A CONTRIBUTION TO SOLAR ENERGY POLICY IN SUB-SAHARAN AFRICA

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i. Abstract

Access to reliable electricity remains one of the central constraints on economic development in sub-Saharan Africa. Despite the region's substantial solar resources and repeated national and international commitments to renewable energy deployment, utility scale, grid-connected solar photovoltaic projects continue to face significant barriers to implementation. This thesis examines whether standardized regulatory frameworks and standardized project documentation can improve the bankability, financing, and implementation of utility-scale solar projects in sub-Saharan Africa.

The thesis addresses two principal research questions: First, whether sub-Saharan Africa would benefit from a standardized regulatory framework for utility-scale, grid-connected solar PV; and second, whether standardized Power Purchase Agreements and related project documents would reduce transaction costs, improve risk allocation, and enhance project bankability. The research is grounded in institutional theory, particularly the concept of institutional voids, and is informed by the researcher's professional experience as a renewable energy developer working on African solar projects. Methodologically, the thesis combines practitioner-informed autoethnographic analysis, comparative policy review, documentary analysis, and legal contractual analysis.

The study finds that the principal barriers to solar deployment in the region are not primarily technical, but institutional, regulatory, contractual, and financial. Weak utility balance sheets, uncertain tariff methodologies, fragmented permitting processes, limited regulatory capacity, inconsistent procurement mechanisms, and the absence of bankable standardized documentation all contribute to delayed development and increased financing risk. Comparative analysis of policy mechanisms, including feed-in tariffs, renewable portfolio standards, auctions, tax incentives, and government guarantee structures, demonstrates that policy instruments are most effective when embedded in predictable regulatory systems and supported by financeable contractual frameworks.

The thesis concludes that standardized regulatory and contractual instruments can operate as practical substitutes for weak or incomplete institutional capacity. In particular, standardized Power Purchase Agreements, implementation agreements, government guarantees, and related project documents can reduce negotiation time, clarify risk allocation, strengthen lender confidence, and support repeatable project development. The accompanying Professional Portfolio provides model documents that operationalize these findings, including a model PPA, government guarantee, implementation agreement, concession agreement, land option agreement, and related project finance documents.

The original contribution of this thesis lies in connecting renewable energy policy, institutional void theory, and bankable project documentation into a practical framework for accelerating utility scale solar development in sub-Saharan Africa. It argues that bridging the gap between policy ambition and project implementation requires not only better energy policy but also standardized legal and financial instruments capable of translating policy into financeable infrastructure.

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ii. Glossary of Terms

Alternating Current (AC): A type of electric current in which the direction of the flow of electric charge periodically reverses. The changes move back and forth in a cyclic manner, oscillating between positive and negative directions. The type of electrical current used in most electrical grids and buildings.

Array: A grouping or collection of multiple solar photovoltaic (PV) panels or modules interconnected to generate electricity from sunlight.

Bankability: In the context of utility sized renewable energy projects, the term refers to the degree of confidence and assurance that a project will be financially viable and able to attract investments and loans from banks, private equity firms, and other investment institutions.

Concession Agreement: A contract between a government or public authority and a private entity, granting the private entity the right to develop, operate, and maintain a specific infrastructure project or service for a defined period.

Creditor: An individual, organization, or entity that is owed a debt or has a claim to receive payment from another party, known as the debtor. The creditor can be a person, a company, a financial institution, or even a government entity.

Debt Coverage Ratio (DCR): Also known as Debt-Service Coverage Ratio (DSCR), is a financial metric used to assess the ability of a borrower to cover its debt payments, particularly interest and principal payments, with its available cash flow or income.

Degression Rate: Refers to the rate at which the feed-in-tariff rate decreases or declines over time. It represents a mechanism by which governments or regulatory authorities gradually reduce the financial incentives provided to solar power producers for feeding electricity into the grid.

Developer: An individual, company, or organization that takes on the responsibility of initiating, planning, financing, and executing the development of a project.

Development Finance Institution (DFI): Is a specialized financial institution that provides various forms of financial support and investment to promote economic development, particularly in emerging, developing or frontier countries. DFIs typically operate as government-owned or government-backed entities, although some may also have private sector participation.

Diminishing Marginal Utility of Money: An economic concept that suggests the satisfaction or value derived from an additional unit of money decreases as the person's wealth or income increases.

Direct Current (DC): Is an electric current that flows in a constant direction, maintaining a consistent polarity. The type of electrical current generated by solar panels.

Environmental Impact Assessment (EIA): An evaluation of the potential environmental effects of a solar project, including impacts on wildlife, habitats, and local communities.

Feasibility Study: A report that assesses the technical, economic, and environmental viability of a utility-scale solar project.

Feed-in Tariff (FiT): A policy mechanism that incentivizes the development of renewable energy, particularly in the context of utility scale solar installations. It is a legislatively mandated pricing

structure and contract arrangement offered by governments or utility companies to promote the generation of electricity from renewable sources, such as solar power.

Fixed Tariff: The term refers to a predetermined and unchanging rate at which the electricity generated from the solar installation is purchased by the off-taker or utility company or off-taker. The fixed tariff is usually established through a power purchase agreement.

Force Majeure: Refers to unforeseeable and uncontrollable events or circumstances that prevent one or more parties from fulfilling their contractual obligations. The term "force majeure" is derived from French law and translates to "superior force" in English.

Grid Interconnection Application: Documentation required to apply for the physical connection of a solar field to the electrical grid.

Implementation Agreement: A legal agreement that sets out the terms and conditions for implementing a project, typically associated with large-scale infrastructure or development projects.

Interconnection: The process of physically and electrically connecting a solar power system to the electrical grid.

Institutional Voids: Refers to the absence of inadequacy of formal institutions and supporting infrastructure that are necessary for the smooth functioning of economic and social activities in a particular country or region. These voids can exist in various areas, such as legal systems, property rights protection, financial markets, governance structures, and public services.

Inverter: A device that converts DC electricity from solar panels into AC electricity suitable for use in the grid or buildings.

Kilowatt-hour (kWh): A unit of energy commonly used to measure electricity consumption or production. One kilowatt-hour of power for one hour. In other words, if you were to use a device that has a power rating of 1kW continuously for one hour, you would consume 1 kWh of energy.

Kilowatt Peak: (KwP) It represents the peak power output of a solar panel or an entire solar power system under standard test conditions.

Levelized Cost of Electricity (LCOE): Is a metric used in the utility-scale solar context to evaluate and compare the cost competitiveness of different energy generation sources, including solar power. It represents the average cost of producing one unit of electricity over the lifetime of a power generation project, typically measured in dollars per kilowatt hour (kWh).

Logit and Tobit: Are types of regression analysis models commonly used in statistical analysis. Logit is short for logistic regression and Tobit addresses the issue of censored data by modeling both the observed and unobserved values of the dependent variable simultaneously.

Megawatt (MW): A unit of power equal to one million watts, commonly used to measure the capacity or output of utility scale solar installations. One megawatt is equivalent to 1,000 kilowatts (kW) or 1,000,000 watts.

Memorandum of Understanding (MOU): A non-binding agreement or document that outlines the intensions, understanding, and areas of cooperation between two or more parties.

Multi-lateral Institution: Is an international organization formed by multiple countries to address global challenges and promote cooperation in various areas, including economic development, poverty reduction, infrastructure, and social welfare, such as, The World Bank.

Net Metering: A billing mechanism that allows solar system owners to receive credit for excess electricity they generate and feed back into the grid.

Off-Taker: An entity or organization that purchases electricity directly from a power generator or a renewable energy project developer.

Permits and Licenses: Various permits and licenses required by local, regional, or national authorities for the construction and operation of a solar field.

Petawatt: A petawatt (PW) is a unit of power in the International System of Units (SI), specifically used to measure the rate at which energy is generated or consumed. One petawatt is equivalent to one quadrillion (10 to the 15 power) watts, making it an extremely large unit of power.

Photovoltaic (PV) System: A solar power system that converts sunlight into electricity using solar panels made of photovoltaic cells.

Polarity: Refers to the direction of electrical flow within a circuit. It indicates whether the electric current flows in one direction (positive to negative) or the opposite direction (negative to positive).

Put/Call Agreement: Is a type of government guarantee that provides protection to the project developer or equity investor. It allows the project developer or equity investor one or both of the following options: sell the project or its equity back to the government or allow the project developer or equity investor to require the government to purchase the project or its equity at a predetermine price or valuation.

Stakeholder: Generally, refers to any individual, group, or entity that has an interest in or is affected by a particular project, decision, or organization.

Step-in Rights: In the context of solar project finance contracts, are provisions that allow a third party, typically a lender or equity investor, to intervene and assume the rights and obligations of the original project sponsor or borrower under certain circumstances.

Tobit Models: Are a type of statistical model for analyzing data with left or right censoring. In these models, the dependent variable has values that are either observed without censoring or censored, meaning they are only partially observed or subject to certain limitations.

iii. Introduction

This doctoral thesis examines the regulatory and contractual determinants of bankability in utility scale solar photovoltaic (PV) development across sub-Saharan Africa, with particular emphasis on the role of standardized implementation frameworks as practical instruments for improving renewable energy procurement outcomes. Despite the region's exceptional solar resource endowment and sustained international policy and economic support for renewable energy deployment, sub-Saharan Africa continues to experience persistent and widespread electricity deficits and comparatively limited penetration of grid connected utility scale solar infrastructure. The central concern of this research is therefore not the technical feasibility of solar PV deployment, but the institutional, regulatory, and contractual conditions that shape investment implementation outcomes.

Across multiple jurisdictions examined in this thesis, governments have adopted renewable energy targets and policy frameworks intended to encourage private sector participation in electricity generation. However, the translation of policy ambition into financeable infrastructure projects remains uneven. This research demonstrates that the principal constraint affecting implementation is not the absence of renewable energy policy intent, but the absence of predictable regulatory coordination mechanisms and standardized contractual structures capable of supporting long tenor project finance investment environments.

The thesis advances the central hypothesis that standardized regulatory and contractual implementation instruments particularly standardized power purchase agreements, implementation agreements, tariff determination pathways, and payment security frameworks can function as practical institutional substitutes within emerging electricity markets. In this context, standardization is understood not as administrative uniformity but as the structured allocation of regulatory responsibility and project risk in ways that improve predictability for investors, lenders, and public sector counterparties. By reducing transaction complexity and clarifying risk allocation, such instruments materially improve project bankability and support repeatable renewable energy procurement across both large and smaller electricity markets within the region.

This hypothesis reflects a persistent and observable disconnect between renewable energy policy commitments and project level execution outcomes across sub-Saharan Africa. While ministries frequently establish ambitious renewable energy targets, utilities often lack balance sheet strength sufficient to support long term payment obligations, and regulators frequently operate within evolving procurement frameworks that shift between feed in tariffs, negotiated transactions, and auction based mechanisms without predictable sequencing. As a result, renewable energy investment remains concentrated within a limited number of jurisdictions possessing prior independent power producer procurement experience.

The research undertaken in this thesis therefore addresses two principal research questions:

1. whether sub-Saharan African electricity markets would benefit from more predictable and standardized regulatory implementation frameworks governing utility scale solar PV procurement; and

2. whether standardized power purchase agreements and associated implementation documentation can reduce risk allocation uncertainty, improve bankability, and accelerate deployment of utility scale solar PV infrastructure.

To address these questions, the thesis pursues a single integrated objective: to examine whether standardized regulatory and contractual implementation frameworks can function as operational substitutes for incomplete institutional capacity within emerging electricity markets, thereby reducing transaction costs, improving investment predictability, and supporting repeatable renewable energy procurement programs across sub-Saharan Africa.

The research is situated within a practitioner informed autoethnographic methodological framework reflecting the researcher's dual positionality as both academic analyst and infrastructure developer. Over more than a decade of professional engagement in renewable energy project development across multiple African jurisdictions, the researcher has participated directly in project negotiation processes involving ministries, utilities, regulators, development finance institutions, and commercial lenders. This insider perspective provides empirical insight into implementation dynamics that remain under documented in formal policy literature. Autoethnography is therefore employed not as narrative reflection but as a structured analytical method triangulated with comparative policy analysis, documentary evidence, and established scholarship on institutional voids and infrastructure finance in emerging markets.

Throughout the thesis, contractual instruments including standardized power purchase agreements, implementation agreements, and sovereign payment security structures are treated as analytically significant policy mechanisms through which renewable energy objectives are translated into financeable infrastructure transactions. By examining these instruments as operational components of regulatory implementation environments rather than merely technical legal documents, the thesis contributes to both renewable energy policy scholarship and project finance practice.

Given these objectives, the structure of the thesis is deliberately sequenced and defensible. The thesis begins by situating renewable energy development within the postcolonial institutional context of sub-Saharan Africa. This material is included not as a historical narrative, but to explain why institutional fragmentation, regulatory uncertainty, and governance capacity remain central explanatory variables in contemporary energy policy outcomes. This contextual grounding is necessary to justify why policy transfer from developed markets cannot be assumed to function seamlessly in African electricity sectors.

The literature review then examines existing scholarship on renewable energy policy, institutional theory, and legal standardization, establishing the theoretical foundations for the study. This is followed by a methodology chapter that explains the autoethnographic and comparative approaches adopted, clarifying how practitioner insight is systematically incorporated into academic analysis. Subsequent chapters move progressively from diagnosis to application: institutional voids are analyzed as a structural constraint on investment; power purchase agreements are examined as the legal nexus between policy, finance, and implementation; and standardized contractual frameworks are proposed as a mechanism for mitigating risk and improving bankability.

The inclusion of business and legal instruments, such as power purchase agreements, is therefore central to the thesis rather than incidental. PPAs are treated as analytically significant artefacts through which public policy objectives are translated into enforceable private contracts. By subjecting these instruments to academic scrutiny, the thesis bridges the gap between policy theory and project finance practice. The portfolio documents included in the later chapters serve as empirical artefacts, demonstrating how the proposed standardized frameworks can be operationalized in real world project contexts.

The scope of the thesis is intentionally focused on utility scale, grid connected solar PV projects in sub-Saharan Africa. It does not seek to address off grid systems, mini grids, or broader energy transition questions, except where necessary for contextual comparison. This bounded scope enables a deeper examination of policy design, legal structure, and bankability within a clearly defined project typology.

