	Power	Interest
Project Sponsor	+	5	5
Technical Consultants	+	4	5
Engineers	+	3	5
Legal Advisor	+	3	4
Environmentalists	-	3	4
Financial Institutions	+	5	5
International NGOs	+	3	4
Residents of La Tourney	-	2	4
Government of Saint Lucia	+	5	5

Power: 1 – Low . . . 5 - High

Interest: 1 – Low . . . 5 - High

Position: + In Favor, – Against

The Stakeholder Communication Requirements will determine the frequency, format and purpose of communication for each stakeholder group on the 3 MW Solar Farm project.

Chart No. 36 Communications Requirements Matrix (Source: Author)

Communication Type	Audience	Purpose	Frequency	Owner	Channel
Kickoff Meeting	Project Sponsors Technical Consultants Engineers Project Team	Introduce the project team Outline project goals Review objectives Set expectations for the project	Once	Project Sponsor	Hybrid meeting (In-person & Virtual meeting)
Bi-weekly Status Meetings	Project Sponsor Technical Consultants Engineers Project Team	Updates on project issues and performance, Discuss action items Identify risks	Bi-weekly	Project Manager	Emails Hybrid meetings
Stakeholder Engagement Meetings	Project Sponsors Technical Consultants Engineers Environmentalists Residents of La Tourney NGOs Government Project Team	Introduce the project team Review project objectives Engage stakeholders and seek buy-in Discuss stakeholders' concerns	As required	Project Manager	Emails Hybrid meeting

Communication Type	Audience	Purpose	Frequency	Owner	Channel
	Financial Institutions				
Public Meetings	Project Sponsor Technical Consultants Engineers Environmentalists Customers/Residents of La Tourney Project Team	Introduce project team Review the project objectives Seek buy-in Discuss concerns Provide feedback on project progress	Twice (One meeting prior to the start of the project and one upon project completion)	Project Manager	Town Hall Meeting Presentations
Reports for Financial Institutions	Project Sponsor Technical Consultants Engineers Financial Institutions Project team	Project progress report as it relates to budget and schedule.	Quarterly	Project Manager	Reports Emails
Feasibility Study Meeting	Technical Consultants Engineers Project Team	Discuss feasibility study report	Once	Project Manager	Emails Hybrid Meeting
Structure/Design Review Meeting	Project Team Engineers	Discuss the positioning and	Once	Engineers	Hybrid Meeting

Communication Type	Audience	Purpose	Frequency	Owner	Channel
	Technical Consultants Project Sponsor	orientation of the solar farm			Presentations
Deliverable Review	Project Sponsor Technical Consultants Engineers Project Team	Meetings to review deliverables and provide updates to the project sponsor.	As Required	Project Manager Technical Consultants	Emails Hybrid Meetings

4.9.4 Manage Communications

This is the process of creating, collecting, distributing, storing, retrieving and the ultimate disposition of project information in accordance with the communications management plan. (PMI, 2017) Chart No identifies the delivery method and technology that will be used to manage communications on the 3 MW Solar Farm Project.

Chart No. 37 Communication Methods and Technology (Source: Author)

Communication Methods & Technology	Description
Meetings	Meetings are important for engaging stakeholders and are a primary means of communication throughout a project (Project Management Institute, 2021). Meetings are interactive sessions that can be in-person, virtual or both. Face-to-face meetings for the project will include:

Communication Methods & Technology	Description
	• Kickoff meeting to formally launch the project and introduce the project to key stakeholders. • Team meetings to provide regular updates on the progress of the project. • Technical meetings where the technical team discuss technical aspects of the project such as the feasibility study report and the structure and design of the solar farm. • Review meetings during which key stakeholders review project deliverables, provide direction and support to the project team, and make decisions that are beyond the authority of the project team. Town Hall meetings (public meetings) will inform the public specifically the residents of La Tourney of the project, hear their concerns and allow them to ask questions regarding the project.
Video Conferencing e.g. Zoom and Microsoft Teams	Video Conferencing tools such as Zoom and Microsoft Teams will allow virtual meetings with stakeholders who cannot meet in-person. These can facilitate daily stand-up meetings, technical meetings, and review meetings.
Email	E-mails will facilitate quick and easy communication and will share project documents, reports, and notices of meetings directly to a large group of specific recipients simultaneously.
Reports	These formal documents will communicate relevant information to stakeholders (Project Management Institute, 2021). Reports will include technical reports, progress reports, meeting reports and financial reports. On occasion, technical reports will be presented to stakeholders via Power Point presentations.
Social Media	Social media platforms such as Meta, Instagram, Twitter and news websites will be used to inform the residents of La Tourney and environmentalists of upcoming town hall

Communication Methods & Technology	Description
	meetings. These platforms will also provide information about the project to sensitize the public about the project.
Electronic Repositories	Project information will be stored on the organization's Electronic Information Centre (EIC). Information will also be updated to the organization's website.

The following sample report will be used for stakeholder communication.

Sample Report

Chart No. 38 Sample Report (Source: Author)

Project Name			
Project Number			
Meeting			
Project Manager		Date	
Subject			

Report		
Item	**Description**	**Status**
Review of last status update		
Work in Progress		
Work Completed		
Challenges		

Next Steps		

4.9.5 Monitor Communications

In the process of monitoring communications, the project manager will ensure that the information needs of the project and its stakeholders are met. The key benefit of this process is the optimal information flow as defined in the communications management plan and the stakeholder engagement plan. (PMI, 2017)

The following tools will be used to monitor project communications.

a) Meetings

   Face-to-face and/or virtual meetings will be held to make decisions, respond to stakeholder requests and hold discussions with suppliers, vendors, and other project stakeholders.

b) Observation/Conversation

   Observation and conversation will enable the project manager to identify issues within the team, conflicts between people and individual performance issues.

c) Stakeholder Engagement Assessment Matrix A Stakeholder Engagement Assessment Matrix will monitor stakeholder engagement. The results will allow the project manager to take the necessary steps to incentivize resistant and neutral stakeholders.

Chart No. 39 Stakeholder Engagement Assessment Matrix (Source: Author)

Stakeholder	**Unaware**	**Resistant**	**Neutral**	**Supportive**	**Leading**
Project Sponsor					**C** D
Technical Consultants				**C** D	
Engineers				**C** D	
Legal Advisor				**C** D	
Environmentalists		**C**		D	
Financial Institutions			**C**	D	
International NGOs			**C**	D	
Residents/Customer		**C**		D	
Government of Saint Lucia				**C** D	

4.10 Develop Stakeholder Management Plan

The Stakeholder Management Plan will outline the appropriate management strategies to effectively engage and monitor stakeholders throughout the lifecycle of the project based on the analysis of their needs, interests and potential impact on project success.

Stakeholder Management Plan

	Project Stakeholder Tracking
Project Name	Project Management Plan for the St. Lucia Electricity Services Ltd 3 MW Solar Farm Project.
Project Number	001
Document ID	001-LUCE-SMP
Document Owner	LUCELEC
Issue Date	
Last Saved Date	
File Name	Stakeholder Management Plan

Version	**Issue Date**	**Changes**
1.0		Release

Role	**Name**	**Signature**	**Date**
Project Sponsor	LUCELEC		
Project Manager	TBD		

4.10.1 Identify Stakeholders

In this process, the stakeholder will identify the people, groups, or organizations that could impact or be impacted by a decision, activity, or outcome of the 3 MW solar farm. The process also involves analyzing and documenting relevant information regarding the stakeholders' interests, involvement, interdependencies, influence, and potential impact on the project's success. (PMI, 2017)

The stakeholders of the 3 MW Solar Farm Project are classified in **Chart No. 40**.

Chart No. 40 Stakeholder Classification (Source: Author)

	Stakeholders	**Interests**	**Category**
1	Project Sponsor	Supports the project team and provides the funding for the project.	Internal
2	Technical Consultants	Support project team with oversight and leadership of project to meet business objectives.	External
3	Engineers	Support the project team on the feasibility study and design of the 3 MW Solar Farm.	External
4	Legal Advisor	Provides the project sponsor and team with legal support.	Internal
5	Environmentalists	Support for protection of the existing ecosystem in La Tourney, Vieux Fort.	External
6	Financial Institutions	Support project finances so it can meet desired outcomes and return on investment.	External

	Stakeholders	Interests	Category
7	International NGOs	Provide additional funding and support for the project.	External
8	Residents of La Tourney	Support for safeguarding public health and safety with proper construction of the solar farm.	External
9	Government of Saint Lucia	Support for transitioning to renewable energy in the country.	External
10	Project Manager	Supports the project team and manages the project.	Internal

4.10.2 Plan Stakeholder Engagement

This is the process of developing approaches to involve project stakeholders based on their needs, expectations, interests, and potential impact on the project. (PMI, 2017) The project manager will plan stakeholder engagement by using expert judgement and data representation. The expertise of individuals with knowledge of previous solar farm projects and local and foreign power structures in the renewable energy sector will be sought.

The project stakeholders are outlined in the stakeholder responsibility matrix in **Chart No. 41** below:

Chart No. 41 Stakeholder Responsibility Matrix (Source: Author)

Name	Organization	Job Title	Responsibility and Authority
XXXXX	LUCELEC	Project Sponsor	The primary organization responsible for funding the 3MW Solar Farm Project. LUCELEC is also responsible for identifying, evaluating and analyzing options for the project site and provides final approvals for project change requests.
XXXXX	Grupotec	Engineers	Conduct a feasibility study on solar farm design and engineering. Oversee construction of the solar farm by monitoring and advising the contractors during the construction phase.
XXXXX	Clinton Foundation	Technical Consultants	Provide technical training on the construction of the solar farm. Work collaboratively with engineering team to assist with the design and structural component of the project.
XXXX	LUCELEC	Project Manager	Prepare project management plans.

Name	Organization	Job Title	Responsibility and Authority
			Manage the construction of the 3 MW Solar Farm.
XXXX	Society For Environmental Protection	Environmentalists	Raise concerns on climate change impacts, clean air and water, and protection of natural habitats. Encourage best practices in the construction of the solar farm.
XXXX	LUCELEC	Legal Advisor	Provide legal counsel and assist with drafting proposals and contracts. Register the project site.
XXXX	Residents of La Tourney, Vieux Fort	Customers	Raise concerns on the impact of the solar farm on the community including topics such as interconnection and aesthetics.
XXXX	Government	Government	Responsible for approval and enforcing compliance with local laws. Facilitate consultations and data collection as well as provide feedback to the project sponsor. Responsible for monitoring and

Name	Organization	Job Title	Responsibility and Authority
			implementation of the project and has legislative power and project authority.
XXXXX	Contractors (Construction/Electrical team	Contractors	Construct the solar farm according to established structural designs and standards.
XXXXX	Financial Institution	Financial Institution	Provide the funding for the project.

The data gathered during stakeholder planning will be presented in a Stakeholder Engagement Assessment Matrix.

Chart No. 42 Stakeholder Engagement Assessment Matrix (Source: Author)

Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
Project Sponsor					**C** D
Technical Consultants				**C** D	
Engineers				**C** D	
Legal Advisor				**C** D	
Environmentalists		**C**		D	
Financial Institutions			**C**	D	

Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
International NGOs			**C**	D	
Residents		**C**		D	
Government of Saint Lucia				**C** D	
Project Manager					**C** D
Construction/ Electrical Contractors			**C**	D	

4.10.3 Manage Stakeholder Engagement

Manage Stakeholder Engagement is the process of communicating and working with stakeholders to meet their needs and expectations, address issues, and foster appropriate stakeholder involvement. This process will allow the project manager to increase support and minimize stakeholder resistance. (PMI, 2017) It will also ensure that stakeholders understand the project goals, objectives, benefits and risks and how their contribution will enhance the project's success.

According to the Project Management Institute (2017), managing stakeholder engagement involves:

1. Engaging stakeholders at appropriate project stages to obtain, confirm, or maintain their continued commitment to the success of the project;

2. Managing stakeholder expectations through negotiation and communication;
3. Addressing any risks or potential concerns related to stakeholder management and anticipating future issues that may be raised by stakeholders; and
4. Clarifying and resolving issues identified.