In conclusion, this introduction provides a roadmap for the thesis by summarizing the underpinning hypothesis, research questions, objectives, and structural logic of the work. The chapters that follow collectively test the proposition that standardized regulatory and contractual frameworks particularly bankable power purchase agreements can function as a practical policy intervention for accelerating utility scale solar deployment in sub-Saharan Africa. By integrating institutional context, legal analysis, and practitioner informed insight, the thesis seeks to make both a scholarly and applied contribution to renewable energy policy and project finance literature.

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iv. Motivation for the Research

Professional Contribution: Navigating Renewable Energy Development Through a Multifaceted Journey

The motivation for this research arises from a persistent and well documented gap between renewable energy policy ambition and project level implementation in sub-Saharan Africa. Despite the region's substantial solar resource potential and repeated policy commitments by governments, multilateral, and development institutions, the deployment of utility scale solar photovoltaic (PV) projects remains uneven, slow, and heavily dependent on external risk mitigation instruments. Academic literature and policy reports frequently attribute this outcome to weak institutions, regulatory uncertainty, and macroeconomic instability. However, comparatively little scholarly attention has been given to the *transactional mechanics* through which these risks materialize at the project level, particularly the role played by legal and contractual instruments in either facilitating or constraining investment.

This thesis is motivated by the observation that, in practice, the absence of standardized and predictable regulatory and contractual frameworks materially increases transaction costs, elongates development timelines, and deters private capital especially in smaller or frontier electricity markets. While standardization has been widely adopted in more mature renewable energy markets through model contracts, template power purchase agreements (PPAs), and harmonized regulatory processes, sub-Saharan Africa continues to rely largely on bespoke, jurisdiction-specific documentation negotiated on a project-by-project basis. This fragmentation introduces legal uncertainty, complicates financing, and places disproportionate bargaining power in the hands of public off takers, thereby undermining bankability.

The central academic hypothesis of this thesis is that sub-Saharan Africa would benefit from the adoption of standardized regulatory frameworks and bankable contractual documentation particularly power purchase agreements as a mechanism for reducing institutional risk, lowering transaction costs, and improving investor confidence in utility scale solar PV projects. This hypothesis is grounded in institutional theory and the concept of "institutional voids," which suggests that where formal institutions are weak or inconsistent, standardized private-order mechanisms can partially substitute for missing regulatory capacity.

This hypothesis directly informs and is tested through the following **research questions**:

1. Whether Sub-Saharan Africa would benefit from a standardized regulatory framework for utility-scale solar PV development?
2. Whether Sub-Saharan Africa would benefit from standardized power purchase agreements and associated project documentation?

By framing the research around these questions, the thesis moves beyond descriptive accounts of policy failure and instead interrogates the legal and institutional design choices that shape investment outcomes. The motivation of the research is therefore not merely to catalogue challenges, but to evaluate whether standardization can function as a practical, scalable policy intervention capable of aligning public-sector objectives with private sector financing requirements.

v. Educational Background

Bachelor's and Legal Studies

The researcher's academic training is interdisciplinary, combining history, political science, law, and finance, and provides the foundation for the analytical approach adopted in this thesis. Undergraduate studies in History and Political Science, with a focus on Eastern Europe and emerging markets, established an early understanding of geopolitical dynamics, state formation, and economic development in transitional contexts. This was followed by legal training culminating in a Juris Doctor with a concentration in corporate law and a Master of Laws (LLM) specializing in international compliance and taxation. Together, this academic formation equips the researcher with the legal, institutional, and financial literacy necessary to analyze complex policy environments and contractual frameworks, particularly in sectors such as renewable energy where public policy, international finance, and private law intersect.

vi. Professional Background

Professionally, the researcher has accumulated over a decade of senior, practitioner level experience in international finance and renewable energy development, including roles at global investment banks and executive leadership positions in cross border infrastructure projects. This includes twenty years of advisory work at major Wall Street institutions, the founding and management of an international boutique investment bank, and more than thirteen years as a senior executive of a renewable energy company responsible for developing, financing, and contracting utility scale solar and wind projects across sub-Saharan Africa. This thesis therefore adopts an autoethnographic

positionality, in which the researcher's insider experience is treated not as anecdotal narrative but as a reflexive source of empirical insight. The autoethnographic approach is theoretically grounded in practitioner research methodologies that recognize the value of situated knowledge in contexts characterized by institutional opacity, fragmented data, and evolving regulatory regimes. Throughout the thesis, this positionality is explicitly acknowledged and critically managed through triangulation with documentary analysis, comparative policy review, and established academic literature, ensuring analytical rigor while leveraging experiential insight into how renewable energy policy and legal instruments operate in practice.

vii. Project Development Tasks

Developers of utility sized solar projects have the responsibility of planning, designing, financial management, site selection and acquisition, permitting and regulatory compliance, supervising engineering design and construction, equipment procurement, grid connection, end of life planning, and operating installations. On a more detailed level, I have been involved with, responsible for, and executed, the following key tasks:

1. Site Selection
2. Permitting and Regulatory Compliance
3. Feasibility Studies
4. Financing
5. Engineering and Design
6. Environmental and Social Governance
7. Negotiating the Power Purchase Agreement
8. Procurement
9. Local Community Engagement
10. Construction Management
11. Grid Connection
12. Testing and Commissioning
13. Operations and Maintenance (O&M)
14. Monitoring and Performance Analysis
15. Asset Management

viii. Policy Influence and Networking

Utilizing my extensive professional network, I will continually advocate for renewable energy policies proposed in my thesis and frameworks that support the findings of my research, aiming to influence high level policy decisions. Through strategic engagement with key stakeholders, including government officials, industry leaders, and multinational organizations, I will present evidence based recommendations to demonstrate the benefits and feasibility of these policies. By leveraging my relationships with diplomats, energy ministers, and finance ministers, I will facilitate discussions that emphasize the critical importance of transitioning to renewable energy sources for sustainable development. Additionally, I will participate in international conferences and forums, such as the Africa Energy Forum, to share insights and collaborate with global experts, ensuring that the

proposed policies gain traction and support across different regions. My goal is to create a coalition of supporters who are committed to implementing effective renewable energy solutions that address both local and global challenges. Through continuous dialogue and collaboration, I aim to drive meaningful changes and contribute to the advancement of renewable energy initiatives worldwide.

ix. Collaboration with Development Finance Institutions

My relationship with numerous development finance institutions will be pivotal in securing funding and support for implementing the recommended solar energy solutions. Development finance institutions finance, directly or indirectly, the bulk of renewable energy projects in emerging markets in general and Africa in particular. Therefore, appealing to them will help influence governments and energy ministries.

By leveraging these connections, I will access a broad spectrum of financial instruments, including grants, low interest loans, and investment capital, which are essential for the development and scaling of solar projects. Collaborating with institutions such as the World Bank, the African Development Bank, the Development Financial Corporation of the United States, the European Investment Bank, and regional development funds, I will navigate the complexities of project financing and ensure that the financial models align with the economic realities of the targeted regions.

Furthermore, I will engage in regular dialogues with financial experts and decision makers within these institutions to advocate for tailored funding mechanisms that address the unique challenges of renewable energy projects in sub-Saharan Africa. This includes structuring financing packages that mitigate risk and enhance the bankability of projects, thereby attracting additional private sector investment.

Through these partnerships, I will also work on fostering capacity building initiatives and technical assistance programs that empower local stakeholders and enhance the sustainability of the projects. By presenting well researched proposals and demonstrating the socio economic and environmental benefits of solar energy, I aim to secure long term commitments and support from these development finance institutions, ultimately driving the successful implementation and scaling of renewable energy solutions across the region.

x. Knowledge Dissemination (1) Public Lectures

One of the key aspects of my role in promoting renewable energy is the dissemination of knowledge to not only stakeholders but to a broader audience. Through guest lectures at universities in Africa, in Israel and the United States, I aim to educate and inspire the next generation of leaders and professionals in the field of renewable energy. These lectures cover a range of topics, including the latest advancements in solar technology, policy frameworks, and the economic impacts of renewable energy projects. Additionally, I engage with public interest groups and community organizations to raise awareness about the benefits of solar energy and sustainable practices. By participating in conferences, workshops, and public forums, I share and will share insights from my research and practical experiences, fostering a collaborative environment where ideas can be exchanged, and innovative solutions can be developed. These activities will not only contribute to the academic community but also help bridge the gap between research and real-world application, driving forward the adoption of renewable energy solutions across diverse communities.

(1) Publications and Teaching

Publishing my research findings in peer reviewed journals and other professional publications is a crucial strategy for extending the reach and impact of my work. By doing so, I aim to provide a scholarly contribution that not only underscores the practical implications of effective solar energy policy but also highlights innovative project finance strategies in sub-Saharan Africa. This endeavor will involve submitting articles that detail the outcome of my research, the methodologies employed, and the potential for scalable solutions within the renewable energy sector.

Furthermore, presenting these findings at conferences, symposiums, and workshops will facilitate engagement with other experts in the field, fostering a collaborative environment for sharing ideas and refining approaches. Through these academic and professional platforms, I can contribute to the ongoing dialogue about renewable energy development, offering insights drawn from my extensive fieldwork and analysis.

Additionally, teaching plays a vital role in disseminating knowledge and inspires the next generation of energy policy and finance specialists. By integrating the key findings of my research into university curricula, guest lectures, and seminars, I can directly influence how emerging professionals understand and approach renewable energy challenges. This educational aspect will not only enhance the academic prowess of students but also equip them with the practical skills necessary to navigate and innovate within the energy sector.

By aligning publications and teaching, my aim is to create a robust framework for knowledge exchange that transcends academic boundaries and makes a tangible impact on the development of sustainable energy practices in sub-Saharan Africa. This integrated approach ensures that the valuable insights gained from my research are passed on effectively, contributing to a more sustainable and economically viable future for renewable energy in the region.

(2) University Lecturing

Beyond my career achievements, I have dedicated the last eight years to teaching three graduate courses annually, as well as delivering guest lectures at multiple universities. Additionally, I have collaborated with professors from Stanford University, Brigham Young University, and Temple University, as well as lecturers globally, to write case studies. Stanford University has a graduate course open to law students, MBA students and Ph.D. candidates in Electrical Engineering, focusing primarily on climate finance. I have the privilege of delivering the lecture for the final class of the year, which typically involves a case study based on an actual project of ours. These activities allow me to share my perspective with numerous students each year, both directly and indirectly. Last year, I was honored by Bar Ilan University as the best lecturer of the year. In addition, this year, I am scheduled to establish and teach a clinic in Project Finance Law to Master of Law (LLM) students.

In addition, we are planning a parallel university program where we have signed agreements with ten universities in Ethiopia, the Thurgood Marshall College Fund, and historically Black colleges and universities (HBCUs) in the United States to build utility sized solar projects on their campuses. My objective is not only to build these projects but also to integrate an environmental learning program whereby students get involved in pre-development, operations, and management of the projects. I have initiated a lecture series in Ethiopia and intend to implement a similar series in the United States.

Drawing on my significant professional experience in this area, the overall goal of this thesis is to improve the understanding of what elements of solar energy policy will help to increase the

investment in grid connected utility-sized solar power plants in sub-Saharan Africa and to draft a portfolio of project documents that will act as a framework to accelerate and simplify the development process. In my research, I explore two primary questions: Firstly, whether sub-Saharan Africa would benefit from a standardized policy framework for the development of utility sized solar farms, and secondly, whether a standard power purchase agreement between independent power producers and off-takers would be beneficial.

In exploring these issues, I evaluate the advantages of having standardized policies and documents; the potential stakeholders who could benefit from an improved or initiated solar policy; the overall effects of a framework policy; and its potential to repair institutional voids and promote social order. Furthermore, my research seeks to address any unintended consequences of implementing a framework policy, including any potential negative effects and outcomes.

xi. Research Objectives

In accordance with this approach, I have two objectives: First, I will propose standard heads of terms for the power purchase agreements used between off takers who buy energy and independent power producers who sell the energy. My second objective is to create a standard, bankable power purchase agreement that can be used by international developers, equity sponsors and lenders that would be acceptable to all stakeholders.

Since bankable legal documents are downstream from policy, in section 7.1, I will first discuss, analyze, and suggest appropriate solar policies for sub-Saharan Africa. These policy suggestions will be drawn from some of the most successful renewable implementation countries in the world including Germany, Spain, the United Kingdom, and others. It is important to understand, however, that even though a certain aspect of solar policy is effective in a developed country, such as Germany, does not mean that it will be successful in an emerging or frontier market (Sun, et al, 2019). Therefore, I will be circumspect regarding the inclination to 'plug and play' successful policies without taking into consideration local and regional customs, infrastructure development or the lack thereof, cultural norms, and existing legal structures. This will be shown in chapter 3 in my methodology section. To do so, I will rely not only on my research but on my years of experience developing utility sized solar projects in Africa, the Mid East, and the United States.

Another essential consideration is the existence of institutional voids that exist in sub-Saharan African that do not exist in developed countries. These institutional voids must be taken into consideration when analyzing whether a policy or policies will be successful in each region, country, or sub-Saharan Africa as a whole.

In addition to discussing, analyzing, and suggesting policy solutions that would increase the investment in and the development of additional utility size, grid connected solar projects, I will address the legal infrastructure that is supposed to act as a bridge between policy and implementation. I will do this by developing a framework for a power purchase agreement (PPA) that can be used in individual countries and regional power agreements.[1] This will include the discussion of support schemes that ensure that the law and documents are aligned with the policy, to ensure there are no barriers to the promotion of solar investment in the region (Oniomoles, 2016).These documents must be locally, regionally, and internationally bankable: In order to account for these

[1] Ses Power Purchase Agreement section 11.9 in the Portfolio Section, page 250.

international variations, documents must be drafted in a way that will be acceptable to all the relevant stakeholders: the off taker the developer, the equity sponsor, development finance institutions, multi-lateral institutions, the creditor(s) and the government.