Chart No. 43 Power/Interest Table (Source: Author)

Stakeholders	**Power**	**Interest**
Project Sponsor	High	High
Project Manager	High	High
Technical Consultants	High	High
Engineers	High	High
Legal Advisor	Low	High
Environmentalists	Low	High
Financial Institutions	High	High
International NGOs	Low	High
Residents of La Tourney	Low	High
Government of Saint Lucia	High	High
Contractors	Low	High

A power interest matrix will be used for stakeholder prioritization on the 3 MW Solar Farm Project. Additionally, it will allow for the categorization of the stakeholders and the creation of the appropriate communication strategy for each stakeholder category. The stakeholders will be grouped according to their level of power and their level of interest in the project's outcomes.

High Power – High Interest

The project sponsor is a decision maker and has high power and high interest in the project. The project sponsor also has a huge impact on the project's success and their expectations must be effectively managed.

High Power – Low Interest

These stakeholders must be kept satisfied despite having low interest because they yield power. They must be cautiously managed to ensure that they do not use their power in a manner that would negatively impact the project.

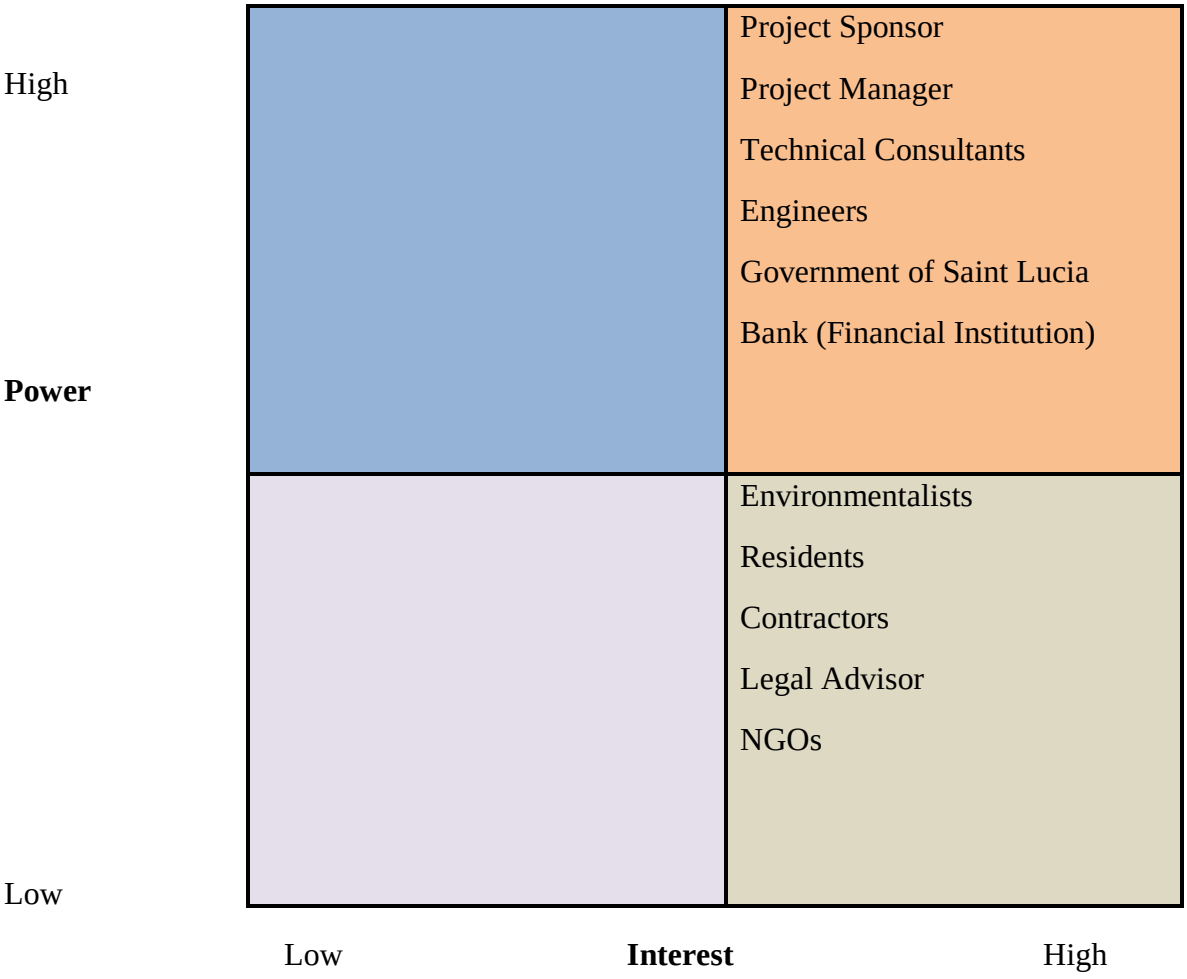
Low Power – High Interest

These stakeholders must be kept adequately informed and engaged to ensure that there are no major issues arising.

Low Power – Low Interest

These stakeholders should be monitored but should not be inundated with excessive information. Their interest levels should be monitored in the event of changes.

Figure 13 Power/Interest Stakeholder Matrix (Source: Author)



4.10.4 Monitor Stakeholder Engagement

A stakeholder register will identify the project stakeholders, document their expectations and concerns and monitor their level of power and interest on the project.

Chart No. 44 Stakeholder Register (Source: Author)

Stakeholder	Role	Responsibility and Authority	Power (H/L)	Interest (H/L)	Expectations	Concerns
LUCELEC	Sponsor	The primary organization responsible for funding the 3MW Solar Farm Project. LUCELEC is also responsible for identifying, evaluating and analyzing options for the project site and provides final approvals for project change requests.	H	H	The project is completed on time and within budget.	The project may not be completed within the established timeframe. Project funds may not be sufficient due to cost overrun.
Grupotec	Engineers	Conduct a feasibility study on solar farm design and engineering. Oversee construction of the solar farm by monitoring and advising the contractors during the construction phase	H	H	There will be sufficient funds to complete the project.	

Stakeholder	Role	Responsibility and Authority	Power (H/L)	Interest (H/L)	Expectations	Concerns
Clinton Foundation	Consultants	Provide technical training on the construction of the solar farm. Work collaboratively with the engineering team to assist with the design and structural component of the project.	H	H	The project team will be technically competent and grasp the skills to help execute the project. The project team will be open to technical guidance.	The team is not open to technical guidance on the construction of the solar farm.
LUCELEC	Project Manager	Prepare project management plans. Manage the construction of the 3 MW Solar Farm.	H	H	The project will be completed on time and within budget and meet stakeholder requirements.	The project may not be completed within the stipulated schedule. The stakeholders are dissatisfied with the project outcome.

Stakeholder	Role	Responsibility and Authority	Power (H/L)	Interest (H/L)	Expectations	Concerns
Society For Environmental Protection	Environmentalists	Raise concerns on climate change impacts, clean air and water, and protection of natural habitats. Encourage best practices in the construction of the solar farm.	L	H	Construction of the solar farm does not affect the integrity of the environment.	The solar farm construction has a negative impact on the natural environment.
LUCELEC	Legal Advisor	Provide legal counsel and assist with drafting proposals and contracts. Register the project site.	L	H	All legal requirements will be met to construct the solar farm.	There are regulatory and legal issues that may affect the project.
Residents of La Tourney, Vieux Fort	Residents	Raise concerns on the impact of the solar farm on the community including topics such as	L	H	The solar farm will provide safe and affordable electricity.	The solar farm may cause harm to residents' health.

Stakeholder	Role	Responsibility and Authority	Power (H/L)	Interest (H/L)	Expectations	Concerns
		interconnection and aesthetics.			There will be no impact on the health of the residents	
Government of Saint Lucia	Government	Responsible for approval and enforcing compliance with local laws. Facilitate consultations and data collection as well as provide feedback to the project sponsor. Responsible for monitoring and implementation of the project and has legislative power and project authority.	H	H	The solar farm will help expand the country's renewable energy program	The solar farm does not meet the government's requirements.
Contractors (Construction/Electrical team	Contractors	Construct the solar farm according to established structural	L	H	The structural and technical designs will be provided for the project.	There are no structural and technical designs.

Stakeholder	Role	Responsibility and Authority	Power (H/L)	Interest (H/L)	Expectations	Concerns
		designs and standards.			The engineers and technical consultants will provide support throughout the course of the project. The equipment and materials for the project are available.	There may be a shortage of materials that may hinder the project's completion.
Financial Institution	Bank	Provide project funding	H	H	The funding will be used for its intended purpose to construct the 3 MW solar farm.	The project funds are not used as intended. The project requirements are not met.
International NGOs	UNDP	Provide financial support	L	H	Funding will be used for its intended purpose to construct the 3 MW solar farm.	The project funds are not used as intended.

Stakeholder	Role	Responsibility and Authority	Power (H/L)	Interest (H/L)	Expectations	Concerns
						The project requirements are not met.

4.11 Develop Sustainability Management Plan

The purpose of the sustainability management plan is to ensure that the 3 MW Solar Farm Project is planned and executed in a manner that is aligned with sustainable and regenerative principles. The plan provides a sustainable framework and describes the approach, roles and responsibilities, and identify the various project costs. The plan will help support the organization's commitment to sustainable electricity and social responsibility.

Sustainability Management Plan

	Project Sustainability Tracking
Project Name	Project Management Plan for the St. Lucia Electricity Services Ltd 3 MW Solar Farm Project.
Project Number	001
Document ID	001-LUCE-SMP
Document Owner	LUCELEC
Issue Date	
Last Saved Date	
File Name	Sustainability Management Plan

Version	**Issue Date**	**Changes**
1.0		Release

Role	**Name**	**Signature**	**Date**
Project Sponsor	LUCELEC		

Project Manager	TBD		

Purpose

The purpose of the Sustainability Management Plan is to describe how LUCELEC will consider and apply the principles of sustainable development during the delivery of the 3 MW Solar Farm Project. It provides a framework for project sustainability and describes the approach, project roles and responsibilities, budget and reporting practices. Furthermore, the document ensures that the project team manages the project in a sustainable way and helps support the organization's commitment to energy-efficiency and environmental protection.

Scope

The scope of the Sustainability Management Plan includes all sustainably related activities required to complete the 3 MW Solar Farm Project. System maintenance, resilience, environmental protection and enhanced performance of the solar farm will be excluded from the scope of the plan.

4.11.1 Approach

a) Planning for sustainability

Planning for sustainability will be done by completing this Sustainability Management Plan. Additional sustainability management planning activities will include:

- Defining sustainability requirements: In this activity, the project manager will define the sustainability requirements that will guide the 3 MW Solar Farm Project.
- Refining the sustainability management plan: This will involve updating the SMP and ensuring that it is complete.
- Analyzing risk to activities: Risk analysis will help the project manager identify and manage the various risks that would affect project sustainability.

b) Identifying sustainability impacts include:

a) Time will be reserved during the first team meeting of each month to focus on reviewing sustainability impacts.

b) Key performance indicators for relevant topics from P5 will be documented.

c) Discussions will be held with sustainability experts to help identify the sustainability impacts prior to the start of the project.

d) The project proposal will be reviewed to identify economic, environmental, and social elements with the potential to impact the sustainability of the project.

c) Responses to sustainability impacts include:

a) The sustainability management plan will be updated throughout the project.

b) Sustainability impact updates will be an agenda item for each team meeting.

c) Sustainability risk and opportunity management will be integrated with overall project risk and opportunity management.

d) The project team will be provided with the requisite training in sustainability management allow them to function effectively in their roles.

e) Sustainable lessons learned will be recorded and utilized for future projects.

4.11.2 Roles and Responsibilities

The roles and responsibilities of the project manager, project team and sustainability impact owner are listed in **Chart No. 45** below:

Chart No. 45 Roles & Responsibility (Source: Author)

Project Manager	Project Team	Sustainability Impact Owner
• Develop and update the P5 Impact Analysis (P5IA) with the support of the Project Team and include it in the project plan. • Coordinate with the Response Owners to implement responses	• Identify sustainability impacts and describe them in the prescribed formats. • Assess the impact of sustainability-related actions on project	• Develop and update the P5 Impact Analysis (P5IA) with the support of the Project Team and include it in the project plan. • Coordinate with the Response Owners to implement responses identified in the P5IA. • Provides feedback for the project initiation documents, which may

identified in the P5IA. • Incorporate the resources and time required to execute the Sustainability Management Plan in the project budget and schedule. • Develop, distribute, and implement this Sustainability Management Plan. • Update the lessons learned database at the end of each project phase. • Engage the project stakeholders.	success criteria. • Perform the impact response actions assigned. • Work as a team based on mutual accountability rather than individual accountability. An effective team is cohesive, aware of the success criteria, motivated towards achieving them, and committed to supporting other team members. • Team members communicate well, share information, and make decisions together. • Assist the project	include a project charter, business case, sustainability plan, P5 impact analysis or feasibility study, to ensure the project is approved by executive stakeholders. • Develops and/or updates the assigned risk response strategy. • Monitors the risk assigned and informs the project manager of any changes to probability or impact. • Monitors the risk triggers and informs the project manager as appropriate. • Appoints a green project manager and a steering committee.

	manager to deliver project objectives. • Advise the project manager if any risk arise that are likely to affect delivery of the project sustainable objectives and to be part of the risk reduction process. • Provide technical expertise in support of delivery objectives. • Complete individual tasks within the expected timeframe. • Document and provide reports on sustainable achievements and issues. • Monitor all sustainable	

	initiatives implemented.	

4.11.3 3 MW Solar Farm Budget

The budget for this project will include the following items related to project sustainability.

1. Construction and implementation of the solar farm.
2. Land acquisition and compensation to affected residents.
3. The implementation of detailed designs, contract support and construction supervision.
4. Staff training.
5. Testing and commissioning of the final product.

Chart No. 46 Budget (Source: Author)

Activity	**Estimated Cost (USD)**
Project planning activities	10,000
Solar Farm Design	160,000
Consultants (RMI & Clinton Climate Initiative)	125,000
Training	30,000
Construction	365,000
Project Site Preparation: Feasibility study, land acquisition and construction of an access road	400,000
Consultants	175,000
Contractor - Construction	1,070,000
Testing & Commissioning	80,000
TOTAL	2,415,000

4.11.4 Key Performance Indicators for Sustainability

Chart No. 47 Key Performance Indicators (Source: Author)

P5 Domain	Lens	Category	Element	Key Performance Indicator	Metric
People	Fairness	Labour Practices & Decent Work	Labour Management Relations	The percentage of disputes between the local project team and foreign consultants.	The number of disputes resolved in favor of foreign consultants
	Servicing	Labour Practices & Decent Work	Training and Qualifications	Solar farm construction training completion percentage rate	The number of training sessions completed during project
	Lifespan	Ethical Behaviour	Fair Competition	Local vendors contract bidding participation rate	Number of contracts awarded to local vendors for the maintenance of the solar farm within a10 year period.
	Fairness	Labour Practices & Decent Work	Equal Opportunity	Local & disabled worker employment rate	Number of disabled and local workers employed on the project
Planet	Effective ness	Transport	Travelling and Commuting	Capacity utilization	The percentage of storage available for

P5 Domain	Lens	Category	Element	Key Performance Indicator	Metric
					equipment and material
	Lifespan	Land Air & Water	Air & Water Quality	Air pollution rate	The percentage of carbon dioxide emissions in metric tons from construction of the solar farm
Prosperity	Efficiency	Project Feasibility	Business Case Analysis	Cost Benefit	The ratio of cost to benefit of the solar farm project
	Servicing	Market and Economic Stimulation	Indirect Benefits	Economic activity	The reduction in annual costs in dollars over a period of 10 years.
	Effectiveness	Business Agility	Resilience	Recovery rate after tropical storms and hurricanes.	The number of hours to restore the system after inclement weather events over a 5 year period.

4.11.5 Potential Impact on Sustainability of Scope Exclusions

Potential impact on sustainability of the scope exclusions are:

a) Environmental Protection Exclusions

   Environmental protection exclusions can impact sustainable construction practices that help protect the environment in and around the solar farm. These practices can help reduce waste and pollution and allow for the efficient use of the project's resources.

b) Maintenance Exclusions

   Maintenance exclusions can eventually affect the functionality of the solar farm and its ability to generate electricity at maximum capacity.

c) Resilience Exclusion

   This can have a significant impact on sustainable construction practices by increasing the resilience of the solar farm to climate change and other environmental threats.

d) Enhanced performance Exclusion

   Exclusion of this consideration can impact the solar farm's ability to perform at maximum capacity

4.11.6 Reviewing and Reporting

Meetings for the purpose of discussing and making decisions on project sustainability will be held once per week with the project team and stakeholders.

The following forms will be used for sustainability reporting:

a. Risk register

b. Issue log

c. Lessons learned log

The risk register will be used to record project risks. It will include a risk and impact description, probability level and the risk owner. An example is provided below:

Chart No. 48 Reviewing and Reporting (Source: Author)

Risk Description	Impact Description	Impact Level	Probability Level	Priority Level	Mitigation Notes	Owner
Inaccurate solar farm orientation/ positioning	Solar farm may not generate at maximum capacity	5 (See Chart No. 32)	1 (See Chart No. 32)	5 (See Chart No. 32)	Ensure proper design and positioning of solar panels	Engineering Team

Downtime due to bad weather	Project delay	5 (See Chart No. 32)	2 (See Chart No. 32)	10 (See Chart No. 32)	Monitor the weather particularly during the hurricane season. Add additional days of contingency to allow for work interruptions due to bad weather.	Project Manager

4.11.7 P5 Impact Analysis

A P5 Impact Analysis (P5IA) is used to define and prioritize sustainability impacts to:

• Improve the project's expected benefits.

• Increase positive impacts and reduce negative impacts to society, the environment, and the project's value.

• Contribute to the sponsoring organization's sustainability goals. A P5IA gives key decision makers actionable information. (GPM Global, 2023)

Chart No 49 P5 Impact Analysis (Source: Author)

People Impacts								
Category	**Labour Practices and Decent Work**	**Lens**	**Description (Cause)**	**Potential Sustainability Impact**	**Initial Impact Score**	**Proposed Response**	**New Impact Score**	**Outcome**
Element	Trainings and qualifications	Efficiency	The local project team lacks knowledge in solar farm construction	The solar farm may be unsustainably and inefficiently constructed and could pose future functionality issues	3	Consultants will provide the project team with the necessary training in sustainable construction	4	A sustainable and optimal performing 3 MW solar farm will be constructed
	Equal Opportunity	Fairness	There are no facilities to accommodate team members with disabilities.	Persons with disabilities are at a disadvantage for employment and this prevents opportunities	2	Build an accessible project site equipped with facilities for persons with disabilities.	3	Employment of differently abled personnel

				for knowledge transfer				
	Human Rights	Fairness	Discrimination and favoritism throughout the project.	A high employee turnover rate can cause project delays and reduced quality of the project deliverable.	2	Hire a Human Relations Officer to monitor and address labour issues that may arise on the project.	4	Fair treatment of all employees.
Planet Impacts								
Category	**Transport**	**Lens**	**Description (Cause)**	**Potential Sustainability Impact**	**Initial Impact Score**	**Proposed Response**	**New Impact Score**	**Outcome**
Element	Logistics	Efficiency	Most of the equipment and materials for the project must be purchased from foreign suppliers	The procurement of materials from oversees vendors will lead to increased air and sea pollution.	2	Consolidate purchases to minimize the number of shipments from international suppliers	4	Reduced imported shipments will lead to a reduction in pollution.
	Noise Pollution	Life span	Noise pollution because of the use of	Residents may experience irritability, hearing loss,	3	Use quieter machinery and equipment	4	Reduced noise pollution in the

			heavy equipment and machinery on the project site.	sleep deprivation and other health issues because of the consistent noise in the area		with noise reduction technologies		residential area
Prosperity Impacts								
Category	**Business Agility**	**Lens**	**Description (Cause)**	**Potential Sustainability Impact**	**Initial Impact Score**	**Proposed Response**	**New Impact Score**	**Outcome**
Element	Resiliency	Life span	Poor solar farm design and construction	The solar farm will not withstand extreme weather conditions such as strong hurricanes.	3	Use sustainable detailed designs in the construction of the solar farm	4	The 3 MW solar farm is able to withstand extreme weather conditions.
Category	**Market and Economic Stimulation**	**Lens**	**Description (Cause)**	**Potential Sustainability Impact**	**Initial Impact Score**	**Proposed Response**	**New Impact Score**	**Outcome**

Element	Indirect Benefits	Effectiveness	Households are dependent on fuel-generated electricity	Increased amounts of CO2 emissions in the environment	2	Increase the output capacity of the solar farm	4	A reduction in the amount of fuel consumed per month

5 CONCLUSIONS

1. The project charter identifies the intended audience of the 3 MW solar farm which includes LUCELEC, the Government of St. Lucia, The Rocky Mountain Institute, Clinton Climate Initiative and Grupotec. The project budget is XCD 20 million dollars with an estimated 15-month duration. The completed Solar Farm Project will reduce the company's energy emissions and support its renewable energy initiatives. The project charter provides a brief project description and presents the business case. Project risks include severe weather and the inability to close the sale agreement for the land to construct the solar farm. Two important project assumptions are that the project engineers have expert knowledge to successfully construct the solar farm and that requisite permits will be obtained immediately. Project constraints include the project budget, global supply chain issues and the small size of the project team. The project charter provides an important framework for the successful construction of the 3 MW Solar Farm.

2. The scope management plan includes all the processes and activities involved in the construction of the solar farm. The project produces a 3 MW utility-scale solar farm that will meet 5% of St. Lucia's electricity demand. The project requirements include a 14, 900 acres of flat land, a budget of XCD $20 million dollars and 15,000 solar panels. Project exclusions includes the construction of a substation and maintenance of the solar farm. Additionally, work on the project site is set to commence at 8 a.m. and end at 5 p.m. from Monday to Friday. The scope

management plan provides a detailed work breakdown structure to guide project activities. Additionally, the project sponsor validates the scope by signing off on the scope management plan and an integrated change control system effectively controls scope changes.

3. The schedule for the 3 MW Solar Farm project has a duration of 15 months. The policies, processes, and procedures of the schedule management plan guides the project team and assists with the proper recording of schedule change requests. The work breakdown structure decomposes and identifies the activities required to produce the project deliverables. It creates an activity list that outlines all the project activities and the duration of each activity. The schedule management plan also provides estimated completion dates for the various project milestones. A schedule network diagram provides a visual of the project's critical path. Additionally, a Gantt chart illustrates the schedule and assists the project manager with planning, coordinating, and monitoring the tasks to complete the project within the 15-month schedule.

4. The construction of the solar farm project is XCD $20 million dollars and is funded by the project sponsor LUCELEC. The various costs associated with the project includes land, equipment, materials and labour costs. Wages for the construction and electrical team are based on the average salary of a construction worker and electrician in St. Lucia. The project manager uses analogous and parametric

estimating as the main cost tools for the project. An 8% contingency reserve is established for procurement, construction works and design and engineering whereas a 2% contingency reserve is established for preliminary assessments and permits & approvals and testing. Additionally, a 5% management reserve is established at $1,000,000 and Earned Value Management is used to control and monitor the project costs.

5. Quality management is very important to ensure that the project deliverable meets the established requirements. The quality management plan ensures that the Solar Farm Project fulfills the needs for which it is undertaken. The key factors related to quality are quality, grade, prevention over inspection and cost of quality. The engineers from Grupotec establishes the quality systems, quality measurements and quality control measures required for the project to meet ISO international quality standards. A metrics and quality baseline table identifies the quality objectives, quality metrics, expected outcome and the team members responsible for achieving quality metrics. A quality control checklist outlines and assigns different areas for inspection to the project team.

6. The resource management plan provides details on the process of planning and scheduling the resources required to successfully complete the construction of the 3 MW Solar Farm project. An organizational chart provides a hierarchical structure of the project team with the project sponsor as the team leader. An estimation of the

activity resources displays the start and finish times of the various resources for the project. The team of engineers provides technical training and the project manager establishes the ground rules for project behavior. Furthermore, the team works at the project site and a system of recognition and rewards appropriately compensates the team for their work on the project. The project manager utilizes the requisite tools and techniques to manage and control the project resources.