One of the most significant and pressing challenges in sub-Saharan Africa is the prevailing practice of extensive time and financial investment required to renegotiate power purchase agreements for each individual project in every country. This recurrent issue significantly escalates project costs, prolongs the pre-development phase, and needlessly heightens the risk of inadequate bankability for each project.

xii. **Original Contribution:**

The original contribution of this thesis lies in its comprehensive approach to addressing the multifaceted challenges of developing and financing utility size solar energy projects in sub-Saharan Africa. By directly tackling the institutional voids, widespread corruption, and lack of experience with solar policy in the region, this work offers innovative solutions that can significantly lower the barriers to entry for both local and international developers. A key contribution is the introduction of relatively uniform legal documents, which can drastically reduce the enormous legal costs typically incurred as projects approach financial close.[2] This approach not only streamlines the process but also provides a template that can be reused across multiple projects, in multiple jurisdictions, thereby increasing efficiency and reducing the time and resources needed for each new initiative. Thereby, reducing time to construction and reducing both hard and soft cost related to project development.

Furthermore, this thesis advocates for the adoption of policies that attract developers of all sizes, recognizing the importance of inclusivity in fostering a robust solar energy market. By recommending that countries begin their solar energy journeys with demonstration projects before moving to tenders, the thesis underscores the importance of building trust and demonstrating feasibility in environments where skepticism may prevail, and unfortunately usually does. The emphasis on policy uniformity, rather than starting from scratch for each new project, and the strategic adaptation of successful policies from industrialized nations, further highlight the originality of this work. These contributions collectively provide a practical and scalable framework for overcoming the significant hurdles to solar energy development in sub-Saharan Africa, positioning this thesis as a valuable resource for policymakers and stakeholders in the region.

[2] Portfolio Section beginning in section 11.1. page 173.

The balance of this thesis is organized to guide the reader through a comprehensive exploration of solar energy policy in sub-Saharan Africa, addressing both the broader context and specific policy issues.

We begin in **Chapter 1** with a survey of Africa and the post-colonial situation, setting the stage for an overall understanding of the current energy landscape and the historical factors that have influenced it.

Moving into **Chapter 2**, we undertake a thorough literature review, where we delve into nine critical areas: policy gaps, institutional voids, feed-in tariffs, renewable portfolio standards, auctions and tenders, power purchase agreements (PPAs), tax policy, bankability, and risk. This chapter lays the foundation by highlighting the existing research and identifying key issues that need to be addressed.

Chapter 3 is dedicated to the methodology employed in this study, outlining the research design, and analytical approaches used to explore the complex issues surrounding solar energy policy in the region.

In **Chapter 4**, we focus specifically on the concept of institutional voids, a critical challenge in emerging markets in general, and sub-Saharan Africa in particular, that negatively affects the implementation and effectiveness of solar energy policies.

Chapter 5 delves into power purchase agreements (PPAs), a pivotal element in the financing and development of solar energy projects. This chapter provides an in-depth analysis of how PPAs function and their significance in the region's energy sector.

Chapter 6 transitions to policy contributions, where we propose practical solutions, and experienced based suggestions to address the gaps identified earlier in the thesis.

In **Chapter 7**, we further explore policy related aspects, covering twelve distinct subsections, including feed-in tariffs, capacity caps, tariff pricing methodology, and more. This chapter offers a detailed examination of various policy tools and their potential impact on the growth of solar energy in the region.

Chapter 8 presents suggested policies, divided into eleven subsections that discuss challenges, governance issues, and the seven phases of policy development. This chapter is designed to provide actionable recommendations for policymakers and stakeholders.

In **Chapter 9**, we return to the topic of power purchase agreements, offering a comprehensive understanding of these agreements with a focus on twelve critical subsections. This includes discussions on bankability, force majeure, government guarantees, dispute resolution, and other key contractual elements that ensure the viability of solar projects.

Chapter 10 introduces the various portfolio documents associated with solar energy projects, guiding the reader through the necessary legal and financial documentation required for project development and execution.

Finally, the thesis is supplemented by a series of appendices, which include critical documents such as the Memorandum of Understanding (MOU), Put-Call Agreement, Concession Agreement, EPC Agreement, Government Guarantee, Implementation Agreement, Land Lease Options Agreement,

Land Lease Agreement, PPA Issues List, PPA Key Terms, the full PPA, and the Project Investment Memorandum. These appendices provide detailed, real life, bankable, examples and templates that can be used as references in the field.[3]

This structured approach ensures that the reader is systematically introduced to the complexities of solar energy policy in sub-Saharan Africa, with each chapter building upon the last to create a cohesive and comprehensive analysis.

[3] Portfolio Section beginning in section 11.1. page 173.

1. Africa and the Post-Colonial Situation

1.2 Selection and Use of Post-Colonial Literature

The postcolonial literature reviewed in this chapter was selected using three criteria:

1. Direct relevance to institutional capacity, governance, and state market relations, rather than cultural or literary post-colonial theory;
2. Applicability to contemporary economic policy implementation, particularly in infrastructure and energy sectors;
3. Analytical compatibility with institutional theory, including the concept of institutional voids used throughout the thesis.

Accordingly, this chapter draws primarily on political economy, development economics, and governance focused postcolonial scholarship. Works were selected where they offer explanatory power for regulatory fragmentation, weak contract enforcement, state credibility deficits, and the persistence of extractive institutional arrangements factors that directly affect renewable energy investment and PPA bankability.

This approach avoids an exhaustive historical narrative and instead positions post colonialism as an explanatory lens for present-day policy constraints, consistent with the applied and practitioner-informed nature of the research

1.3 Post-Colonial Institutional Legacies and State Capacity

The transition from colonial rule to independence across sub-Saharan Africa occurred rapidly and unevenly during the mid-twentieth century. While sovereignty was achieved, institutional capacity did not develop at the same pace. Many newly independent states inherited legal systems, administrative structures, and economic models designed for extraction and control rather than long-term service provision or infrastructure development.

These legacies continue to shape electricity sectors today. Energy ministries, regulators, and state owned utilities in many jurisdictions operate with overlapping mandates, limited autonomy, and constrained technical capacity. Regulatory frameworks are often incomplete, inconsistently applied, or subject to political intervention. As a result, policy commitments made at the national level frequently fail to translate into predictable, enforceable outcomes at the project level.

This institutional environment directly affects renewable energy development. Utility scale solar projects require long term contractual certainty, credible off takers, and enforceable tariff mechanisms. Where these conditions are absent or unreliable, private capital either demands extensive risk mitigation or exits the market entirely.

1.4 Post-Colonial Political Economy and Energy Path Dependence

Colonial energy systems in Africa were designed to serve extractive industries and administrative centers, not universal access or industrial diversification. Infrastructure investment prioritized mining

zones, ports, and urban elites, leaving rural and peri-urban populations underserved. After independence, many states retained these centralized and fossil fuel oriented energy systems due to fiscal constraints and inherited technical capacity.

This path dependence has persisted. Fossil fuels particularly oil, gas, and coal remain dominant in many African energy mixes, not because they are optimal for development or climate outcomes, but because existing institutional arrangements favor them. Subsidy structures, political patronage networks, and rent seeking behavior further entrench incumbent energy interests.

For renewable energy, this creates an uneven playing field. Solar PV challenges established political economic arrangements by decentralizing generation, reducing fuel rents, and requiring transparent contractual frameworks. Resistance to solar policy reform is therefore often institutional rather than technical, manifesting in delayed approvals, renegotiated PPAs, and regulatory uncertainty.

1.5 Institutional Voids as a Postcolonial Outcome

The concept of institutional voids defined as the absence or weakness of formal institutions necessary for market coordination provides a direct bridge between postcolonial theory and the core analytical framework of this thesis.

In sub-Saharan Africa, institutional voids in the electricity sector commonly include:

- Weak or politicized regulators;
- Non creditworthy state owned utilities;
- Inconsistent tariff methodologies;
- Limited judicial capacity to enforce long term contracts;
- Fragmented legal documentation negotiated on a bespoke basis.

These voids are not incidental; they are historically rooted in postcolonial state formation and administrative inheritance. Their presence explains why identical renewable energy policies can produce vastly different outcomes across jurisdictions, and why policy ambition alone is insufficient to attract private investment.

1.6 Implications for Solar Policy and Power Purchase Agreements

The relevance of post-colonial analysis becomes most apparent at the level of power purchase agreements, which function as the legal interface between public policy and private capital. In environments characterized by institutional voids, PPAs carry an unusually heavy burden: they must compensate for weak regulation, limited enforcement, and off taker risk.

As a result, PPAs in sub-Saharan Africa are frequently over engineered, heavily negotiated, and politically sensitive. Each project becomes a bespoke legal exercise, increasing transaction costs and undermining scalability. This reality directly motivates the thesis's focus on standardized, bankable PPA frameworks as a policy tool rather than merely a contractual convenience.

By standardizing key risk allocations and aligning them with international financing norms, PPAs can partially substitute for missing institutional capacity. This logic is consistent with institutional theory

and provides a defensible rationale for treating legal documentation as a core policy instrument in post colonial contexts.

1.7 Why This Chapter Appears at the Start of the Thesis

The placement of this chapter at the beginning of the thesis is deliberate and methodologically defensible. It establishes the structural conditions within which renewable energy policy operates in sub-Saharan Africa and explains why subsequent chapters focus on institutional voids, PPAs, and legal standardization rather than purely technical or economic variables.

Without this contextual grounding, later discussions of bankability, risk allocation, and policy transfer would risk appearing decontextualized or normatively biased toward developed market assumptions. This chapter therefore provides the necessary analytical foundation for evaluating why standardized frameworks may function differently and more effectively in post-colonial electricity markets.

1.8 Conclusion

This chapter has demonstrated that postcolonial institutional legacies remain central to understanding renewable energy policy outcomes in Sub-Saharan Africa. Rather than serving as historical background, postcolonial analysis explains the persistence of institutional voids, regulatory uncertainty, and contractual fragmentation that constrain utility-scale solar investment.

By situating renewable energy policy within this context, the thesis establishes a coherent justification for its central hypothesis: that standardized regulatory and contractual frameworks particularly bankable PPAs can act as functional substitutes for weak institutions and thereby accelerate solar deployment.

The following chapter builds on this foundation by reviewing the academic literature on renewable energy policy mechanisms, institutional theory, and legal standardization, setting the stage for the applied analysis that follows.

2. Literature Review: Comprehensive Analysis of Solar Policy Challenges in Sub-Saharan Africa

2.1 Introduction

This chapter adopts a problem driven, narrative literature review grounded in institutional theory and project finance bankability frameworks. Rather than surveying renewable energy policy literature exhaustively, the review focuses selectively on bodies of work that directly inform the thesis's two core research questions:

- **RQ1:** Whether sub-Saharan Africa would benefit from a standardized regulatory framework for utility scale, grid-connected solar PV; and
- **RQ2:** Whether standardized Power Purchase Agreements (PPAs) and associated contractual documents would improve project bankability and reduce transaction costs.

Inclusion criteria for the Literature Review are limited to studies addressing macro level energy policy design, institutional capacity and institutional voids, procurement mechanisms, contractual structures (particularly PPAs),[4] risk allocation, and bankability in emerging and frontier markets. Literature focusing exclusively on off grid systems, household level adoption, or purely technical PV efficiency is excluded, as it does not directly inform the research questions or the project level policy and contractual challenges examined in this thesis.

This chapter is structured thematically to guide the reader through the policy and institutional conditions that shape solar project outcomes. Each section explicitly addresses one or both research questions and collectively builds the analytical foundation for the comparative and practice-based methodology developed in Chapter 3.

To address the two research questions, it is necessary to conduct a comprehensive analysis of solar policy challenges in sub-Saharan Africa. This analysis will examine (a) whether sub-Saharan Africa will benefit from a standardized policy framework for solar PV; and (b) whether sub-Saharan Africa will benefit from a standardized power purchase agreement. It follows that it is necessary to identify the potential benefits of standardized solar policy and the impact of such a policy; the potential of such a policy to support other areas of the economy, and its ability to address existing institutional voids.

It is crucial to note that the utility size solar market in Africa is still a new and growing market. As a result, the solar regulatory landscape in Africa, apart from South Africa, is currently little to non existent, with each new country's project starting from scratch. Regulations are not uniform, at times based upon fossil fuel regulations, and the only common goal is the desire to lower feed-in tariffs

[4] *See "[Power Purchase Agreement]," § [Sections: 2.1, 6, 10.4, 11.4, 11.6, and 11.9], pp. [250], where the allocation of development and commercial risk between the parties is addressed.*

(Schwerhoff and Sy, 2020). This reality creates a lacuna of research that is on point in most, if not all, of my research topics.

This gap presents both an obstacle and an opportunity. This lack of research that is directly on point makes the research process challenging. However, the absence of primary or secondary research directly on point provides the opportunity to write a thesis that can have a tremendous impact not only on future relevant literature but also on the overall regulatory market.

The efforts made by the international development and academic communities to address the various challenges in solar policy in sub-Saharan Africa have fallen short as they tend to focus on individual problems, rather than addressing multiple issues through a multi factor approach. While it is important to solve individual problems, a more comprehensive solution is needed to address the complex and interconnected challenges facing solar policy in this region. This thesis contends that a successful macro policy should address several problems simultaneously, rather than solely focusing on single factor solutions.

This chapter is structured thematically to reflect the policy-to-project transmission mechanism that underpins utility-scale solar development. It begins with macro policy gaps, then examines institutional voids, followed by an evaluation of principal policy instruments (feed in tariffs, renewable portfolio standards, and auctions), before turning to contractual mechanisms particularly PPAs [5]that translate policy intent into financeable projects. This structure mirrors the thesis's core argument: that policy effectiveness ultimately depends on institutional credibility and contractual standardization.

Accordingly, the first section of this literature review (section 2, 2.1) provides a review of policy problems that continue to affect sub-Saharan Africa. The second section examines the concept of institutional voids and how they affect solar development. Section three addresses feed in tariffs. Section four reviews renewable portfolio standards (RPS). The fifth section discusses auctions and tenders. Section six reviews the literature on power purchase agreements (PPAs). Section seven describes tax policy. Section eight outlines the basic understanding of the concept of bankability. And lastly, section nine analyzes the concept of risk and how it relates to solar development.

2.2 Policy Gaps

The macro policy literature consistently identifies renewable energy as central to climate mitigation, economic development, and energy security. However, in sub-Saharan Africa, solar policy remains fragmented, aspirational, and weakly implemented. While governments frequently adopt ambitious renewable targets, these are often unsupported by coherent regulatory frameworks that address generation, grid connection, and transmission simultaneously (Egute et al., 2017; Papacostantis, 2017; Heffron, 2017).