7. The communication management plan identifies and classifies the stakeholders of the Solar Farm Project. The plan also establishes the communication methods and the frequency of communication with stakeholders. The communication plan is essential to maintain stakeholder support and keep them engaged throughout the project implementation. A power/interest matrix identifies the stakeholders based on their level of power and interest throughout the project. The project communication methods include video conferences, meetings, reports and emails and stakeholder communication is monitored using a stakeholder engagement assessment matrix. A communication management plan ensures that the stakeholders provide the support necessary for a successful project outcome.

8. The project manager and project team identify and manage risks throughout the construction of the 3 MW Solar Farm Project. The risk management plan documents the risks that could potentially affect the successful implementation of the project. Technical, external, organizational and project management risks are

identified and include bad weather, global supply chain issues, high transportation costs and inadequate funds. The project manage evaluates the risk impacts using a probability impact assessment. Additionally, the risk register contains a record of risks that the project team identifies and the critical responses that are necessary to mitigate negative risks and capitalize on positive risks and opportunities.

9. The procurement management plan includes the activities necessary to procure the equipment such as solar panels, inverters, cameras, lights, cables and other materials and supplies which were required to complete the 3 MW Solar Farm Project. The project manager arranges bidder conferences along with the procurement team and the project's legal advisor supports vendor contract negotiation. The project manager conducts performance reviews to ensure that the vendors adheres to the agreement. Additionally, the team controls procurement by conducting physical inspections of the solar farm and monitoring work in progress.

10. The stakeholder management plan identifies the project stakeholders and outlines the appropriate management strategies to effectively engage and monitor the project's stakeholders. The plan identifies the tools to plan stakeholder engagement and provides a detailed stakeholder responsibility matrix that identifies the stakeholders by role and authority on the 3 MW Solar Farm Project. A Stakeholder Engagement Assessment Matrix assesses the level of engagement required from each stakeholder and highlights the various ways to manage stakeholders

throughout the project. Furthermore, a power interest matrix classifies stakeholders based on their power and interest in the project.

11. The sustainability management plan outlines the sustainable approach used in the construction of the 3 MW Solar Farm project. The plan also identifies the roles of the project manager, project team and the sustainability impact owner to ensure that the sustainability was maintained throughout the project. Key performance indicators are categorized under labour practices and decent work, ethical behavior, transport, project feasibility and business agility. Scope exclusions which have the potential to impact the sustainability of the project are also identified. These include maintenance exclusions that could gradually affect the solar farm's functionality and resilience exclusions that could affect the system's longevity.

6. RECOMMENDATIONS

The construction of the 3 MW Solar Farm will allow LUCELEC to expand into the renewable energy sector. The Final Graduation Project is a theoretical project management plan developed to execute the construction of the Solar Farm Project successfully. Throughout the development of the FGP, several areas of improvement and lessons learned were gathered. The following recommendations will address improvement areas identified during the development of the project management plan.

1. The Government of Saint Lucia has embarked on a National Energy Transition Strategy (NETS) that is focused on the use of renewable energy and energy efficiency. The goal is a 20 percent reduction in the country's carbon emissions by 2025. This new strategy may have implications on the construction of the 3 MW Solar Farm Project. As a result, it is recommended that the project manager, with the assistance of the legal advisor, remain updated on changes in government regulations to avoid risks and potential disruptions to the project. Additionally, the project team should closely follow changes in the demand for the renewable energy which may affect the project requirements.

2. A second recommendation is the provision of training for the project team on the construction and implementation of solar farms. The 3 MW Solar Farm Project is a new initiative for LUCELEC and the team has limited experience and training on such projects. The project sponsor must facilitate training sessions with the project team and Grupotec, the leading engineering consultants prior to the start of the

project. The training will be valuable to the team for the successful completion and commissioning of the solar farm. It will also equip the team with the knowledge and training that will be valuable for future solar farm projects.

3. A Sustainability Management Plan (SMP) will allow for the incorporation of sustainable and regenerative principles and methods throughout the implementation of the 3 MW Solar Farm. Sustainable methods will provide long-term environmental and social benefits to the immediate community of La Tourney Vieux Fort. For example, agri-voltaic farming, the practice of growing crops underneath solar panels is recommended. This practice allows the use of the solar farm to grow agricultural crops for the community while also providing a source of clean energy. Agri-voltaics will also promote increased farming by residents and promote long-term food security.

4. Community engagement is crucial for the success of the solar farm. The project sponsor, project manager and technical team must engage the residents of La Tourney, Vieux Fort on the project timeline, any potential interruptions during construction as well as the benefits of the solar farm upon project completion. This can be done through a series of town hall meetings where the project team meets with the residents to answer questions and address their concerns about the 3 MW Solar Farm Project. This form of stakeholder engagement will ensure that the concerns of this high interest group are addressed prior to project execution and will avoid any delays and hindrances during construction of the solar farm.

5. Climate change has caused more frequent and catastrophic storms and hurricanes over the last decade. According to Renewable Energy World (2023), the solar industry is losing $2.5 billion annually from equipment under performance, likely caused by equipment malfunctions and weather conditions. The engineering team must consider this and ensure that the 3 MW solar farm is resilient against the conditions associated with inclement weather systems. Grid resilience refers to the ability of an energy system to withstand and recover from disruptions, whether caused by extreme weather events, cyber-attacks, or other emergencies. (Energy, 2023) It is therefore recommended that the Solar Farm Project has the appropriate insurance coverage to manage the impact of bad weather and other disruptions. Additionally, the engineering team should consider the use of 3.2 mm (about 0.13 in) heat-tempered solar panels to build weather resilience.

6. Inverters are essential for obtaining maximum electrical performance of the solar farm because they convert the power of the solar panels into electricity that can be utilized by the connected power grid. Additionally, the solar panels must be positioned in a manner that will ensure maximum sun exposure so that they operate at optimal capacity. The team should therefore procure inverters based on nominal inverter efficiency and expected climate conditions. There should also be an evaluation of solar panels at different orientations to ensure maximum input and output of solar energy and no solar energy is wasted.

7. VALIDATION OF THE FGP IN THE FIELD OF REGENERATIVE AND SUSTAINABLE DEVELOPMENT

Sustainable development is the use of resources to improve society's wellbeing in a way that does not destroy or undermine the support systems needed for future growth. (Regenerative Development: Going Beyond Sustainability, 2016b) Regenerative development goes beyond sustainability and is the use of resources to improve society's wellbeing in a way that builds the capacity of the support systems needed for future growth. (Regenerative Development: Going Beyond Sustainability, 2016b)

According to the UN, the average temperature of the Earth's surface is now about 1.1°C warmer than it was in the late 1800s and warmer than at any time in the last 100,000 years. (United Nations, n.d.) This steady increase in global temperature is linked to carbon dioxide emissions and has serious detrimental effects on the environment such as "intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms and declining biodiversity." (United Nations, n.d.) Therefore, to limit global warming to 1.5°C above pre-industrial levels, emissions must already be decreasing and need to be reduced by almost half by 2030. (Martin, 2023)

Additionally, the post-pandemic global energy crisis has steadily increased the cost of fuel and the subsequent cost of producing electricity. According to Rinkesh (2023), the energy crisis stems from the increasing global demand for limited natural resources, essential for powering our industrial society. As the demand for these resources increases, they edge closer to depletion, presenting a pressing concern. Furthermore, consumers now demand affordable energy and access to renewable energy options.

The 3 MW solar farm is an alternative to fuel generated electricity and aims to contribute to the achievement the goal of zero emissions in the future. The project deliverable supports sustainable development because solar farms use sunlight, a renewable natural resource to produce electricity. It is expected to reduce LUCELEC's fuel dependency. Despite the sustainability of the solar farm, there are opportunities to make the deliverable more regenerative in nature. The use of Agrivoltaics can be used to produce crops while simultaneously generating electricity on the solar farm. The use of the solar farm as agricultural land will further expand the use of the project deliverable, building capacity in both the renewable energy and agricultural sectors. There is also an opportunity to recycle the solar panels thus reducing environment degradation from their disposal. This will also increase the lifespan of the solar farm.

The project manager, through the Sustainability Management Plan uses several key performance indicators to determine whether the project meets sustainable and regenerative requirements. Consequently, the requisite strategies and techniques will make the project more regenerative.

BIBLIOGRAPHY

Bunker, K., Doig, S., Locke, J., Mushegan, S., Teelucksingh, S., & Torbert, R. (2017). Saint Lucia National Energy Transition Strategy. In *United Nations Framework Convention on Climate Change*. Government of Saint Lucia. Retrieved January 9, 2024, from https://www4.unfccc.int/sites/PublicNAMA/_layouts/UN/FCCC/NAMA/Download.aspx?ListName=NAMA&Id=225&FileName=Saint%20Lucia%20NETS%20Final%20Report_%20Aug%209%202017.pdf

Chariot Energy. (2022, October 20). Solar Farms: What Are They & How Do They Work? | Chariot Energy. https://chariotenergy.com/chariot-university/solar-farms/

Cspo, E. a. P. P. &. (2021, May 21). Quality vs. Grade PMP Guide. Project Management Academy Resources. https://projectmanagementacademy.net/resources/blog/quality-vs-grade-pmp guide/#:~:text=Grade%20refers%20to%20a%20category,they%20want%20from%20the%20deliverable.

Easy Legal Docs. (2023, December 12). Vendor agreement. https://easylegaldocs.com/templates/agreements/vendor-agreement/

Energy, E. C. (2023, December 24). Community solar farms and grid resilience powering through challenges. Energy5. https://energy5.com/community-solar-farms-and-grid-resilience-powering-through-challenges

GIS. (2018, August 16). Opening of the solar farm. Saint Lucia - Access Government. https://www.govt.lc/news/opening-of-the-solar-farm

GPM Global. (2023). *The GPM® P5™ Standard for Sustainability in Project Management* (Version 3).

https://sandiego.ascm.org/images/downloads/Eco_Sustainability/the_gpm_p5_standard_for_sustainability_in_project_management_3.0.pdf

Goal 7: Affordable and clean energy - The Global Goals. (2023, April 18). The Global Goals. https://www.globalgoals.org/goals/7-affordable-and-clean-energy/?gclid=CjwKCAjw9-6oBhBaEiwAHv1QvP1qTlmmu04qpa2-A93QpGDyTiSlSpkiu6GRdLpSkXTYjQaqLzhOFhoC438QAvD_BwE

Government of Saint Lucia. (2022). Saint Lucia's First Adaptation Communication to the United Nations Framework Convention on Climate Change (UNFCCC). Department of Sustainable Development, Ministry of Education, Sustainable Development, Innovation and Vocational Training.

Hassan, M. (2023, August 14). Research methods - types, examples and guide. Research Method. https://researchmethod.net/researchmethods/

Myles, I. S. (2023). Perez Zeledon Community Seed Bank Project Management Plan [Final Graduation Project]. University for International Cooperation.

Igberaese, D. A. (2022). Introduction to project management: A Source Book for Traditional PM Basics. Routledge.

Joseph, C. (2018, August 7). LUCELEC To Officially Open Its Solar Farm. Lucelec.com. https://www.lucelec.com/content/lucelec-officially-open-its-solar-farm

Joseph, C. (2020, November 6). LUCELEC Begins Cabling Work For Solar Farm Battery Storage. Lucelec.com. https://www.lucelec.com/tags/solar-farm

Martin. (2023, September 11). Climate change - United Nations Sustainable development. United Nations Sustainable Development. https://www.un.org/sustainabledevelopment/climate-change/

MyPM, LLC. (2022, May 31). Change request Template | Change Request Form. MyPM. https://www.mypmllc.com/project-management-resources/free-project-management-templates/change-request-template/

Reference - LibGuides: Primary, Secondary, and Tertiary Sources of Information in the Sciences: Types of Information Sources. (n.d.). https://libraryguides.uwsp.edu/InformationSourcesInTheSciences

Regenerative development: going beyond sustainability. (2016b, January 25). Kosmos Journal. https://www.kosmosjournal.org/article/regenerative-development-going-beyond-sustainability/

Renewable Energy World. (2023, August 22). Building resilient solar projects: Tips and best practices. https://www.renewableenergyworld.com/solar/building-resilient-solar-projects-tips-and-best-practices/#gref

Research tools and techniques. (n.d.). PPT. https://www.slideshare.net/RonitRKharade/research-tools-and-techniques-245926961

St. Lucia Electricity Services Limited. (n.d.). Brief History of LUCELEC. lucelec.com. Retrieved March 27, 2023, from https://www.lucelec.com/content/brief-history-lucelec

Project Management Institute. (2021). A Guide to the Project Management Body of Knowledge, (PMBOK® Guide) - Seventh Edition, Project Management Institute, Inc., 2021.

Project Management Institute. (2017). A guide to the Project Management Body of Knowledge (PMBOK guide) (6th ed.). Project Management Institute, Inc., 2017.

Rinkesh. (2023, July 28). Causes, effects and solutions to Global Energy Crisis - Conserve Energy future. Conserve Energy Future. https://www.conserve-energy-future.com/causes-and-solutions-to-the-global-energy-

crisis.php#:~:text=Causes%2C%20Effects%2C%20and%20Solutions%20to,depletion%2C%20presenting%20a%20pressing%20concern

Schwartz, B. (2023, October 10). The risk management process in project management. ProjectManager. https://www.projectmanager.com/blog/risk-management-process-steps

St. Lucia Electricity Services Limited. (2020). LUCELEC Organizational Structure. LUCELEC. Retrieved September 4, 2023, from https://www.lucelec.com/content/lucelec-organizational-structure.

Steel, N. (2023, March 9). Press release: Rocky Mountain Institute-Carbon War Room and Clinton climate initiative facilitate groundbreaking for solar farm in Saint Lucia. RMI. https://rmi.org/press-release/press-release-rocky-mountain-institute-carbon-war-room

Tina, C. (2023, April 11). Agrivoltaics: The farm-to-solar trend that can help accelerate the renewable energy transition. resilience. https://www.resilience.org/stories/2023-04-11/agrivoltaics-the-farm-to-solar-trend-that-can-help-accelerate-the-renewable-energy-transition/

United Nations. (2022, November 9). Energy - United Nations Sustainable Development. United Nations Sustainable Development. Retrieved July 23, 2023, from https://www.un.org/sustainabledevelopment/energy/

United Nations. (n.d.). What is climate change? | United Nations. https://www.un.org/en/climatechange/what-is-climate-change#:~:text=In%20a%20series%20of%20UN,the%20end%20of%20the%20century.

What does information source mean? (n.d.). https://www.definitions.net/definition/information+source

APPENDICES

Appendix 1: FGP Charter

CHARTER OF THE PROPOSED
FINAL GRADUATION PROJECT (FGP)

1. Student name

Sibyl Dostalie

2. FGP name

Project Management Plan for St. Lucia Electricity Services Ltd 3 MW Solar Farm Project

3. Application Area (Sector or activity)

Renewable Energy

4. Student signature

5. Name of the Graduation Seminar facilitator

Róger Valverde Jiménez

6. Signature of the facilitator

7. Date of charter approval

October 16th, 2023

8. Project start and finish date

August 29th, 2023	April 4th, 2024

9. Research Question

What requirements should be met to successfully construct a 3MW solar farm in Vieux Fort?

10. Research Hypothesis

Is it possible to construct a 3 MW solar farm that would reduce St. Lucia's fuel-based electricity demand and reduce the amount of fuel purchased by the St. Lucia Electricity Services Ltd (LUCELEC)?

11. General Objective

To develop a project management plan for the construction of a 3 MW Solar Farm Project in La Tourney, Vieux Fort.

12. Specific Objectives

1. To develop the project charter in order to define the key input elements to develop the project management plan.
2. To develop the scope management plan to ensure that the project includes all the work required to be completed successfully.
3. To develop the schedule management plan to manage the timely completion of the project.
4. To develop the cost management plan to ensure that the project is completed within the approved budget.
5. To develop the quality management plan to ensure that the project meets the desired quality standards.
6. To develop the resource management plan to identify, acquire, and manage the resources needed for the successful completion of the project.
7. To develop the communication management plan to organize and document the process, types, and expectations of communications throughout the project.
8. To develop the risk management plan to identify, monitor and control project risks.
9. To develop the procurement management plan to efficiently organize the purchases of goods and services required for the project.
10. To develop the stakeholder management plan to effectively manage the goals and expectations of stakeholders throughout the project.
11. To develop the sustainable development plan to ensure that the project deliverable is aligned with sustainable and regenerative principles.

13. FGP Purpose or Justification

The purpose of the project is to develop a project management plan for the construction of a 3 MW Solar Farm in La Tourney Vieux Fort. The Saint Lucia Electricity Services Ltd is constructing the solar farm that seeks to meet about 5% of Saint Lucia's electricity demand and will reduce the volume of fuel purchased by the company by about 300 thousand gallons per year.

The project is supported by the Government of Saint Lucia and is the first utility-scale Solar PV Farm on the island; paving the way for more renewable energy initiatives in the country. The project management plan will increase the chances of the project's success by providing a roadmap for the execution of the project.

The solar farm project is a relatively new project and there is no historical data and information from other similar projects, which will prove useful during implementation. Therefore, the project management plan is essential to ensure that materials and equipment, are managed and resources are efficiently utilized so that the project remains within the schedule and the stipulated budget.

14. Work Breakdown Structure (WBS). In table form, describing the main deliverable as well as secondary, products or services to be created by the FGP.

1. FGP Graduation Seminar
1.1 FGP Deliverables
1.1.1 Week 1
1.1.1.1 FGP Charter items 1 – 10
1.1.1.2 Preliminary Bibliography
1.1.2 Week 2
1.1.2.1 FGP Charter Items 11 – 12
1.1.2.2 FGP WBS
1.1.2.3 Self-Assessment
1.1.3 Week 3
1.1.3.1 Corrections
1.1.3.2 FGP Charter Items 13 – 19
1.1.4 Week 4
1.1.4.1 Corrections
1.1.4.2 Theoretical Framework
1.1.4.3 FGP Charter Item 20
1.1.4.4 Self-Assessment 2
1.1.5 Week 5
1.1.5.1 Corrections

1.1.5.2 Methodological Framework
1.1.5.3 FGP Charter Item 21
1.1.6 Week 6
1.1.6.1 Corrections
1.1.6.2 Introduction
1.1.6.3 Project Validation in the Regenerative and Sustainable Design
1.1.6.4 FGP Charter Item 22
1.1.6.5 FGP Schedule
1.1.7 Week 7
1.1.7.1 Corrections
1.1.7.2 Executive Summary
1.1.7.3 Abstract
1.1.7.4 Bibliographical Research
1.1.7.5 Indexes
1.1.7.6 Signed FGP Charter
1.2 Graduation Seminar Approval
2. Tutoring Process
2.1 Tutor
2.1.1 Tutor Assignment
2.1.2 Tutor Communication
2.2 Adjustment of previous chapters (if needed)
2.3 Development (Results)
2.3.1 Project Charter
2.3.1.1 Develop business case
2.3.1.2 Define pre-assigned resources and main requirements
2.3.2 Scope Management Plan
2.3.2.1 Define the scope and identify project exclusions
2.3.2.2 Create the WBS and WBS dictionary
2.3.2.3 Use tools and techniques to control the project scope
2.3.3 Schedule Management Plan
2.3.3.1 Develop, monitor and control the project schedule
2.3.4 Cost Management Plan
2.3.4.1 Estimate the project costs
2.3.4.2 Establish management and contingency reserves
2.3.4.3 Prepare the project budget
2.3.4.4 Use Earned Value Management to control the project costs
2.3.5 Quality Management Plan
2.3.5.1 Identify quality requirements
2.3.5.2 Determine metrics and quality baselines
2.3.5.3 Manage and control the project quality using a quality checklist
2.3.6 Resource Management Plan
2.3.6.1 Establish resource requirements
2.3.6.2 Develop organizational chart and RACI matrix

2 .3.7 Risk Management Plan
2.3.7.1 Identify and plan project risks
2.3.7.2 Develop the risk register
2.3.7.3 Identify the critical responses to manage risks
2.3.7.4 Control risks using risk management tools and techniques
2.3.8 Procurement Management Plan
2.3.8.1 Identify vendors
2.3.8.2 Prepare bids and contracts
2.3.8.3 Monitor and control procurement
2.3.9 Communication Management Plan
2.3.9 Plan and control the project communication using tools and techniques
2.3.10 Stakeholder Management Plan
2.3.10.1 Classify the stakeholders
2.3.10.2 Monitor and control stakeholder engagement
2.3.11Sustainable Development Plan
2.3.11.1 Establish the sustainable approach
2.3.11.2 Outline the sustainability roles and responsibilities of the project team
2.3.11.3 Identify the key performance indicators
2.4 Conclusions
2.5 Recommendations
3. Reading by Reviewers
3.1 Reviewers Assignment Request
3.1.1 Assignment of Two Reviewers
3.1.2 Communication
3.1.3 FGP Submission to Reviewers
3.2 Reviewers Work
3.2.1 Reviewer 1
3.2.1.1 FGP Reading
4. Adjustments
4.1 Report from Reviewers
4.2 FGP Update
4.3 Second Review by Reviewers

15. FGP Budget

Budget: $1242
Transportation to interviews and tour of solar farm - $220.00
Food - $150
Printing & Binding of FGP document - $300
Review of FGP by Philogist - $300
Shipping of FGP to Costa Rica - $ 235
Microsoft Projects License – $87.00

16. FGP Planning and Development Assumptions

1. Information about the solar farm project is available.
2. There will be unrestricted access to the information on the solar farm project for completion of the FGP.
3. The interviews will provide information that will be relevant to the FGP.
4. Research time will be a minimum of 10 hours per week during the FGP development process.

17. FGP Constraints

1. The budget for the FGP is $1242.
2. The maximum time to execute the FGP is 3 months.
3. The FGP must be developed using UCI guidelines and Project Management Standards
4. The development of the FGP must be complete by October 17, 2023 and this provides little flexibility to change the project topic is an issue arises.

18. FGP Development Risks

1. The industry experts who will provide information to complete the project may not always be available for an interview and this may delay the collection of information and the development of deliverables.
2. An active hurricane season may delay the tours to the solar farm and the collection of data in the field and subsequently delay the development of the deliverables.
3. Sudden illness of student or subject matter experts might delay the work done to develop the FGP deliverables.
4. Stakeholders may renege on the agreement to provide access to FGP information and this will delay the development of the FGP deliverables.

19. FGP Main Milestones

Milestones are related to deliverables on the second level (deliverables) and third level (control accounts) of the WBS of section 14 of this Charter. At the same time the deliverables are related to the specific objectives (in the case of the FGP please include the times for the tutorship reviews as well as for the readership).

Deliverable	Estimated Finish Date
1.1 FGP Deliverables	16-Oct-2023
1.1.1 Charter items 1 – 10, Preliminary bibliographical research	4-Sept-2023
1.1.2 Charter items 11 and 12, FGP WBS, Self - assessment	11-Sept-2023
1.1.3 Corrections, Charter items 13 to 19	18-Sept-2023
1.1.4 Corrections, Chapter 2 Theoretical Framework, Charter item 20, Self-assessment 2	25-Sept-2023
1.1.5 Corrections, Chapter 3 Methodological framework, Charter item 21	2-Oct-2023
1.1.6,Corrections,Chapter 1 Introduction, Chapter 7 Project Validation in the regenerative and sustainable design, Charter item 22, FGP Schedule	9-Oct-2023
1.1.7 Corrections, Executive Summary, Abstract, Bibliographical references, Indexes, Signed FGP Charter	16-Oct-2023
1.2 Graduation Seminar approval	23-Oct-2023
2.1 Tutor	26-Oct-2023
2.1.1 Tutor assignment	24-Oct-2023
2.1.2 Communication	26-Oct-2023
2.2 Adjustments of previous chapters (If needed)	2-Nov-2023
2.3 Charter IV. Development (Results)	16-Jan-2024
2.4 Chapter V. Conclusions	23-Jan-2024
2.5 Chapter VI. Recommendations	30-Jan-2024
3.1 Reviewers assignment request	6-Feb-2024
3.1.1 Assignment of two reviewers	1-Feb-2024
3.1.2 Communication	5-Feb-2024
3.1.3 FGP submission to reviewers	6-Feb-2024
3.2 Reviewers work	20-Feb-2024
3.2.1 Reviewer	20-Feb-2024
3.2.2 Reviewer	20-Feb-2024
4.1 Report for reviewers	4-Mar-2024
4.2 FGP update	5-Mar-2024
4.3 Second review by reviewers	19-Mar-2024
5.1 Final review by board	21-Mar-2024
5.2 FGP grade report	26-Mar-2024

20. Theoretical framework

20.1 Estate of the "Matter"

A solar farm is a large collection of photovoltaic (PV) solar panels that absorb energy from the sun, convert it into electricity and send that electricity to the power grid for distribution and consumption by customers. (Chariot Energy, 2022, para. 2) The solar photovoltaic farm is the first utility scale solar farm on the island. A utility scale solar farm consists of panels on a stretch of land that absorb energy from the sun, generate an electric current and distribute that power on high-voltage power lines.