[5] *See "[Power Purchase Agreement]," §§ 11.6 and 11.9, p. 250 of the Portfolio (pp. 26–29 of the PPA), discussing the allocation of development and commercial risk between the parties.*

This section addresses Research Question 1 by examining macro level energy policy literature to assess how fragmented and incomplete policy design contributes to sub optimal utility scale solar deployment in sub-Saharan Africa. The literature reviewed here establishes the baseline policy challenges that standardized regulatory frameworks are intended to address. It explores the critical role of energy policy in sub-Saharan Africa, highlighting the urgent need for robust solar policies to address climate vulnerability, gaps in current frameworks, and the importance of a holistic approach to power generation, grid connection, and transmission.

Public policy is often put forth as a solution to a pressing issue or in response to political pressure. Energy, being a critical factor for economic growth, public health, and social development, and having a significant impact on the environment, requires a well-crafted energy policy in every country. However, Sub-Saharan Africa, due to its inadequate infrastructure, widespread poverty, and weak healthcare system, is particularly vulnerable to the impacts of climate change (Satterlee 2017 and Papacostantis, 2017).

The aforementioned reasons have contributed to the recent implementation of solar and renewable energy policies in Sub-Saharan Africa. With its abundant renewable resources, Africa stands to greatly benefit from a well-designed and effective solar policy (A. Niyibizi, 2015). Currently, most African solar policies are broad but lack depth (T. Egute 2017). These policies often imitate macro incentives from neighboring countries that set ambitious targets to impress European investors. According to Egute (2017), Cameroon's government has established a goal of achieving an installed capacity of 3000MW by 2020, but has yet to achieve this goal (Bellini, 2019). Government targets often fall short due to inadequate and inefficient policies that do not attract sufficient developer and investor interest.

Literature in the field of macro solar policy (Egute, E. Albrecht & Ateghang, 2017), (Papacostantis 2017), (Heffron, 2017) offers a comprehensive examination of the role of solar energy in combating climate change, alleviating poverty, and promoting economic growth. (Heffron, 2017) suggests that the goal of solar policy is centered around the management of energy resources, the rights and duties involved in energy activities, and their regulation at the local, national, and international levels. Based on my experience, a broad approach to energy policy often yields successful outcomes, but it must be combined with achievable targets.

In Papacostantis (2017) it is stated that mid and long-term development plans for solar energy should involve setting energy -consumption targets as a means of incentivizing power generation, grid connection, and transmission. Meanwhile, Ferroukhi et. al (2015) reports that 164 countries around the world have adopted at least one form of renewable energy target as of mid-2015. These articles reflect a common trend in literature, with some focusing solely on targets and others proposing a more comprehensive approach that encompasses power generation, grid connection, and transmission.

This thesis contends that the policy gaps lie in the former approach. While it is acceptable to write about a single issue, if the goal is to impact energy policy, a more comprehensive approach is necessary. For example, if the aim of an article is to compare renewable energy policy and law in China with the South African framework and develop lessons for South Africa, then a more inclusive and comprehensive approach, offering multifaceted solutions, would result in a more effective policy outcome.

The lack of a comprehensive approach in addressing the crucial issues of power generation, grid connection, and transmission in solar energy policy is a common flaw in the literature. The article by Papacostantis (2017) stands out for its unique perspective on the matter, as it proposes a combination of targets and incentives for not just power generation but also grid connections and transmission.

This integrated approach is crucial to the success of solar energy policy as it acknowledges the interdependence of these three factors. Without a robust grid connection that can accommodate the growth of solar energy, the policy will ultimately fail. Additionally, effective transmission of energy from the grid connection to the users is also crucial to ensure the viability of the policy. A successful solar energy policy must be designed with a balanced approach that considers all three of these crucial aspects, creating a symbiotic relationship between power generation, grid connection, and transmission, much like the legs of a three legged stool.

Most articles which address the subject of renewable energy targets, such as Egute, Albrecht & Ateghang, (2017) Papacostantis (2017), Pueyo (2016), and Pollitt (2017), tend to focus on power targets without considering the crucial aspects of grid connection and transmission from an engineering viewpoint. Although connecting more people to the grid is important from various perspectives, it is imperative to acknowledge that without proper connections, growth in the solar sector will be hindered.

Most policy articles, such as Cox et. al, (2015), Spillias (2020), Sierra Club (2020), EU (2019), and IRENA (2014), address targets effective, but overlook the issues of grid connections and the transmissions. While some articles attempt to tackle the trade-offs associated with quantitative targets by considering implementation, execution, and economic issues, they still ignore the crucial aspect of grid connection and transmission. According to Spillias (2020), establishing a quantitative target such as achieving an 80% energy threshold, rather than setting a quantitative objective that seeks to maximize energy, can result in overlooking potential trade-offs when evaluating different policy measures.

The works of Tolman (2017) and Grimm, et. al., (2016) both approach the issue of grid connection from important economic and sociological perspectives. However, it is crucial to also consider the engineering aspect as it forms the basis for the construction of solar power plants and plays a fundamental role in the growth of solar energy. Despite this, most literature neglects to do so. Tolman (2017) highlights that grid extension is politically popular in various donor organizations and national governments, including those in Africa, as it is rightly seen as a crucial part of the infrastructure development required to achieve the standard of living of industrialized countries.

Grimm (2016) analyzes the efficacy of off grid solutions and their impact on economic growth, using the example of Rwanda where the author has participated in developing the largest grid connected solar project to date. However, policy makers and regulators often overlook the engineering perspective of grid connections and transmission until issues arise, hindering the growth of renewable energy projects. This is supported by Larson (2020).

The importance of strategy is a crucial policy issue discussed in some of the literature (World Bank, 2016). The presence of well defined strategic goals and objectives is integral to any policy proposal. Solar energy has considerable potential in the medium and long-term, thus the strategic policy of governments must prioritize three objectives: Setting clear goals, communicating the government's

vision to the public and international investment community, and informing potential stakeholders of the government's intended course of action (Foster, Witte, Banerjee, 2017).

The key to sustainable solar development is a combination of clear goals and effective implementation. A white paper sponsored by the energy ministry of South Africa and authored by Shabangu (2013) is considered the most important literature in the field of strategic policy. The paper proposes reasonable guidelines for the implementation of both grid and off grid solar programs. It distinguishes itself from other literature by advocating a phrased approach to strategy. Unfortunately, other articles such as those authored by Papacostantis (2017), from a strategic standpoint, disregard the incremental approach. In contrast, the Shabangu (2013) paper acknowledges that the targets can only be achieved through a phased and flexible strategy with early investments that yield quick results.

The author's professional experience indicates that a staged or incremental approach is necessary in sub-Saharan Africa due to the general weakness of institutions and the lack of experience with renewable energy development and implementation. The staged approach allows governments to develop, implement, maintain, and continuously improve their legislative and regulatory systems while concurrently increasing their overall capacity. This approach is consistent with Shabangu (2013), the proposal therein and reflects the need for careful planning and implementation to achieve long-term sustainable solar development.

Taken together, the literature reviewed in this chapter provides a clear answer to Research Question 1: *sub-Saharan Africa would benefit from a standardized regulatory framework for utility-scale solar PV development*, but only if such a framework is designed to accommodate weak institutional capacity and high implementation risk. Studies across feed-in tariffs, renewable portfolio standards, and auction mechanisms consistently show that policy instruments are most effective when embedded within credible, predictable regulatory environments. In markets characterized by institutional voids, fragmented authority, and limited enforcement capacity, comprehensive "one step" regulatory solutions are unlikely to succeed. Instead, the literature points toward the value of incremental, staged regulatory approaches that reduce uncertainty, lower transaction costs, and allow market participants to build confidence over time. This insight directly informs the regulatory logic adopted in this thesis.

This concept of a staged or incremental approach to solar regulation in sub-Saharan Africa has significantly influenced the selection and sequencing of documents in the professional portfolio accompanying this thesis. Rather than relying on a single, comprehensive regulatory intervention, the portfolio reflects a graduated structure from the memorandum of understanding through to the power purchase agreement designed to progressively address institutional voids at each stage of project development. To ensure effectiveness, each stage incorporates standard, bankable documents that are familiar to equity sponsors and lenders and capable of prior approval by relevant authorities. The use of standardized documentation, as represented in the portfolio, is intended to simplify project development, reduce negotiation risk, and attenuate the complexity and high transaction costs that frequently undermine utility-scale solar projects in sub-Saharan Africa.

Shabangu's (2013) article stands out in two significant ways. Firstly, it addresses the crucial issue of economic incentives, highlighting the challenge for the government to provide sufficient encouragement for renewable energy-based industries to grow and sustain themselves in the long term. Secondly, the article sets admirable goals for developing an appropriate legal and regulatory framework to integrate solar energy into the mainstream, support the integration of renewable energy into the energy economy, and attract investment.

While other policy-specific literature exists, including works by Cox (2015), Larson (2020), Gordon (2018) and (Ferroukhi et al., (2015), Shabangu's (2013) article is the only one that directly links the proper designation of legal and regulatory instruments to stimulate the uptake of solar energy power generation into the electricity system. This is key to any country's long-term goal of setting policies that promote sustainable development and investment in the solar energy industry.

This article by Shabangu (2013), which is a comprehensive white paper on policy, is an important contribution to the field. However, one of the major shortcomings of the white paper is the absence of any discussion on corruption and compliance. Given the public's knowledge of corruption in South Africa, as highlighted in the State of Capture report (2016), it would have been more comprehensive if the paper had addressed this issue and provided general policy prescriptions to mitigate its effects.

This can be illustrated by the current financial and operational issues faced by Eskom, South Africa's main utility, including cancelled renewable projects and daily brownouts, can largely be attributed to corruption and poor corporate governance (Joubert, 2016). In the years since 2016, the situation at Eskom has only worsened (Joubert, 2016). The cancellation or postponement of numerous solar projects has resulted in a lag in electricity generation compared to economic growth, with improper and potentially corrupt award of state contracts and benefits cited as the main cause (Joubert, 2016).

The next section explains the policy choice between bundling and unbundling in the electricity sector, defines each model, and summarizes why unbundling is generally associated with better performance before noting the continuing prevalence of bundled structures in sub-Saharan Africa.

One of the most important policy prescriptions relating to the distribution of electricity is the issue of bundling or unbundling of the utility sector. There are three basic functions of the utility sector: generation of electricity, transmission of electricity and the distribution of electricity. When these three functions are controlled by the same entity in a country, state, or region the function is called a bundled structure. When each of these functions are separated and performed by three different companies the utility structure is called unbundled. Most of the industrialized world has unbundled electric utility systems. Unbundled systems are more efficient, more competitive, and statistically provide better services (Fuentes-Bracamontes, 2016). Unfortunately, the majority of Sub-Saharan Africa still has bundled electricity services (Blimpo & Cosgrove-Davies, 2019).

The history of electricity supply in most states has been marked by the dominance of monopolies, frequently owned, or controlled by federal or state authorities (Grassani, 2008). During the 1990s, the European Union led the way in liberalizing its electricity sector, followed by the United States, parts of South America, and several countries in Asia. This move aimed to break up existing monopolistic or oligopolistic structures in favor of free competition across national borders and to provide households and other consumers with greater choice and lower prices (Grassani, 2008). Africa is the last continent to undertake the unbundling or liberalization of its electricity sector (Blimpo & Cosgrove-Davies, 2019).

Before the thesis extols the many virtues of liberalization, it is important to first understand what the problems are with vertical or bundled network ownership. Some of the articles state that when one company owns the generation, transmission and distribution of electricity it often leads to: a higher risk of the network companies engaging in anti-competitive or sub-optimal behavior; it disincentivizes outside investments, notwithstanding regulatory Chinese Walls; it encourages information leakage between the supply and network affiliates; and lastly, it distorts overall incentives of efficiency (Kroes, 2008), (Malmendier & Schendel, 2006), (Pollitt, 2007). The result of the problems is two-fold: higher prices, and sub-standard service for the end user.

Having discussed the broader policy gaps affecting solar development in sub-Saharan Africa, the discussion now turns to another structural issue in electricity markets: the question of bundling and unbundling in the utility sector. The way these functions are organized generation, transmission, and distribution can have a significant impact on regulatory transparency, market access, and enforcement. For the purposes of this thesis, this issue is directly relevant to the research questions because sector structure influences both the effectiveness of a standardized regulatory framework for utility-scale solar PV and the feasibility of using standardized PPAs and related project documents, particularly with respect to counterparty risk and overall project bankability.

This section analyzes the intricacies of bundling and unbundling policies within the utility sector, highlights the lack of focused research on sub-Saharan Africa, reviews key literature such as "The Unbundling of the German Energy Market," and examines the practical reasons for liberalization through successful global examples.

The concept of unbundling is widely recognized as a crucial policy prescription and there is a significant body of related literature available on the subject (Malmendier & Schendel, 2006). However, many of these resources pertain to countries outside of sub-Saharan Africa. The scarcity of research directly focused on Africa highlights a gap in the understanding of how this concept applies to this region. Despite the similarities in structure, methodology, and content across the articles, some studies stand out for their unique perspectives and insights.

One such article, "The Unbundling of German Energy Market" by Malmendier and Schedel (2006), provides valuable insights into the subject. Like other studies, it covers the history of the vertical market and the benefits of liberalization. However, it sets itself apart by presenting a theoretical foundation for unbundling, rooted in the assumption in monopoly theory that energy networks are natural monopolies and thus susceptible to inefficiency and restrictions on competition. The article further explains that monopolies and oligopolies are not ideal institutions for the development and distribution of electricity to the public. This sets the article apart from many others (e.g. Bracamontes, 2016) as it provides a deeper understanding of the reasons behind the concept of unbundling.

Theory aside, what are the practical reasons for liberalization? Most of the articles, Grassani (2008), Malmendier & Schendel (2006), Pollitt (2007), Power Futures South Africa (2019), Ibanga (2018), contend that the liberalization process aims to do three primary things: promote third party access to the electricity network; completely separate the electricity networks from the commercial activities of the vertically integrated firms that own them; and lastly, encourage fair competition by ex-ante regulation (Grassani, 2008). If you look back at the European Union and their unbundling process, it has been a remarkable success that has incentivized an enormous investment in both traditional and renewable energy projects (Malmendier & Schendel, 2006).

It is crucial, therefore, to consider the potential constraints of unbundling within the electricity markets of sub-Saharan Africa, where institutional voids are widespread. In situations where the unbundling process is not properly carried out or is inappropriately staged, there is a risk that network operators might fail to adhere to regulations. This could lead to persistent conflicts of interest and ambiguity regarding the objectives of network companies, ultimately fostering anticompetitive practices that undermine the advantages of liberalization (Lowe, 2007). Furthermore, such circumstances could create scenarios where investment incentives become distorted and act as a deterrent for third-party developers and companies seeking to invest.

Numerous articles and studies have discussed different models of unbundling, including (Grassani, 2008), (Malmendier & Schendel, 2006), (Pepermans & Willems, 2006), (Bernard et al, 2013), and (Wieser, 2012). These sources describe three or four types of bundling and their respective functions. Policy makers need to clearly articulate which liberalization model they want to implement.

One type of unbundling is ownership unbundling, also called full unbundling, where the incumbent company no longer owns part of the network operator and cannot influence the decision process (Pepermans & Willems, 2006). Another type is the independent systems operator approach or legal unbundling, which involves transferring all activities of the network system operator to a separate legal entity (Grassani, 2008). A third type is accounting unbundling, which separates the financial accounts of the network and generation activities (Bernard et al, 2013). Lastly, management unbundling is added to accounting unbundling to require the separation of network business of the energy company network (Grassani, 2008).

The articles and studies in the literature discuss different models or forms of unbundling in the energy sector. Notably, Grassani, (2008), Malmendier, and Schendel (2006), Pepermans and Willems, (2006) Pepermans and Willems, (2006), Bernand et. al., (2013) and Wieser, (2012) examine three or four different types of bundling and describe each of their functions.

Analysis of the existing literature demonstrates the importance of understanding and selecting the appropriate model of unbundling for a given energy market. Each form of unbundling comes with its own set of advantages and disadvantages, and policy makers must carefully consider the implications of each before implementing any unbundling policy.

2.3 Bundling/Unbundling

Understanding these issues is critical to the implementation of solar policy in sub-Saharan Africa due to the relatively new status of such regulations, the fragile state of institutions, and the need for time and expertise for proper implementation. In most cases, a slow and staged implementation of policy is the most sustainable approach. The various forms of unbundling have been well articulated in various studies, but only one study discusses the proper implementation stages. In Bernard et.al., (2013), the four forms of unbundling are split into three stages. Stage one encompasses both accounting management unbundling, requiring separate accounts for network and generation activities as well as operational and management activities to be assumed separately from other network companies. This is due to the ease of structurally separating these duties and the simplicity of managing them from a regulatory standpoint.

Stage two is legal unbundling. In legal unbundling, as was done by the European Union directives, policy makers create legally independent companies. Creation of a legally separated company structure is considered a precondition for the development and implementation of complete ownership unbundling. (Bernard et al, 2013). This concept has worked in many jurisdictions because it usually, on a relative basis, is easily accepted by regulators and legislators (Bernard et al, 2013). The final stage articulated in this article is ownership unbundling which is included in the final European Union directive (Bernard et al, 2013). In ownership unbundling, all vertically integrated network companies are mandated to sell their assets to third parties (Jones, 2006).

In Bernard et al, (2013) the authors differentiate their work from other discussions of unbundling by emphasizing the importance of establishing a supervisory board to oversee not only unbundling process, but also the regulation of post unbundling net networks. According to the authors, these boards serve as a crucial check and control mechanism and are responsible for making important strategic, economic, financial, and technological decisions. Furthermore, the authors delve into the specific use of supervisory boards in the United Kingdom and some European countries, providing a comprehensive examination of the topic.

To connect the discussion of bundling/unbundling to the thesis's central research questions, the next paragraph explains how sector structure conditions (i) the potential benefits of a standardized regulatory framework for utility-scale solar PV in Sub-Saharan Africa (RQ1) and (ii) the potential benefits of standardized PPAs and related project documents (RQ2). At this juncture, the question is how the bundled unbundled distinction can be operationalized within this thesis to answer its core research questions. Given persistent institutional and administrative constraints across many Sub-Saharan African jurisdictions, this thesis argues that unbundling is not merely a structural reform, but a facilitating condition for standardization: it can strengthen transparency, clarify roles and accountability, and improve regulatory implementation thereby supporting the claim that Sub-Saharan Africa may benefit from a standardized regulatory framework for utility-scale solar PV (RQ1).

In parallel, unbundling can reduce counterparty ambiguity and improve risk allocation among sector actors, making it more feasible to deploy standardized PPAs and related project documents that enhance bankability and comparability across projects (RQ2). Accordingly, the thesis includes unbundling as a central policy recommendation, alongside complementary measures needed to make regulatory and contractual standardization workable in practice.

The article by Pepermans and Willems (2006) is notable for its analytical and comprehensive approach to the topic of unbundling. While other articles primarily discuss the various forms of unbundling, their effectiveness in European markets, and their shortcomings, this article goes a step further by constructing a financial model to examine the numerical effects of unbundling.

The author's model captures two types of ownership interactions between the generation and transmission sectors, allowing for a detailed analysis of the dynamics between consumers, generation firms, network operators, and electricity transmission companies.

One distinctive feature of this article is the data collection and calibration methodology, which relies on mathematical programs with equilibrium constraints. This approach enhances the robustness and accuracy of data representation. Moreover, the model is employed to critique the monopoly generation market and analyze the effects of a monopoly network compared to a perfectly competitive environment. In addition, the article constructs a meticulously detailed financial model that dissects the interactions among consumers, generation firms, network operators, and electricity transmission companies. Unlike many other articles, their unique approach to data collection and calibration revolves around mathematical programs with equilibrium constraints, providing a robust foundation for their analysis.

Pepermans and Willems (2006) provides a robust analytical foundation for understanding the economic rationale for electricity-sector unbundling, particularly through its critique of monopoly generation markets. Using mathematical modeling, the authors highlight inefficiencies associated with monopolistic generation and show how unbundling can foster competition and improve market performance, making a valuable contribution to the liberalization literature.

For this thesis, however, the article's relevance is primarily conceptual rather than methodological. This distinction matters for the thesis's research questions: whether sub-Saharan Africa will benefit from a standardized regulatory framework for utility-scale solar PV, and whether sub-Saharan Africa will benefit from standardized power purchase agreements (PPAs) and related project documents. While formal models can illuminate efficiency outcomes under idealized assumptions, this thesis does not adopt such modeling as a primary tool because many sub-Saharan African power systems face constraints in data availability, regulatory capacity, and institutional implementation.

Accordingly, the thesis uses the unbundling literature to motivate unbundling as an enabling condition for standardization supporting clearer roles, improved accountability, and more credible counterparties rather than as a conclusion derived from abstract optimization. This framing aligns unbundling with the practical objective of making standardized regulation and standardized PPAs workable in sub-Saharan Africa and, in turn, improving bankability and investment incentives for utility-scale solar PV.

First, mathematical models, integral to generating meaningful insights, heavily depend on accurate and reliable data. However, in sub-Saharan Africa, accessing comprehensive, current, and precise data poses significant challenges. This limitation can undermine the accuracy and relevance of the models utilized in the region (Kinyondo, 2018). Second, the regulatory landscape in sub-Saharan Africa differs substantially from more established regions like Europe and the United States. The energy sector here grapples with diverse, evolving, and often fragmented policies. This complexity makes it challenging to devise a universally applicable mathematical model that effectively represents the intricate regulatory environment (Obeng-Darko, 2020). Third, the solar market across sub-Saharan Africa exhibits considerable variability due to unique socio-economic and geographical factors in each country. Mathematical models that might perform admirably in well-developed regions can falter in the face of such regional disparities and the resultant uncertainty, which are prevalent in the African context (Obeng-Darko, 2020). Fourth, Fifth, infrastructure hurdles further complicate solar project feasibility and maintenance in sub-Saharan Africa. Challenges such as inadequate transmission and distribution networks introduce complexities that mathematical models may not fully account for (Lakmeeharan et al., 2020).

Sixth, beyond quantitative data, local social and cultural dynamics in Africa play a significant role in influencing the success and adoption of solar policies and projects. These qualitative aspects often elude mathematical models, which primarily focus on quantitative factors (Ravindran, 2016). The dynamic nature of policy development in the region necessitates flexibility and adaptability. Static mathematical models may struggle to keep pace with the rapidly changing policy landscape in sub-Saharan Africa, highlighting the need for models that can adapt to evolving circumstances (Henning et al., 2018).

While mathematical models have their place in energy policy analysis and can offer valuable insights into more mature markets, their immediate efficacy in sub-Saharan Africa might be limited due to the unique challenges and characteristics of the region (Obeng-Darko, 2020). However, it is essential to recognize that as data collection improves, regulatory frameworks evolve, and technology advances, mathematical models might become more relevant and useful tools in shaping sustainable solar policies in sub-Saharan African in the future. Until then, a more holistic approach that considers qualitative factors, stakeholder engagement, and on the ground, realities might be necessary for effective policy making in the region.

Taken together, the above-mentioned articles provide a comprehensive account of the European approach to electricity sector unbundling and offer policy relevant insights for sub-Saharan Africa. Their relevance to this thesis lies in how they inform its central research questions: whether sub-Saharan Africa will benefit from a standardized regulatory framework for utility-scale solar PV, and whether sub-Saharan Africa will benefit from standardized power purchase agreements and related project documents. The European experience illustrates how unbundling can clarify institutional roles, enhance regulatory enforcement, and reduce counterparty risk conditions that are essential for the effective implementation of both standardized regulation and standardized contracting.

At the same time, these studies underscore that unbundling is not a universal solution. As Thomas Sowell observes, “there are no solutions, just trade-offs” (Sowell, 2013), and no single policy reform is without cost or limitation. Nonetheless, by identifying the structural preconditions under which regulatory and contractual standardization has functioned in practice, this body of literature provides policymakers in sub-Saharan Africa with practical guidance for designing reforms that can support investment, bankability, and the scaling of utility scale solar PV.

While the literature provides useful insight into renewable energy targets and broader policy objectives, it pays much less attention to how those policies work in practice particularly how generation policy interacts with grid access, transmission capacity, and the contractual arrangements required to build projects. This omission is important because utility scale solar projects ultimately succeed or fail at the point where policy meets project execution. This gap in the literature helps explain the focus of this thesis on both regulatory design and contractual standardization, and why it is necessary to examine whether sub-Saharan Africa would benefit from a standardized regulatory framework for utility-scale solar PV and a standardized set of project documents.

2.4 Institutional Voids

Another issue that helps explain the challenges of solar development in sub-Saharan Africa is the presence of institutional voids. These gaps in regulatory capacity, enforcement, and market infrastructure have a direct impact on investor risk, transaction costs, and the ability to implement energy policy in practice. Understanding these institutional constraints is therefore important when considering whether sub-Saharan Africa would benefit from a standardized regulatory framework for utility-scale solar PV and standardized PPAs and related project documents.[6]

sub-Saharan Africa countries are replete with institutional voids (Gao et al, 2017). Khanna (2015) coined the term institutional void, which refers to the lack of adequate development of formal institutions that aid business operations. Professor Khanna also refers “to the absence of intermediaries like market research firms and credit card systems to efficiently connect buyers and sellers in international markets” (Khanna, 2010:14). Institutional voids make it difficult to implement and supervise much needed public policy and attract direct investments. Countries that have institutional voids have some, most or all of the following characteristics; high levels of transaction

[6] As evidenced by the materials contained in the Professional Portfolio Appendices, §§ 11.1–11.9, beginning at p. 173.

uncertainty, high transaction costs, limited access to credit, inadequate physical infrastructure, lack of efficient intermediaries, a need for smooth functioning markets, a difficulty for buyers and sellers to access information which allows them to find each other, reliable legal systems, lack of intellectual property rights, and markets where auditors cannot reliably certify a firm's financial operations (Gao et al, 2017), (van Dijk, 2018), (Khanna et al, 2015), (Khanna, 2010), (Chipp et al, 2019).

Institutional voids can broadly be categorized into two types: dyadic voids, which deal with project or contracting voids, and infrastructure institutional voids, which deal with regulatory and capital voids.

According to Khanna (2010), without adequate physical infrastructure, it becomes challenging for participants in product, labor, and capital markets to function effectively. Khanna highlights the blended nature of both types of institutional voids and how they can negatively impact emerging markets. In such markets, investors and companies quickly realize the numerous deficiencies in infrastructure, both physical and institutional, needed for the smooth functioning of markets, making it difficult for buyers and sellers to access information, find each other, and evaluate the quality of products and services. The concept of institutional voids refers to both the lack of physical infrastructure and the lacunae created by the absence of such market intermediaries (Khanna, 2010).

An important study commissioned by the World Bank (Blimpo & Cosgrove, 2019), takes the infrastructure approach but focuses specifically on electricity or lack thereof. This large comprehensive study deals with the lack of access of electricity and how policy affects that lack of access, the high cost of electricity relative to per capita income, the lack of long-term investment in electrification in Africa, the lack of access to electricity regardless of income in sub-Saharan Africa. The article discusses several African countries and their lack of electricity capacity, and an analysis of how inadequate policy affects supply demand for electricity. Largely, it focuses on both short and long-term effects of electricity growth or lack thereof, in Africa. Even though many African countries have not allocated sufficient investment in electricity, it is important to note that the immediate advantages of electrification may not outweigh the associated costs. Nevertheless, in the long term, the electrification of these plays a vital role in fostering economic transformation (Blimpo & Cosgrove, 2019:4). In addition, the institutional void of below par electricity capacity and "delaying electrification has a high opportunity cost because the lack of electricity impedes modern technology adoption and lowers the quality of delivery of services…" (Blimpo & Cosgrove, 2019:5).