The solar farm will provide many long-term cost benefits for LUCELEC, leading the way for the Government of Saint Lucia to invest in other sustainable energy projects such as wind and geothermal energy. However, such projects are relatively new to the company with limited recorded information.

Since it is a relatively new renewable energy project undertaken by LUCELEC, there has not been significant research on a project management plan for this project type. Notwithstanding, data will be gathered from interviews, online articles and available project documents and reports to develop the FGP.

20.2 Basic Conceptual Framework

1. Project Management
2. PV solar farm
3. Sustainable and regenerative design
4. Solar energy generation

21. Methodological Framework

Objective	Name of Deliverable	Information Sources	Research Method	Tools	Restrictions
To develop the project charter in order to define the key input elements to develop the project management plan.	Project Charter	Primary: Interviews, technical reports, and archived project documents Secondary: PMBOK Guide and literature reviews	Qualitative research	Interviews Expert judgement Meetings	The deliverable must meet established requirements and standards.
To develop the scope management plan to ensure that the project includes all the work required to complete the project successfully.	Scope Management Plan	Primary: Interviews and technical reports Secondary: PMBOK Guide and textbooks	Qualitative research Quantitative research	Expert judgement Meetings Alternatives analysis	The project must meet scope requirements.

Objective	Name of Deliverable	Information Sources	Research Method	Tools	Restrictions
To develop the schedule management plan to manage the timely completion of the project.	Schedule Management Plan	Primary: Interviews and technical reports Secondary: PMOK Guide, textbooks and literature reviews	Qualitative research Quantitative research	Forecasting Analogous estimating Expert judgement	The project must be completed within the allotted time frame.
To develop the cost management plan to ensure that the project is completed within the approved budget.	Cost Management Plan	Primary: Interviews and archived project documents Secondary: Literature reviews and PMBOK Guide	Qualitative research Quantitative research	Earned value analysis Reserve analysis Cost of quality Expert judgement	The project must be executed within the stipulated budget.

Objective	Name of Deliverable	Information Sources	Research Method	Tools	Restrictions
To develop the quality management plan to ensure that the project meets the desired quality standards.	Quality Management Plan		Qualitative research Quantitative research	Benchmarking Meetings Cost benefit analysis Test and inspection planning	The final product must meet user requirements.
To develop the resource management plan to identify, acquire, and manage the resources needed for the successful completion of the project.	Resource Management Plan	Primary: Technical reports, archived project documents and interviews Secondary: PMBOK Guide, journal articles and literature reviews	Qualitative research Quantitative research	Expert judgement Decision making Analogous estimating Work Breakdown Structure Resource Breakdown Structure	The assigned project team must complete the project.

Objective	Name of Deliverable	Information Sources	Research Method	Tools	Restrictions
To develop the communication management plan to organize and document the process, types, and expectations of communications throughout the project.	Communication Management Plan	Primary: Technical reports, interviews and archived project documents Secondary: PMBOK Guide, journal articles and literature reviews	Qualitative research	Communication technology Project reporting Meetings	Communication depends on a third party internet service provider.
To develop the risk management plan to identify, monitor and control project risks.	Risk Management Plan	Primary: Interviews, speeches archived project documents Secondary: PMBOK Guide, journal articles, literature reviews and textbooks	Qualitative research Quantitative research	Expert judgement SWOT analysis Checklists Assumptions and constraint analysis	All project risks must be documented by the team.

Objective	Name of Deliverable	Information Sources	Research Method	Tools	Restrictions
To develop the procurement management plan to efficiently organize the purchases of goods and services required for the project.	Procurement Management Plan	Primary: Archived project documents and interviews Secondary: PMBOK Guide and literature reviews	Qualitative research Quantitative research	Bidder conferences Cost and selection analysis Data analysis Inspection	The procurement of project supplies and equipment is dependent on external vendors.
To develop the stakeholder management plan to effectively manage the goals and expectations of stakeholders throughout the project.	Stakeholder Management Plan	Primary: Interviews, archived project documents and speeches Secondary: PMBOK Guide, journal articles and literature reviews	Qualitative research	Stakeholder analysis Kickoff meeting Status update meetings Feedback	The project manager must engage all stakeholders whether of high or low interest and influence.

Objective	Name of Deliverable	Information Sources	Research Method	Tools	Restrictions
To develop a Sustainability Management Plan to achieve sustainability objectives.	Sustainability Management Plan	Primary: Speeches Secondary: Sustainable Project Management: The GPM Reference Guide and internet articles	Qualitative research	Sustainable Project Management: The GPM Reference Guide tools	The project must be guided by sustainable development principles.

22. Validation of the Work in the Field of Regenerative and Sustainable Development.

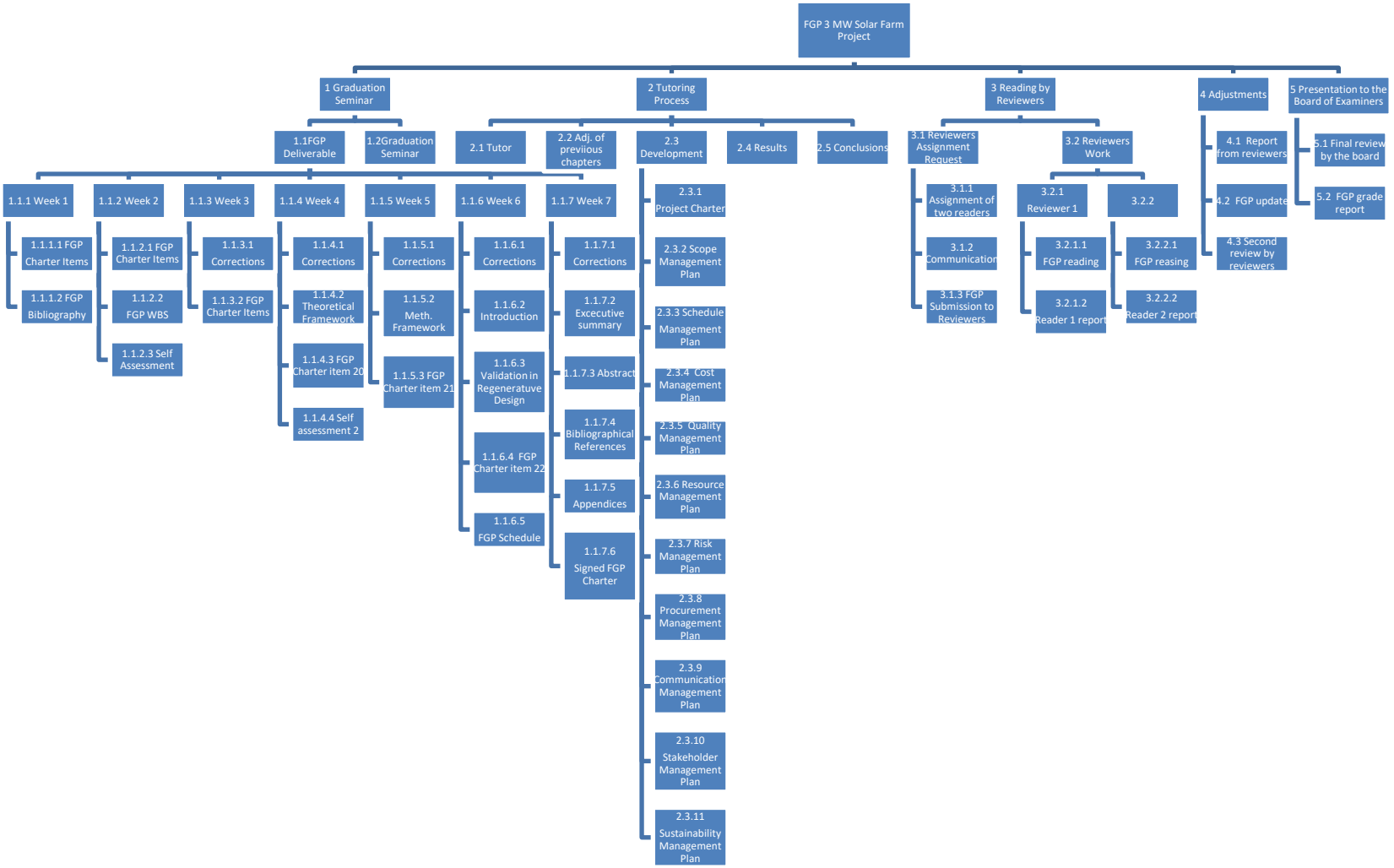
The construction of the solar farm is a sustainable project because it used the sun, which is a renewable source of energy to generate electricity. The organization's strategic objectives includes gradually expanding into the renewable energy market in order to reduce its carbon footprint and achieve the sustainable development goal of clean and affordable energy by the year 2023.

Regenerative development expands on the principles of sustainable development and encourages the maintenance of social, economic, political and environmental systems within planetary boundaries. Although the project will be based on the sustainable principles such as reducing fuel emissions and providing an affordable electricity alternative to consumers, there are opportunities for advancement in the field of regenerative development. An example of this opportunity is recycling the solar panels in order to increase the lifespan of the solar farm. Additionally, the project manager can expand the project into the agricultural sector through agri-voltaics. Agri-voltaics is the use of land for both agriculture and solar photovoltaic energy generation. An expansion into the agricultural sector will be an important way of improving the country's food security.

The project manager will use key performance indicators to measure and validate the project's work in the fields of sustainable and regenerative development.

Appendix 2: FGP WBS

Chart No. 50 FGP WBS (Source: Author



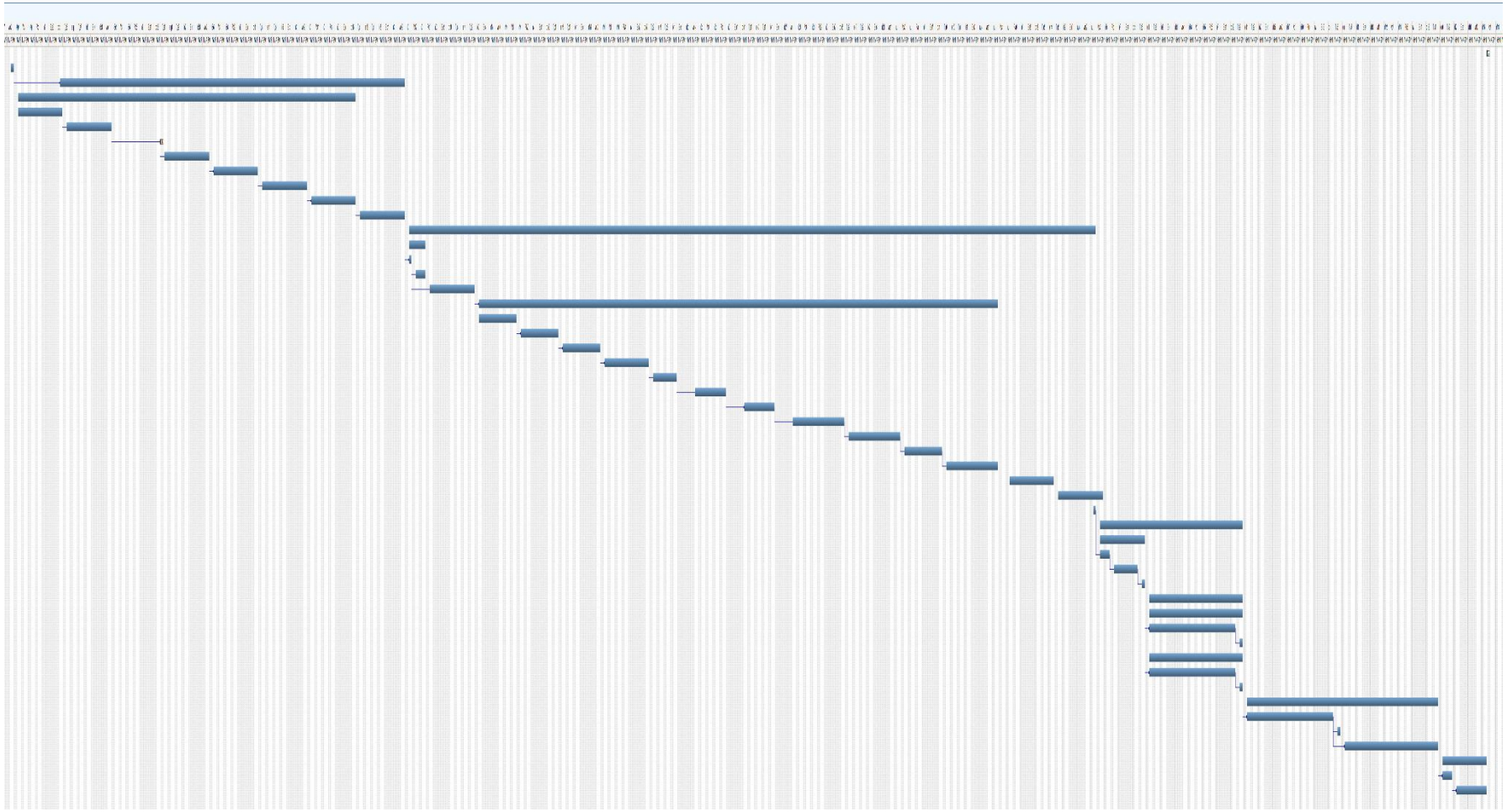
Appendix 3: FGP Schedule

Figure 14 FGP Schedule (Source: Author)