Blimpo & Cosgrove-Davies (2019) shows that in Sub-Saharan Africa the central electricity problem is not only access but reliability (frequent outages affecting firms and households), which forces businesses to adopt costly "coping strategies" like diesel generators. That has two direct implications for RQ1:

1. A standardized regulatory framework would be beneficial if it reduces reliability risk and makes investment more financeable.
   The paragraph supports the idea that investors face a systemic reliability/operational risk environment, and regulation that standardizes reliability obligations, performance standards, and accountability could reduce uncertainty and improve bankability for utility scale solar PV.

2. Standardization must address reliability explicitly, not just licensing or tariffs.
   The evidence implies that "regulatory standardization" can't be purely procedural. To benefit sub-Saharan Africa, a standardized framework would need clear, repeatable rules for issues tied to reliability., grid connection and dispatch rules, curtailment protocols, grid-code

compliance, performance and maintenance obligations, metering and outage reporting, and (where relevant) storage/ancillary services and compensation mechanisms.

Gao et. al., (2017) presents a comprehensive view of institutional voids and propose strategies for investors and companies to overcome and survive in countries where policy and business institutions are lacking. Unlike other studies, the authors focus on the concept and effects of reputation and how a good reputation can facilitate long-term survival, even in countries that are replete with institutional voids.

The authors keenly note that "when institutional credibility enhancers and adjudicators are not present, a firm's reputation can provide transactional confidence" (Gao et. al., 2017:12). A good reputation is derived from the firm's past actions or product quality, which can be inferred by the market. Once a good reputation is established, (Gao et. al., 2017) argue that it can increase the quality of transactions, thereby overcoming the specific institutional voids that would otherwise have attenuated or stopped the transactions.

In summary, the Gao et. al., (2017) study provides valuable insights into how companies can navigate institutional voids in challenging business environments. They emphasize the importance of reputation, as it can compensate for the lack of institutional credibility enhancers and adjudicators. By building and maintaining a good reputation, companies can increase the quality of transactions and overcome institutional voids that may otherwise hinder their survival.

For the purposes of this thesis, the discussion of reputation is directly relevant to the research questions of whether sub-Saharan Africa would benefit from a standardized regulatory framework for utility scale solar PV and standardized PPAs and related project documents. In markets where formal institutions are weak or incomplete, credibility and reputation often substitute for those missing institutions and help facilitate project finance transactions in otherwise high uncertainty environments.

The literature on reputation (Gao et al., 2017; Weigelt & Camerer, 1988; Allen, 1984) shows that in emerging markets, firm survival and strategic success often depend less on formal enforcement mechanisms and more on accumulated reputation, which reduces uncertainty and facilitates repeated transactions. This insight supports the argument underlying Research Question 1: a standardized regulatory framework can benefit sub-Saharan Africa not only by formalizing rules, but by creating predictable, repeatable interactions that allow credible developers, utilities, and regulators to build reputational capital over time, even where institutional capacity is weak.

Similarly, the cumulative nature of reputation reinforces Research Question 2, as standardized PPAs and project documents enable learning effects, benchmarking, and reputational spillovers across projects and markets. By lowering information asymmetries and signaling reliability, standardization can reduce transaction costs and increase investor confidence, particularly in smaller or less mature markets. In this sense, reputation theory provides a behavioral and strategic foundation for why regulatory and contractual standardization may be especially valuable in sub-Saharan Africa, where uncertainty and institutional voids are pervasive.

Chipp et al., (2019) emphasizes the importance of addressing institutional voids and highlights the network theory as an effective approach. They illustrate those collaborative networks, where firms voluntarily join forces to tackle voids, can reduce risks, cut costs, and minimize capital investments. In the realm of solar utility projects, this underscores the potential of cooperative efforts among different stakeholders, such as governments, local communities, and international investors, to collectively address challenges arising from gaps in regulations and infrastructure.

Lee (2009) suggests that informal alliances and frequent communication among firms can help overcome challenges associated with institutional voids. Drawing from the author's own experiences, this underscores the practicality of collaboration in the context of solar utility projects in Africa, emphasizing that sharing information and experiences can indeed bridge gaps in regulations and policies.

Furthermore, Chipp et al. (2019), Dikova and Brouthers (2016), Lee (2009), and Lo et al. (2016) collectively inform this thesis's research questions—whether sub-Saharan Africa will benefit from a standardized regulatory framework for utility-scale solar PV and whether Sub-Saharan Africa will benefit from standardized PPAs and related project documents by showing that institutional voids shape both the feasibility and the design requirements of standardization. Specifically, this literature suggests that network-based collaboration (among regulators, utilities, developers, DFIs, and other intermediaries) can partially substitute for weak formal institutions, improving coordination, information flows, and enforcement capacity; in doing so, it explains *how* a standardized regulatory framework could be implemented and supervised in practice (RQ1) and *how* standardized PPAs/project documents could be operationalized and replicated across projects through shared norms, templates, and repeated relationships that reduce transaction costs and perceived risk (RQ2).

This section reviews feed-in tariffs (FITs), one of the most widely used regulatory mechanisms for promoting renewable energy development. FITs are particularly relevant to this thesis because they combine standardized pricing policies with contractual structures that are often replicated across projects. For this reason, they provide a useful lens for considering whether sub-Saharan Africa would benefit from both standardized regulatory frameworks for utility-scale solar PV and standardized PPAs and related project documentation.

Among the various renewable energy policy mechanisms, feed-in tariffs (FITs) are widely considered as the most successful and commonly used. This is supported by the findings of studies by Couture et. al. (2010), Davies et. al. (2013), and Priest (2012), which indicate that over sixty countries and twenty-six regional jurisdictions have implemented some form of FIT laws.

According to a law review article by Motl (2010), a feed-in tariff can be defined as legislatively mandated rates that electric utilities are obligated to pay renewable energy producers. These rates are set over a specific period to compensate for the cost of energy production and ensure a reasonable profit for the independent power producer.

Given the widespread implementation of feed-in tariffs, the subject has been widely analyzed and reported on, resulting in a vast body of literature. Much of this literature has traditionally focused on the most successful feed-in tariff programs, such as those in Germany and Spain (Motl, 2010),

(Fulton, 2012), (Georgopoulos et. al., 2012), (Held, 2010), (Brunn et. al., 2014), and (Davies et. al., 2013).

The existing research can be broadly divided into two streams: one that adopts a macro approach, analyzing the general characteristics, methodologies, advantages, and disadvantages of feed-in tariffs (Courture et. al., 2010), and the other that adopts a micro approach, examining the specifics of one country or a small group of countries (Motl, 2010).

Feed-in tariff laws and regulations have been widely adopted since the early 1990s (Davies et. al., 2013). Several of the studies have explored the evolution of feed-in tariffs, examining how they have matured over time (Brunn et. al., 2014; Motl, 2010; T. Courture et. al., 2010; Manabe, 2016; P. Gipe 2021; and J. Lipp, 2007). These studies are effective in providing readers with a fundamental understanding of feed-in tariffs and their development and offer a historical perspective that can inform future policymaking and academic pursuits.

There is a good industry understanding of which policies work and which policies do not. Some of the literature claims that successful feed-in tariff regulations include three regulatory provisions: one, unencumbered grid access; two, long-term power purchase agreements; and lastly, market-based payment schemes. (Mendonca, 2007), (T. Brunn et al, 2014), (Courture et. al, 2010). In addition, according to Courture et al, (2010), in nations like Germany, there are policies in place that aim to expedite the deployment of renewable energy by minimizing bureaucratic overheads, shortening lead times, reducing project costs, and accelerating the process.

Courture et al, (2010) states that determining the payment structure is a crucial design challenge for the effectiveness of any feed-in tariff policy. They note that a range of approaches are employed globally, as evidenced by their worldwide review of FIT policies. Most of the literature divides the approaches into three macro categories; one, levelized cost of energy generated, two, the value of that generation to the off-taker, three, a fixed prices incentive. Courture et al (2010), Cory (2009) and Odeku (2011) One of the studies distinguishes itself by adding that pricing results of an auction or tender “can help inform price discovery by appealing to the market directly. An auction-based mechanism can be applied and differentiated based on different technologies, project sizes…” (Courture et al, 2010:56). Each of the above articles contends that these methodologies are considered very important ways of establishing long-term sustainable feed in tariff structures. It is important to note here that each of these methods are different and separate ways of establishing a cost based system.

Policy choices in developing nations are frequently grounded in multiple assumptions, many of which hold validity. For instance, when developing a solar project in Germany, developers and policymakers can assume that roads will be able to support large trucks, the high voltage grid will be functional, and the ports will be able to accommodate large container ships. In contrast, in sub-Saharan Africa, few of these assumptions can be made with certainty, and the downsides and trade-offs must be considered. It is therefore necessary to consider both the positive and negative aspects of a FIT policy and how it might relate to sub-Saharan Africa.

2.4.1 Feed-in Tariffs: Advantages

This section discusses the benefits of performance-based feed-in tariff policies, where compensation aligns with actual electricity output, offering a clear and accountable model.

Firstly, feed-in tariff policies operate as performance-based systems. This means that the off- taker pays for the actual generation of electricity produced (Motl, 2010). Secondly, implementing feed-tariff policies has been shown to result in lower than average per-kWh cost for government or the off-taker (Georgopoulos, 2012; Menateau et. al., 2003, and Fell, 2009)).

Moreover, the body of evidence from European markets demonstrates that feed-in tariff policies have fostered more rapid solar development than other policy mechanisms (Grinlinton, 2010). This is significant because it provides a more secure and stable market for investors (Fouquet & Johansson 2008), (IEA 2008), (Lesser & Su, 2008), (Ragwitz et. al., 2007) and (Courture et. al. 2010).

Additionally, feed-in tariff policies provide grid access and interconnection in a more logical fashion (Mendoca, 2007) (Courture et. al., 2010). This increases market access for investors (Grace et. al., 2008), (Courture et. al., 2010).

Furthermore, evidence from European regulations has shown that feed-in tariff policies have had a positive impact on renewable energy generation and capacity (Courture et. al., 2010), (IEA 2008), (REN21 2009), (Germany BMU, 2008). Finally, feed-tariff policies have high levels of overall cost efficiency and effectiveness (Raqwitz et. al., 2009), (IEA 2008), (Courture et. al., 2010).

In summary, the main arguments in favor of feed-in tariff policies relate directly to the research questions of this thesis. FIT programs typically work by standardizing key investment conditions such as pricing, grid access, and eligibility rules. These features can reduce regulatory uncertainty and support the development of utility-scale solar projects. At the same time, the implementation of FIT policies usually depends on standardized offtake arrangements, most often through long term PPAs which provide predictable revenue streams, improve bankability, and reduce transaction costs for investors.

2.4.2 Feed-In Tariffs: Disadvantages

This section critically examines the challenges of longstanding renewable energy feed-in tariff policies, emphasizing the necessity of understanding their costs and tradeoffs for a thorough analysis. Although feed-in tariffs have been around since 1990, industry and literature have highlighted several arguments against them.

Firstly, implementing feed-in tariffs has been shown to increase the short-term cost of electricity (Grinlinton 2010), (Mendonca, 2007), (Lesser & Su, 2008), (Georgopoulos, 2012), (Motl, 2010), (Klein, 2008).

Secondly, although feed-in tariffs are designed to offer stable revenues, they do not address the high up-front cost of technology (Courture et. al., 2010), (Leser & Su,2008), and (Menateau et. al., 2003). Moreover, feed-in tariffs are usually designed in a take-or-pay scheme, meaning that the consumer pays for the energy whether they use it or not. Therefore, they are not market-oriented (Lesser & Su, 2008).

Additionally, feed-in tariffs are not done via tenders or auctions, which means they do not directly encourage price competition between developers or independent power producers (Courture et. al., 2010), (Fouquet & Johannson, 2008), (Butler & Neuhoff, 2008). Given the complexity and need for continuous updates, it is challenging to incorporate feed-in tariffs within existing policy frameworks and regulatory environments (Courture et. al., 2010), (Menateau et. al., 2003). Finally, given their history, feed-in tariffs require continuous administrative commitments (Courture et. al. 2010) (Menateau et. al., 2003).

In summary, the arguments against feed-in tariffs include an increase in short-term cost, not addressing high up-front cost, not being market-oriented, lack of direct price competition, challenges in incorporating them within existing policy framework, and requiring continuous administrative commitments.

One policy tool our company has used in Sub-Saharan Africa is tariff regression, typically embedded directly in the Power Purchase Agreement (PPA) for projects operating under a feed-in tariff (FIT). Under this approach, the FIT rate is tied to the project's commissioning year: new projects receive a lower tariff each year, while once a plant is commissioned, its per-kWh tariff remains fixed for the guaranteed support period (Couture et al., 2010; Klein et al., 2008). In PPA terms, the tariff regression clause reduces the risk of overcompensating the IPP, encourages cost and technology improvements, and helps policymakers defend the contracted tariff if nearby markets secure lower prices later thereby lowering political risk that can otherwise delay approvals and slow project development.[7]

The system's inherent assumption that future prices will always decline limits its flexibility, especially when facing varying technology prices due to structural changes, such as increased steel or silicon cost. Additionally, determining future feed-in-tariff rates and the basis for reductions can lead to negotiation challenges, as both parties often hold different assumptions about future price declines, which may not always be grounded in comprehensive analysis. According to Klein et al. (2008:14), this makes it "difficult to set an appropriate degression rate, due to the difficulties in predicting technological learning, which is, for example, related to the cumulative amount of installed capacity."

A fixed-price FIT sets an agreed payment per kWh for a defined duration (Couture et al., 2010) and is widely used, especially in newer renewable-energy programs (Klein et al., 2008). This directly links to the thesis research questions: whether Sub-Saharan Africa will benefit from a standardized regulatory framework for utility-scale solar PV (RQ1) and whether Sub-Saharan Africa will benefit from standardized PPAs and related project documents (RQ2). Fixed-price designs support RQ1 by creating a clear, transparent regulatory price signal, and they support RQ2 because the policy is typically implemented through a fixed-price PPA, which improves bankability by making cash flows predictable, easing financial modeling, and helping lenders and investors assess coverage ratios and returns.

There are, however, disadvantages of the fixed price design policy (Couture et. al., 2010).

The literature identifies several structural weaknesses in **fixed-price feed-in tariff (FIT)** schemes. Because prices are administratively set, fixed-price FITs risk incentivizing development in sub-optimal

[7] See § 11.9 of the Power Purchase Agreement Portfolio, which contains the principal feed-in tariff provisions.

locations and can lead to overcompensation when technology or component costs decline over time. This undermines cost efficient deployment and violates principles of comparative advantage and least-cost generation (Heinicke & Kahlenborn, 2013). In addition, fixed prices disconnect renewable generation from market demand signals, encouraging smaller, dispersed projects that may increase grid connection and transmission costs relative to utility-scale alternatives (Couture et al., 2010). More broadly, fixed-price FITs can distort wholesale electricity prices by imposing inflexible benchmarks that crowd out competitive price formation (Ngo et al., 2015). These limitations highlight the trade-off between investor certainty and market efficiency inherent in fixed-price policy design.

In contrast, premium feed-in tariffs compensate generators at the market price plus an additional premium. While widely discussed in the literature, most studies treat premium FITs as a single category without distinguishing between their structural variants. Two studies, Cory et al. (2009) and Couture et al. (2010) are notable exceptions and are therefore emphasized in this thesis. These authors differentiate between fixed (non-variable) premiums and variable premiums that fluctuate with spot-market prices. This distinction is analytically important because it directly affects risk allocation, revenue stability, and investor behavior. Variable premium models are frequently described as hybrid instruments, offering partial price certainty through a floor while retaining exposure to market volatility.

The literature identifies clear tradeoffs in premium based schemes. On the positive side, premium FITs are more market-oriented, better integrate renewables into liberalized electricity markets, reduce grid stress by encouraging dispatch responsiveness, and promote competition among developers (Couture et al., 2010). However, these benefits are offset by higher revenue volatility, reduced hedging capacity, and increased risk for investors particularly given the intermittent nature of renewable generation and its limited ability to respond to short term price signals. As a result, premium-based policies may raise the weighted average cost of capital for projects despite improving market alignment.

Taken together, the literature demonstrates that neither fixed price nor premium FITs provide a complete solution in isolation. The core policy challenge lies in balancing investor certainty with market efficiency, a tension that becomes more acute in electricity markets characterized by weak institutions and limited regulatory credibility. This insight directly informs the thesis's later analysis of bankability, institutional voids, and the role of standardized contractual frameworks, particularly power purchase agreements, as mechanisms for stabilizing investment conditions in Sub-Saharan Africa.

The importance of the feed-in tariff contract duration cannot be overstated. Its length can mean the difference between a successful project and an abandoned project. To a point, the longer the duration the more bankable the project will be. Globally, contract durations range between 10 to 25 years for renewable energy projects, which provides investors with a long term stable financial incentive (Brown, 2020). Both equity sponsors and debt providers prefer longer durations because it allows them the ability to get a long-term stable return and best supports the debt coverage ratio. One of the first things the author does during a contract negotiation is to determine the length of the contract. The worse the other terms in the power purchase agreement are, the longer the developer demands of the feed-in tariff duration.

Following the analysis above, it becomes clear that the value of feed-in tariff policy lies not only in the tariff itself, but also in the contractual structure used to implement it. This connection is important for both research questions. It shows how lessons from policy tools such as feed-in tariffs can be translated into standardized contractual provisions that improve bankability and lower transaction costs. In practical terms, the PPA included in the portfolio serves as the link between policy design and project implementation, demonstrating how standardized project documents can help address the institutional uncertainty that often characterizes electricity markets in Sub-Saharan Africa.

This connection is important for both research questions. It shows how lessons from policy tools such as feed-in tariffs can be translated into standardized contractual provisions that improve bankability and lower transaction costs. In practical terms, the PPA included in the portfolio serves as the link between policy design and project implementation, demonstrating how standardized project documents can help address the institutional uncertainty that often characterizes electricity markets in sub-Saharan Africa.[8]

When the other terms in the power purchase agreement are perceived as unfavorable or less beneficial to the developer, as evidenced from my portfolio, the developer may seek to compensate for the potential risks or challenges by demanding a longer duration for the feed-in tariff. In my portfolio example, the agreed term is twenty years. This strategy allows the developer to lock in a guaranteed revenue stream for an extended period, providing greater financial stability and potentially justifying the investment in the project despite less favorable terms elsewhere in the agreement.

By securing a longer feed-in tariff duration, the developer can mitigate the impact of the market fluctuations, technological advancements, or other uncertainties that could affect the project's economic viability over time. Consequently, the negotiation of feed-in tariff duration becomes a strategic tool for balancing risk and return in utility-size solar contracts, ensuring the overall financial sustainability of the project for all parties involved.

Moreover, the duration of the feed-in tariffs, when implemented appropriately, serves as a risk-mitigating factor. According to Courture et al., (2010), the length of the contract is generally deemed crucial in minimizing financial risks, as longer contract terms typically result in a lower cost of capital and a higher level of investment security. A longer duration reduces risk to investors and developers as from a financial modeling perspective, duration is central to ensuring reliable cost recovery; renewable energy usually requires high up-front cost which generally requires longer amortization periods; and "longer contract terms for fixed-price FIT policies can provide a hedge against volatility in future energy and electricity prices" (Courture et al., 2010:54).

The discussion about the contract length and the efficacy of longer contract duration, to me, begs the question of what, if any, advantages are there in shorter contracts. What are the positives to shorter feed-in tariff duration? Courture et. al., (2010) is the only article that even tangentially discusses the issue. The article contends that shorter contracts can mitigate the possibility of

[8] See "[Power Purchase Agreement]," §[section 6], pp. [19 of the PPA], where the allocation of development and commercial risk between the parties is addressed.

excessive compensation. The reason behind this is that the longer the duration the higher the risk of overcompensating the investor. This is especially true if the power purchase agreement has inflation adjustments clauses that raise the feed-in tariff accordingly.

In conclusion, the literature regarding feed-in tariffs presents two predominant themes: efficiency and comprehensiveness. Taken as a whole, the studies provide a comprehensive understanding of successful feed in tariffs, including their description, policy range, methodology, and incentives. Of all the sources examined, Couture et. al., (2010) stands out as the most informative, comprehensive, and unique. It covers all major aspects of feed-in tariffs and although not specifically aimed at the sub-Saharan African market, its comprehensive nature will serve as the foundation for policy recommendations in my thesis.

Taken together, the feed-in tariff literature provides an important foundation for the recommendations developed in this thesis. The studies show that clear and predictable regulatory incentives can help stimulate renewable energy development when they are supported by coherent policy frameworks. At the same time, the literature highlights the importance of long-term contractual certainty and predictable revenue streams, which in practice are implemented through bankable power purchase agreements. In this sense, the effectiveness of solar policy in Sub-Saharan Africa ultimately depends not only on policy targets, but on whether those policies translate into projects that can be financed and built.

The following sections build on this discussion by examining additional policy tools, including renewable portfolio standards, auctions, and power purchase agreements. The goal is to evaluate how these mechanisms contribute to the broader case for more consistent regulatory frameworks and standardized project documentation. As the discussion progresses, the analysis moves from macro-level policy design to the contractual structures that ultimately determine whether solar projects in sub-Saharan Africa are bankable and capable of attracting investment.

Renewable Portfolio Standards are examined in this thesis because they provide one of the most mature and empirically tested examples of a standardized, legally enforceable renewable-energy policy framework. As this research investigates whether sub-Saharan Africa would benefit from standardized regulatory frameworks and bankable contractual structures (RQ1 and RQ2), the RPS model offers a critical comparative benchmark. In jurisdictions such as the United States, RPS policies translate government renewable energy targets into binding legal obligations for utilities, thereby creating predictable demand for renewable electricity and reducing market uncertainty.

This predictability directly affects investor confidence, project bankability, and the ability to finance utility scale solar projects. By analyzing how RPS policies structure compliance mechanisms, allocate risk, and create long term demand signals, this section provides insights into how standardized policy instruments can bridge the gap between policy ambition and project implementation, one of the central problems identified in sub-Saharan Africa. The RPS framework therefore serves as a comparative policy to evaluate which elements of standardized regulation could be adapted to

reduce institutional risk, lower transaction costs, and improve the bankability of solar projects in emerging electricity markets.

Renewable Portfolio Standards (RPS) are widely recognized policy instruments, with the most prominent presence in the United States (Rabe, 2007). According to Shrimali et. al. (2012) RPS are the most widely used state level policies for promoting the deployment of renewable energy technologies for electricity generation. The primary objective of these policies is to increase the use of various renewable energy sources for electricity production (EIA, 2021).

The literature provides a consistent definition of RPS. RPS are legislative or regulatory mandates that require electricity suppliers, also known as load-serving entities, to use or increase the production of electricity from renewable energy sources within a specific jurisdiction (Shrimali et. al., 2012; Rabe 2007; Greenstone and Nath 2019; Sovacool and Cooper 2007; Davies, 1997).

Both Davies (1997) and Shrimali et. al (2012) analyzes the effectiveness of the four key components of Renewable Portfolio Standard (RPS) policies. These components include setting percentages of renewable energy to be produced, the timeline for achieving these goals, defining what qualifies as renewable energy, and implementing a compliance mechanism. Proponents of RPS, including Loomis and Ohler (2010), Sovacool and Cooper, (2007), Mullooly and Britt (2015), argue that RPS policies have five main benefits. These benefits include increased economic growth, diversification of energy supply, utilization of local resources, increased renewable electricity production capacity, and greater policy flexibility compared to other top down regulatory approaches.

Despite the stated advantages, several studies have concluded that renewable energy standards have yielded less than satisfactory outcomes (Tan and Fine, 2012). There have been several studies conducted to evaluate the effectiveness of RES policies in several states and localities in the United States (Shrimali et. al., 2012). However, the results of these studies have been mixed. Some studies have shown relatively positive results, such as those conducted by (Menz and Vachon, 2006) and (Yin and Powers, 2010), while others have shown neutral to negative results, such as those conducted by (Carley, 2009) and (Shrimali and Kneifel, 2011).

As someone who has been involved in the development of a project in the southeastern part of the United States, I believe that these differences may be attributed to other variable inputs that have more to do with state-level discrepancies in the application of the policies than the policies themselves. However, (Shrimali et. al., 2012) assert that they have reconciled the differences in the literature by "examining differences in datasets, analytical techniques, and the time period over which the impact of policies…the differences in results are due to usage of different datasets and not due to different methodologies."

Furthermore, Shrimali et. al., (2012) reconciled the differences by explaining that the discrepancies in the results could be attributed to the different quantitative methodologies used by the various studies. They cited different methods of dataset collection, which they referred to as the "state-level" dataset and the "generator-level" dataset. According to them, "the former is the correct dataset…and the latter used to a change in classification methodology in the middle of the time series." (Shrimali et. al., 2012:7). In summary, the literature on the effectiveness of RES policies has yielded mixed results and more research needs to be conducted to fully evaluate the effectiveness of RES policies in promoting renewable energy adoption.

The literature on Renewable Portfolio Standards (RPS) is dominated by quantitative, model based analysis, largely because most RPS policies originate in the United States, where regulatory frameworks are clear, long standing, and supported by more than two decades of high-quality data from well-developed electricity markets. As a result, scholars have relied heavily on regression-based approaches to assess how RPS policies influence macro-level outcomes such as renewable energy deployment, employment, carbon emissions, and electricity prices.

Across this body of work, findings are mixed. Some studies identify positive effects on renewable capacity growth or emissions reduction, while others report neutral or even negative outcomes, depending on model specification, time horizon, and dependent variable. Although these studies share similar objectives, they differ substantially in methodological detail, ranging from simple ordinary least squares models to more complex approaches that incorporate time trends, geographic variation, and censored data. These differences make cross-study comparison difficult and limit the ability to draw uniform policy conclusions.

Only a small subset of the literature examines micro-level or institutional mechanisms through which RPS policies operate. Delmas and Montes-Sancho (2011) is a notable exception, employing a two-stage regression model to link RPS policy design to firm-level renewable capacity outcomes. Most other studies treat firms, utilities, and regional resource endowments as homogeneous, overlooking how institutional context, company characteristics, and natural resource availability shape policy effectiveness. This represents a significant gap in existing literature.

The RPS literature also focuses overwhelmingly on state or regional policies, with very limited attention paid to national level standards. The few studies that do examine national RPS frameworks, most notably Michaels (2008) and Rossi (2010) are strongly critical, arguing that national standards are inefficient, costly, and poorly aligned with existing environmental regulations. These critiques further underscore the importance of institutional context in determining policy outcomes.

Overall, the RPS literature demonstrates strong empirical rigor at the macro level but limited explanatory power regarding how and why policies succeed or fail across different institutional environments. This limitation is particularly relevant for sub-Saharan Africa, where electricity markets are characterized by institutional voids, weaker regulatory credibility, and limited data availability. Consequently, while RPS studies offer useful quantitative insights, their applicability to African renewable energy policy is constrained reinforcing the thesis's focus on institutional design, contractual frameworks, and bankability rather than direct policy transplantation.

Mixed results notwithstanding, a cogent case can be made for state or local RPS regulations and targets. A small, targeted area that also takes into consideration the level of radiation, the management of the utility and other controlled inputs can have positive outcomes. However, the use of a national Renewable Portfolio Standard (RPS) policy should not ignore the potential negative distributional and economic impacts, as suggested by Rossi (2010). Moreover, Rossi (2010) argues that there are more effective and equitable means of promoting renewables, such as a permanent national subsidy in the form of grants, production tax credits, or loan guarantees. The vast geographical size of some regions poses challenges for national policies to consider the unequal distribution of weather conditions, according to (Rossi, 2010). Lastly, the article notes that national RPS policies may not be able to adequately anticipate and consider the varying cost structures in different regions of the country.

Recent empirical studies of U.S. Renewable Portfolio Standards (RPS) continue to report mixed outcomes. A Climate Policy Initiative study (Pierpont, 2013) found that while many states achieved renewable capacity growth, overall costs frequently exceeded expectations, prompting politically unpopular but largely unsuccessful attempts to weaken or repeal RPS legislation. The study also highlights regulatory ambiguity, noting that poorly defined consumer-protection provisions and unclear compliance rules increase uncertainty for market participants. A comprehensive Berkeley Energy Lab analysis (Barbose, 2017) similarly found wide variation across state RPS frameworks: although most states met interim targets, compliance costs rose over time despite declining median RPS prices. Finally, Greenstone and Nath (2019), using twelve years of data from 29 states, conclude that RPS policies tend to overstate their impact on renewable generation, increase electricity prices when full system costs are considered, but nonetheless contribute to net carbon reductions. Taken together, this literature suggests that while RPS policies can produce environmental benefits, their economic efficiency and investment effects depend on institutional design and regulatory context.