gantter™

Project Name **Copy of "Final Graduation Project Development Schedule"**

		Name	Duration	Start	Finish	Predecessors	Resources
1		Final Graduation Project	152days	08/28/2023	03/26/2024		
2		FGP Start	1day?	08/28/2023	08/28/2023		
3		1. Graduation Seminar	40days?	08/29/2023	10/23/2023	2	
4		1.1 FGP Deliverables	35days?	08/29/2023	10/16/2023		
5		1.1.1 Charter items 1 – 10, Preliminary bibliographical research	5days?	08/29/2023	09/04/2023		
6		1.1.2 Charter items 11 and 12, FGP WBS, Self - assessment	5days?	09/05/2023	09/11/2023	5	
7		1.1.3 Corrections, Charter items 13 to 19	5days	09/12/2023	09/18/2023	6	
8		1.1.4 Corrections, Chapter 2 Theoretical Framework, Charter item 20, S	5days?	09/19/2023	09/25/2023	7	
9		1.1.5 Corrections, Chapter 3 Methodological framework, Charter item 2	5days?	09/26/2023	10/02/2023	8	
10		1.1.6 Corrections,Chapter 1 Introduction, Chapter 7 Project Validation ir	5days?	10/03/2023	10/09/2023	9	
11		1.1.7 Corrections, Executive Summary, Abstract, Bibliographical referen	5days?	10/10/2023	10/16/2023	10	
12		1.2 Graduation Seminar approval	5days?	10/17/2023	10/23/2023	11	
13		2. Tutoring Process	71days?	10/24/2023	01/30/2024		
14		2.1 Tutor	3days?	10/24/2023	10/26/2023		
15		2.1.1 Tutor assignment	1day?	10/24/2023	10/24/2023	12	
16		2.1.2 Communication	2days?	10/25/2023	10/26/2023	15	
17		2.2 Adjustments of previous chapters (If needed)	5days?	10/27/2023	11/02/2023	15,16	
18		2.3 Charter IV. Development (Results)	53days?	11/03/2023	01/16/2024	17	
19		2.3.1 Project Charter	4days?	11/03/2023	11/08/2023		
20		2.3.2 Scope Management Plan	4days?	11/09/2023	11/14/2023	19	
21		2.3.3 Schedule Management Plan	4days?	11/15/2023	11/20/2023	20	
22		2.3.4 Cost Management Plan	5days?	11/21/2023	11/27/2023	21	
23		2.3.5 Quality Management Plan	4days?	11/28/2023	12/01/2023	22	
24		2.3.6 Resource Management Plan	5days?	12/04/2023	12/08/2023	23	
25		2.3.7 Communication Management Plan	5days?	12/11/2023	12/15/2023	24	
26		2.3.8 Risk Management Plan	6days?	12/18/2023	12/25/2023	25	
27		2.3.9 Procurement Management Plan	6days?	12/26/2023	01/02/2024	26	
28		3.0.0 Stakeholder Management Plan	4days?	01/03/2024	01/08/2024	27	
29		3.0.1 Sustainability Management Plan	6days?	01/09/2024	01/16/2024	28	
30		2.4 Chapter V. Conclusions	5days?	01/18/2024	01/24/2024		
31		2.5 Chapter VI. Recommendations	5days?	01/25/2024	01/31/2024		
32		Tutor Approval	1day?	01/30/2024	01/30/2024		
33		3. Reading by Reviewers	15days?	01/31/2024	02/20/2024		
34		3.1 Reviewers assignment request	5days?	01/31/2024	02/06/2024		
35		3.1.1 Assignment of two reviewers	2days?	01/31/2024	02/01/2024	32	
36		3.1.2 Communication	2days?	02/02/2024	02/05/2024	35	
37		3.1.3 FGP submission to reviewers	1day?	02/06/2024	02/06/2024	36	
38		3.2 Reviewers work	10days?	02/07/2024	02/20/2024		
39		3.2.1 Reviewer	10days?	02/07/2024	02/20/2024		
40		3.2.1.1 FGP Reading	9days?	02/07/2024	02/19/2024	37	
41		3.2.1.2 Reader 1 Report	1day?	02/20/2024	02/20/2024	40	
42		3.2.2 Reviewer	10days?	02/07/2024	02/20/2024		
43		3.2.2.1 FGP Reading	9days?	02/07/2024	02/19/2024	37	
44		3.2.2.2 Reader 2 Report	1day?	02/20/2024	02/20/2024	43	
45		4. Adjustments	20days?	02/21/2024	03/19/2024		
46		4.1 Report for reviewers	9days?	02/21/2024	03/04/2024	44	
47		4.2 FGP update	1day?	03/05/2024	03/05/2024	46	
48		4.3 Second review by reviewers	10days?	03/06/2024	03/19/2024	46,47	
49		5. Presentation to Board of Examiners	5days?	03/20/2024	03/26/2024		
50		5.1 Final review by board	2days?	03/20/2024	03/21/2024	48	
51		5.2 FGP grade report	3days?	03/22/2024	03/26/2024	50	
52		FGP End	1day?	03/27/2024	03/27/2024	51	



Appendix 4: Preliminary Bibliographical Research

Chariot Energy. (2022, October 20). Solar Farms: What Are They & How Do They Work? | Chariot Energy. https://chariotenergy.com/chariot-university/solar-farms/

GIS. (2018, August 16). Opening of the solar farm. Saint Lucia - Access Government. https://www.govt.lc/news/opening-of-the-solar-farm

- This reference was used because it provides important information on the opening of the solar farm.

Goal 7: Affordable and clean energy - The Global Goals. (2023, April 18). The Global Goals. https://www.globalgoals.org/goals/7-affordable-and-clean-energy/?gclid=CjwKCAjw9-6oBhBaEiwAHv1QvP1qTlmmu04qpa2-A93QpGDyTiSlSpkiu6GRdLpSkXTYjQaqLzhOFhoC438QAvD_BwE

Government of Saint Lucia. (2022). Saint Lucia's First Adaptation Communication to the United Nations Framework Convention on Climate Change (UNFCCC). Department of Sustainable Development, Ministry of Education, Sustainable Development, Innovation and Vocational Training.

- This article provides pertinent information on St. Lucia's climate change adaptation programs and draws reference to the solar farm project.

Hassan, M. (2023, August 14). Research methods - types, examples and guide. Research Method. https://researchmethod.net/researchmethods/

Joseph, C. (2018, August 7). LUCELEC To Officially Open Its Solar Farm. Lucelec.com. https://www.lucelec.com/content/lucelec-officially-open-its-solar-farm

- This article provides some information on the cost and schedule of the solar farm project.

Joseph, C. (2020, November 6). LUCELEC Begins Cabling Work For Solar Farm Battery Storage. Lucelec.com. https://www.lucelec.com/tags/solar-farm

- This article provides information on maintenance work on the solar farm.

Martin. (2023, September 11). Climate change - United Nations Sustainable development. United Nations Sustainable Development. https://www.un.org/sustainabledevelopment/climate-change/

Reference - LibGuides: Primary, Secondary, and Tertiary Sources of Information in the Sciences: Types of Information Sources. (n.d.). https://libraryguides.uwsp.edu/InformationSourcesInTheSciences

Regenerative development: going beyond sustainability. (2016b, January 25). Kosmos Journal. https://www.kosmosjournal.org/article/regenerative-development-going-beyond-sustainability/

Research tools and techniques. (n.d.). PPT. https://www.slideshare.net/RonitRKharade/research-tools-and-techniques-245926961

St. Lucia Electricity Services Limited. (n.d.). Brief History of LUCELEC. lucelec.com. Retrieved March 27, 2023, from https://www.lucelec.com/content/brief-history-lucelec

Project Management Institute. (2021). A Guide to the Project Management Body of Knowledge, (PMBOK® Guide) - Seventh Edition, Project Management Institute, Inc., 2021.

- The project management guide will provide information on the various knowledge management areas that will be covered throughout the project

Project Management Institute. (2017). A guide to the Project Management Body of Knowledge (PMBOK guide) (6th ed.). Project Management Institute, Inc., 2017.

- The project management guide provides useful information on the various knowledge management areas that will be covered throughout the project.

Rinkesh. (2023, July 28). Causes, effects and solutions to Global Energy Crisis - Conserve Energy future. Conserve Energy Future. https://www.conserve-energy-future.com/causes-and-solutions-to-the-global-energy-crisis.php#:~:text=Causes%2C%20Effects%2C%20and%20Solutions%20to,depletion%2C%20presenting%20a%20pressing%20concern

St. Lucia Electricity Services Limited. (2020). LUCELEC Organizational Structure. LUCELEC. Retrieved September 4, 2023, from https://www.lucelec.com/content/lucelec-organizational-structure.

- This website provides a copy of LUCELEC's organizational structure which will be utilized in the FGP.

Steel, N. (2023, March 9). Press release: Rocky Mountain Institute-Carbon War Room and Clinton climate initiative facilitate groundbreaking for solar farm in Saint Lucia. RMI. https://rmi.org/press-release/press-release-rocky-mountain-institute-carbon-war-room

- This article describes the initiative and explains some of the benefits that the solar farm will have on Saint Lucia's energy sector.

Tina, C. (2023, April 11). Agrivoltaics: The farm-to-solar trend that can help accelerate the renewable energy transition. resilience. https://www.resilience.org/stories/2023-04-11/agrivoltaics-the-farm-to-solar-trend-that-can-help-accelerate-the-renewable-energy-transition/

- This article was selected because it provides information on how the solar farm can be expanded and become regenerative.

United Nations. (2022, November 9). Energy - United Nations Sustainable Development. United Nations Sustainable Development. Retrieved July 23, 2023, from https://www.un.org/sustainabledevelopment/energy/

- This article discusses the UN goal number 7 of sustainable and clean energy which is tied to the construction of solar farms.

United Nations. (n.d.). What is climate change? | United Nations. https://www.un.org/en/climatechange/what-is-climate-change#:~:text=In%20a%20series%20of%20UN,the%20end%20of%20the%20century.

What does information source mean? (n.d.). https://www.definitions.net/definition/information+source

Appendix 5: Document Tracking

	Project Information
Project Name	
Project Number	
Document ID	
Document Owner	
Issue Date	
Last Saved Date	
File Name	

Change Control

Version	**Issue Date**	**Changes**
1.0		Release

Approvals

Role	**Name**	**Signature**	**Date**
Project Sponsor			
Project Manager			

Appendix 6: Change Request Form

Project Name		**Date**	
Project Number		**Requestor**	
Project Manager		**Project Owner**	
Project Name		**Date**	
Project Number		**Requestor**	
Project Manager		**Project Owner**	
Describe the Reason for the Request			
Risk Identification/Analysis			
Impact Analysis			
Work Products to be Modified			Version Number
1.			
2.			
3.			
Describe the impact of the suggested change to work that is already complete.			
Quality Impact			
Additional Quality Assurance or Quality Control Activities			
1.			
2.			
3.			
Describe the impact of the change to quality assurance activities and quality control activities.			
Schedule Impact			
New Deliverables Description	Effort Hours	Date Required	Impact to Other

			Delivery Dates
1.			
2.			
3.			
Based on the impact, state the estimated date for implementing the requested change. State the new estimated project completion date.			
Budget Impact			
New Deliverables Description	Lessen or Eliminate Other Expenses? Please describe	Cost of New Deliverable	Total
1.			
2.			
3.			
Describe the overall impact to budget/cost.			

Decision				
		Approved		Rejected
		Approved with modifications		Deferred

Justifications
Additional Comments

Appendix 7: Log Sheet

Project Name				**Date**			
Project Number				**Document Number**			
Project Manager				**Project Owner/Client**			
Change Request Number	**Date Received**	**Requestor**	**Change Request Name and Description**	**If approved,** **approved by**	**Implementation** **Due Date, if Applicable**	**Requirement** **Or WBS Number, if Applicable**	**Status**

Appendix 8: Sample Report

Project Name			
Project Number			
Meeting Interval			
Reporting Officer		Date	
Subject			

Report		
Item	Description	Status
Review of last status update		
Work in progress		
Work completed		
Challenges		
Next Steps		

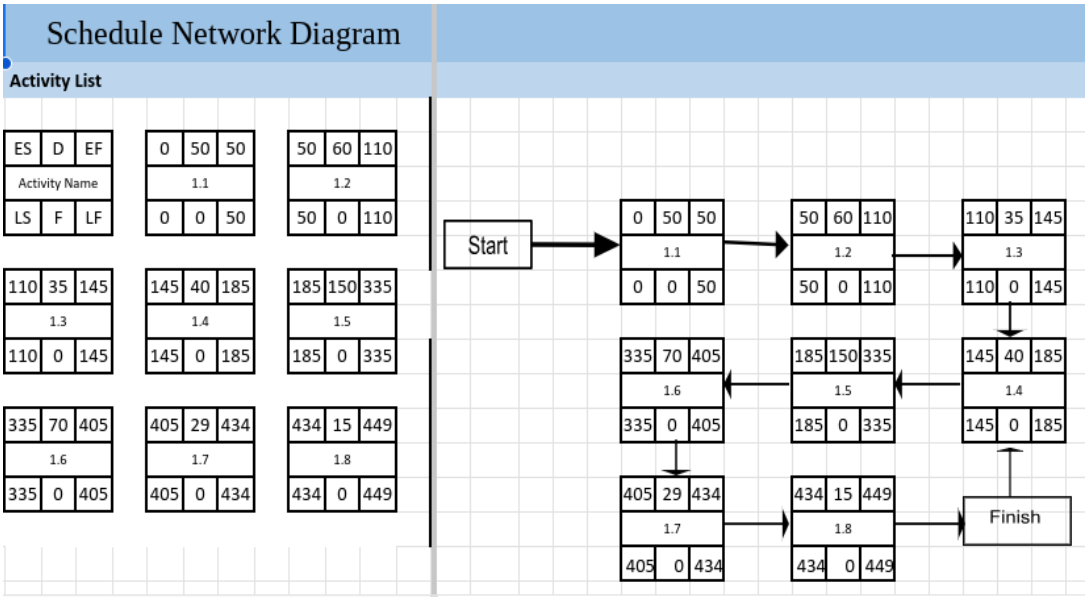
Appendix 9: Sample Quality Report

Project Name			**Date**	
Project No			**Document ID**	
Reviewer 1			**Signature**	
Reviewer 2			**Signature**	
ID	**Description**	**Inspection Criteria**	**Responsible**	**Comments**

Appendix 10: Risk Register Format

RBS Code	Risk	Cause	Consequence	Probability	Impact	Risk Rating	PxI	Risk Response	Risk Owner

Appendix 11: Schedule Network Diagram



Appendix 12: Vendor Agreement

This Vendor Agreement (hereinafter referred to as the "Agreement") shall commence on [COMMENCEMENT DATE],

BY AND BETWEEN:	**[CLIENT NAME]**, hereinafter referred to as the "Client".
AND:	**[VENDOR NAME]**, hereinafter referred to as the "Vendor", collectively referred to as the "Parties".

This Agreement will be considered agreed and valid upon signature by both parties. In consideration of the mutual promises and covenants in this Agreement, the Parties further agree to the terms as follows

Scope of Engagement

The Vendor hereby agrees to supply the following goods or services at the Client's place of business, located at [CLIENT ADDRESS], in accordance with the terms of this Agreement:

(Amend and list any additional items or services here. Be as specific as possible specifying the brand, model, and any unique features).

Payment Terms

The Client will receive monthly invoices and, after verifying that the charges are accurate, issue payment within 30 days. All payment matters should be address to the Client's accounts payable department.

Representation and Warranties

The Parties mutually represent and warrant that they have the capacity and qualifications necessary to abide by the terms and conditions of this Agreement.

The Vendor represents that it is a legally registered entity or individual with the legal capacity to enter into this Agreement and fulfill its obligations herein.

Furthermore, the Vendor represents that it possesses the expertise, experience, licenses, and certifications required to provide the goods or services specified in the "Scope of Engagement" section.

The Vendor also warrants its commitment to compliance with all applicable laws, regulations, and industry standards while providing the goods or services outlined in this Agreement.

Liability and Indemnification

The Vendor will take responsibility and cover any losses or damages that the Client and its representatives may experience.

In addition, the Client agrees to protect the Vendor from any loss or damage, except in the case of extreme carelessness or recklessness by the Vendor or its representatives.

Insurance

The Vendor is obligated to source suitable insurance for the duration of the contract and upon request will provide verification of such insurance to the Client.

If the Vendor fails to provide proof of insurance, the Client will treat this as a violation of the vendor Agreement and it will be cause for termination.

Independent Contractor

The Vendor will be regarded as a self-employed individual. This Agreement does not establish an employer-employee relationship, and such an Agreement will never be formed in the future.

Termination

This vendor Agreement can be terminated by either party with 10 days written notice. All unpaid debts must be paid to the Vendor within 30 days of the termination.

Entire Understanding

This vendor Agreement, along with any associated documents, constitutes the complete Agreement and shall supersede any previous Agreements, both written and spoken.

Legal Fees

In the event of any legal action, the victorious party is eligible to receive compensation for expenses such as lawyer fees, court costs, and transportation costs.

Notices

All communication regarding this vendor Agreement must be done in writing and either sent by mail or delivered in person.

Delays

Should either of the parties become aware of any issue that may postpone any part of the contract, they must inform the other side within five days in a written report that includes all relevant details.

Signatures

In signing this Agreement, the Vendor confirms their familiarity with the conditions of operating with the Client, and pledges to adhere to these terms at all times.

CLIENT	**VENDOR**
_____	_____
Signed (signature)	Signed (signature)
_____	_____
Print Name	Print Name
_____	_____
Address	Address
_____	_____
Date	Date

Appendix 13: Key Performance Indicators Table

P5 Domain	Lens	Category	Element	Key Performance Indicator	Metric
People					
Planet					
Prosperity					

Appendix 14: Philogist Dictum

Zenith Edward
zenithedward@gmail.com
Tel: 1 (758) 729-1388

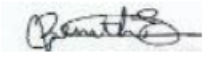
February 25, 2024

Academic Advisor
Masters Degree in Project Management
Universidad para la Cooperacion Internacional (UCI)

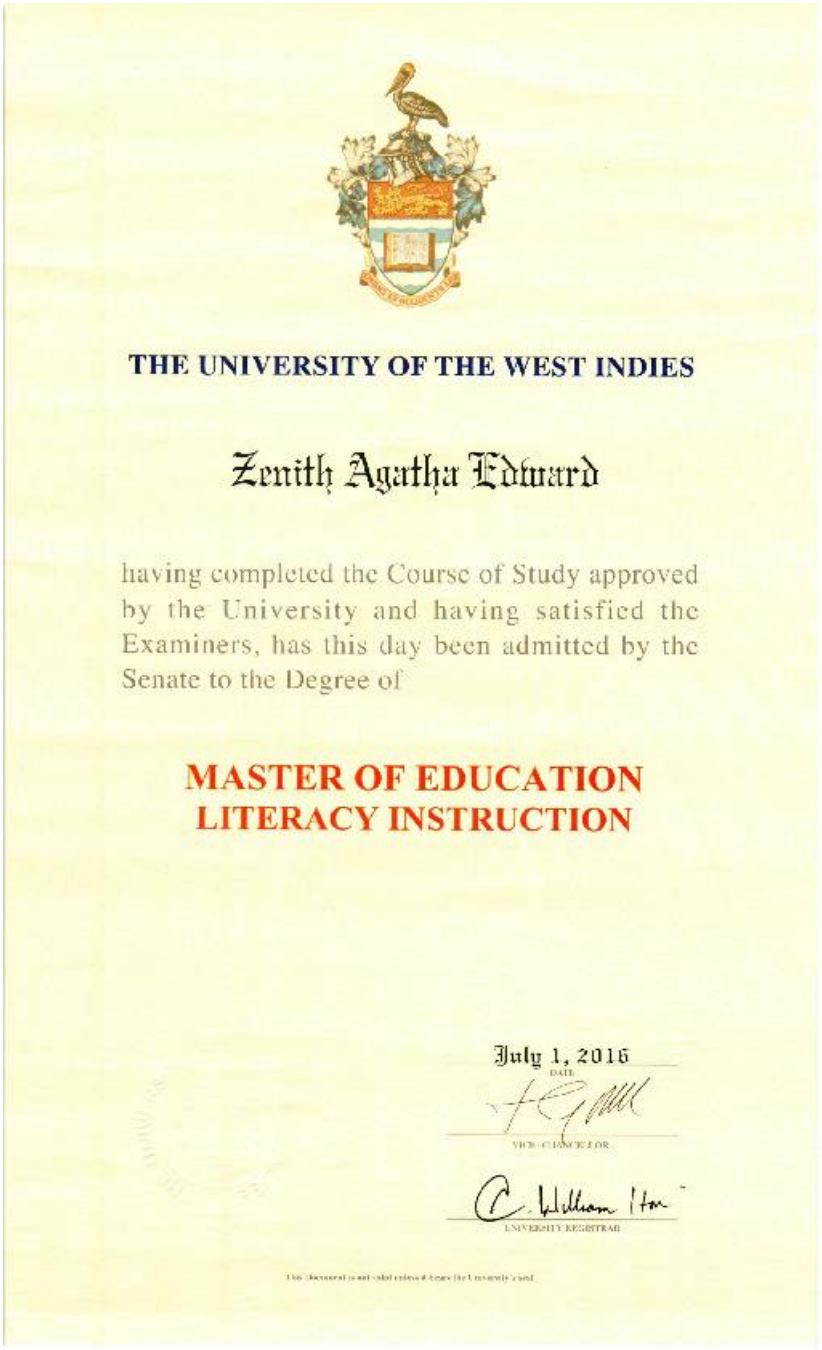
Dear Academic Advisor,

Re: Thorough Review and Proofreading of Final Graduation Project submitted by Sibyl Dostalie in partial fulfillment of the requirements for the Masters in Project Management (MPM) Degree

I hereby confirm that Sibyl Dostalie has made all of the corrections to the Final Graduation Project document as I have advised. In my opinion, the document does now meet the literary and linguistic standards expected of a student for a degree at the Masters level.



Zenith Edward
Literacy Co-ordinator



THE UNIVERSITY OF THE WEST INDIES

Zenith Agatha Edward

having completed the Course of Study approved by the University and having satisfied the Examiners, has this day been admitted by the Senate to the Degree of

MASTER OF EDUCATION
LITERACY INSTRUCTION

July 1, 2016
DATE

VICE-CHANCELLOR

UNIVERSITY REGISTRAR