Literature on RPS regulations is valuable as it offers a data-centric contrast to feed-in tariffs. In formulating policy prescriptions, this contract will be of critical importance as most studies evaluating the efficacy of RPS policies have overlooked certain design characteristics and relevant comparisons. By utilizing the findings from this and other studies, it is possible to propose the most effective policy prescriptions for sub-Saharan Africa.

Taken together, the literature on Renewable Portfolio Standards further reinforces the central questions of this thesis. In relation to RQ1, the evidence suggests that policy instruments such as RPS are most effective when embedded within stable and predictable regulatory frameworks capable of monitoring compliance and enforcing long-term obligations. In weak institutional environments, fragmented implementation and regulatory uncertainty can undermine their effectiveness. In relation to RQ2, the literature highlights that the success of RPS mechanisms ultimately depends on the availability of bankable contractual arrangements that translate policy obligations into revenue certainty for developers and lenders. This reinforces the emerging conclusion that policy design and contractual standardization must be considered together. The next section therefore turns to competitive procurement mechanisms auctions and tenders to examine how governments attempt to operationalize renewable policy in practice and how these approaches inform the case for standardized regulatory and contractual frameworks in sub-Saharan Africa.

2.5 Auctions/Tenders

This section examines the use of auctions and tenders in the energy sector of sub-Saharan Africa, particularly in environments where corruption and weak institutions can affect procurement outcomes. The literature reviewed evaluates their effectiveness, transparency, and the institutional capacity required to implement them successfully. This discussion is directly relevant to the research questions of this thesis, as the design and credibility of procurement mechanisms influence both the

effectiveness of regulatory frameworks for utility scale solar PV (RQ1) and the feasibility of implementing standardized PPAs and related project documents that improve project bankability and reduce transaction costs (RQ2).

Due to the prevalence of corruption in sub-Saharan Africa, many governments, and multi-national institutions that support them, are turning to policies, and regulations that introduce tenders and auctions as a means of alleviating the issue. However, this approach may be misguided, as the implementation of tenders alone does not guarantee a corruption free purchasing system (Idowu and Jayawardena, 2018). While tenders and auctions can be effective, their success hinges on the presence of strong internal institutions and a diverse range of competent, and honest, actors (Rieiro and Weischer, 2017). They are not a panacea for eliminating corruption (Ragwitz et. al., 2014).

The development of a successful tender or auction system requires experienced policy makers and managers. Contrary to popular belief, these systems can be easily manipulated and corrupted by those in charge of supervising them. Despite these challenges, governments, development financial institutions, and multilateral organizations are actively promoting the adoption of tenders and auctions in Africa. For the purposes of this discussion, the terms “auctions” and “tenders” are used interchangeably.

Much of the literature about renewable energy auctions, for approximately the last ten years, on a macro level, tends to center on, borrow from or has been crowded out by a series of studies by the International Renewable Energy Agency (IREANA). (IRENA, 2011), (IRENA 2013), (IRENA 2015), (IRENA 2018), (IRENA 2019). The International Renewable Energy Agency is a multilateral organization whose task is to support the international community in their transition from the use fossil fuels to a sustainable energy future (IRENA, 2019). The International Renewable Energy Agency (IRENA) is a leading provider of research in the renewable energy sector, particularly in relation to tenders. This is due to the quality, breadth, and marketing of its research.

IRENA has published five major studies that are highly comprehensive, employ a consistent methodology, and have a high degree of content homogeneity. There are two notable exceptions to this trend, the first being a case study on tenders in South Africa, Uganda, and Zambia (IRENA, 2018), and the second being a study on auctions in developing countries, including Brazil, China, Morocco, Peru, and South Africa (IRENA, 2013). These two studies represent a departure from the general focus of IRENA’s research and offer unique insights into the topic.

The five major studies conducted by IRENA follow a consistent format and address the advantages and disadvantages of various auctions in the renewable energy sector (IRENA, 2019). The studies highlight four key strengths of auctions, including flexibility, the potential for real price discovery, increased certainty in price and quantity, and the assurance of commitments and transparency. The studies also examine two major drawbacks of auctions, namely high transaction costs and the risk of underbuilding.

IRENA, (2015) highlights that overly aggressive bidding, which can result from factors such as overly optimistic assessments of technology cost and underestimation of financial consequences from project delays, is a common issue in auctions. Overall, these studies provide valuable insights into the efficacy of auctions in the renewable energy sector and inform policy making in this area.

The corrupt practice of submitting an overly aggressive bid in an auction is a common issue in the tender process. This practice occurs when developers participate in an auction with the intention of

winning by submitting a bid that is not currently financeable due to an insufficient debt coverage ratio (Shetty, 2023). Once the stakeholders are committed to the project, the developer will inform them that the project cannot be carried out at the agreed price per kwh and will require an increase.

In many cases, the government will continue to work with the developer and sponsor due to a reluctance to start over, and the potential political risk involved in abandoning the project. This corrupt practice is widely observed in both industrial and emerging markets, as noted by Amazo-Blanco et. al (2018). It highlights the importance of ensuring the integrity and transparency of the tender process to avoid such unethical practices.

Another important common aspect of all five studies is the discussion and analysis of the various categories of auction design elements. In many successful auction structures, there are usually four design elements: auction demand, qualification requirements, winner selection processes, and sellers' liabilities.

The concept of auction demand is central to the auction process in the renewable energy industry, as it refers to the designated amount to be auctioned and, if necessary, the allocation between different renewable energy technologies. This is crucial in determining the participation of developers and sponsors, as the structure of the auction demand will impact who is eligible to participate. The qualification requirements for participation often include off taker demands, such as equipment, site selection, and grid access, as well as socio-economic development and corporate social responsibility projects (IRENA 2019), (IRENA 2015), and (IRENA, 2018).

This selection process is a critical component of the auction procedure, as it involves the application of bidding and clearing rules and the awarding of contracts to the winning bidders. In addition to the bidding process, the awarding of marginal bids is another important aspect (IRENA, 2011).

A seller's liabilities refer to the specific responsibilities and obligations of the developer and sponsor, as stipulated in the power purchase agreement and implementation agreement. This can include penalties for underperformance, construction delays, and underbuilding, among others. The use of a ceiling price mechanism is also an important aspect in the auction process, as it is used to prevent excessive prices resulting from collusion among developers. Setting the ceiling price appropriately is crucial, as a low ceiling may limit competition, while disclosing the ceiling to developers prior to the auction can pose its own challenges (IRENA, 2011).

It is important to note that the possibility of corruption in auctions is a concern, as developers may collude on price when submitting their bids. Properly constructed auctions include a ceiling mechanism to prevent excessive prices and prevent such corruption (IRENA, 2018). However, the process of setting the ceiling price is complex and challenging, as the auctioneer or off taker must determine the appropriate balance between preventing corruption and promoting competition.

Besides the IRENA studies, there are four additional studies that are considered to embody the core ideals of the literature on auctions. These include (Cozzi, 2012), (Meyer et. al. 2015), (Ragwitz et. al. 2014) and (del Rio 2017). While these studies often align with the findings of the IRENA studies, it is important to highlight their unique perspectives and contributions to the field. Instead of reiterating the common themes discussed in the IRENA studies, this paper will focus on the distinct features of these additional studies. del Río (2017) analyzes Spain's first renewable energy auctions, focusing on why specific design choices were made and how they shaped results. The study's key contribution is its comparison of three ways to define auction volume by installed capacity (MW), expected

generation (MWh), or a fixed budget and its conclusion that clearly specifying auction volume improves price outcomes.

The second article is Ragwitz et. al. (2014) which is a study of auctions in Europe commissioned by the Agora Energiewende, a German based energy think tank that focuses much of its research on renewable energy. One of the four major takeaways from their study is that a country or jurisdiction would benefit greatly by instituting a pilot tender program. According to Ragwitz et al (2014) it is recommended to conduct testing of various design options before implementing tendering schemes. These tests should cover aspects such as prequalification criteria, auction methods, payment options, and lot sizes.

Their conclusion proposes that the learning and experience gained from that experience is of the utmost importance in developing a successful auction system. Conceptually, this leads me to suggest that most sub-Saharan African countries developing a solar program should start with a pilot program at every stage. This will help their institutions gain the experience needed to develop and tailor their solar regulations.

This insight directly relates to the research questions guiding this thesis. In relation to RQ1, the emphasis on pilot programs and institutional learning supports the argument that sub-Saharan Africa would benefit from a standardized regulatory framework that is staged and incremental, allowing governments to build capacity while reducing policy and implementation risk. At the same time, the need for repeatable pilot programs highlights the importance of standardized documentation and procurement structures, which speak directly to RQ2. If governments can rely on pre-approved, bankable contractual templates, the learning gained from early auction rounds can be transferred efficiently across projects and jurisdictions. This also informs the thesis's implicit question: that standardization may be particularly important for smaller or frontier markets, where limited institutional capacity makes it difficult to develop bespoke regulatory and contractual frameworks for each project.

Meyer et al (2015) highlights three key reasons for Uganda's decision to enlist outside consultants to set up and manage their initial auction system. Firstly, Uganda lacked experience with competitive bidding. Secondly, they aimed to ensure that the selected projects met international industry standards in terms of technical compliance. Lastly, the article points out that the Investment Committee's selection decisions could not be overruled by governmental authorities or Multi-stakeholders (R. Meyer et al., 2015)

It is worth nothing that using outside consultants for various aspects of renewable energy development is a well established practice in sub-Saharan African countries and relatively common. However, the article raises questions about the overall success of this approach. This issue will be further explored in the body of my thesis.

In Cozzi, (2012), a comparison is made of the experiences of British, Chinese, and Brazilian with a subset of auctions known as reverse auctions. The general design elements in this study are similar to those outlined in other articles and studies, particularly the IRENA studies. Renewable energy development relies on three main pillars: finance, engineering, and project development. Most research is focused on these three areas or a subset thereof. However, in my professional experience, the most challenging aspect of solar development is not limited to the three areas mentioned above but also involves understanding and interacting with the political climate of the country during development. These interactions would be easier, more efficient, and ultimately have

a higher success rate if there were a framework for standard legal and financial documentation, thus the reason for my thesis.

Of the existing literature on renewable energy auctions, Cozzi (2012) stands out as the only study to systematically examine the political climate and its implications for auction design. This is conceptually valuable for the development of my thesis. Recognizing the role of politics in energy development in Africa is crucially important and understanding it is critical to the success of project development.

At the time of this writing, the author is leading a 400MW auction bid, for our development company, in a southern African country. The basic process and documents look familiar to the process and documents suggested by all the IRENA studies (IREANA), (IRENA, 2011), (IRENA, 2013), (IRENA,2015), (IRENA,2018), (IRENA 2019), and several other tender related literatures (Cozzi, 2012), (Meyer et. al. 2015), (Ragwitz et. al. 2014) and (del Rio, 2017). Much of the auction's processes in Sub-Saharan African countries have thus far taken their framework policies from the several articles mentioned above. The level of sophistication of the literature in the field varies greatly. The IRENA studies are helpful in setting a basic framework for my policy suggestions, but they tend to be overly positive. One of the major reasons for this, I believe, is because they are government sponsored and it would be difficult for them to be critical of member nations. Accordingly, it is necessary to apply the analysis and conclusions but tailor them to what I believe would be best practice.

The use of auctions as a policy prescription is often viewed by policy makers and researchers as more empirical and less susceptible to corruption compared to other policy tools. While the literature mentioned in this section reflects these views, there are certain downsides to this perspective. This thesis contends that the literature on auctions tends to overemphasize the reliability of empirical evidence, particularly in industrialized countries where institutions are more robust. However, in emerging markets and sub-Saharan Africa, political, institutional, and cultural factors can play a significant role in the success of auction-based policies, and their application requires a fair amount of skepticism and nuance. Although auctions can attenuate corruption in theory, it is not a fool proof solution, and corrupt governments often exploit it as a cover for their corrupt activities (Sinha and Balachandra, 2017). Therefore, policymakers must remain vigilant and ensure that appropriate safeguards and oversight mechanisms are in place to prevent misuse of auctions. In conclusion, while auctions can be an effective policy tool, their success is contingent on a range of factors beyond just empirical evidence, and policymakers must be mindful of these factors when implementing auction-based policies (da Silva and de Paiva, 2017).

In the practical realm, the suggestions from IRENA (2017) and other studies cited above (Cozzi, 2012; Meyer et al., 2015; Ragwitz et al., 2014; del Río, 2017) align directly with the professional portfolio accompanying this thesis, particularly their emphasis on repeatable procurement, institutional learning through staged rounds, and standardized, bankable documentation to reduce transaction costs and increase investor confidence. This alignment is reflected in the portfolio's sequencing of documents across the project life cycle from early stage instruments (e.g., MOU and Land Options Agreement), through enabling government and risk-mitigation instruments (e.g., Concession Agreement, Implementation Agreement, and Government Guarantee), to the core revenue and risk-allocation instrument (PPA, supported by PPA Key Terms and Issues List). In this way, the portfolio

operationalizes the auction literature's core insight and links it back to RQ1 (standardized regulatory frameworks) and RQ2 (standardized PPAs and related documents).

My thesis aims to apply some of the insights and conclusions from these studies, the ones practical enough to be included, considering the unique challenges and nuances of the local contexts.

The literature on auctions and competitive tenders provides a crucial bridge between high level policy design and project level implementation. With respect to RQ1, auctions demonstrate how governments seek to operationalize renewable energy policy through transparent and competitive procurement frameworks; however, their success depends heavily on institutional capacity, regulatory clarity, and credible implementation. In relation to RQ2, the literature consistently shows that the effectiveness of auction programs depends on standardized and bankable project documents particularly Power Purchase Agreements and associated risk allocation instruments which reduce transaction costs and increase investor confidence. These findings directly support the thesis's implicit question regarding whether standardized regulations and documentation can stimulate development in smaller or frontier markets by reducing uncertainty and facilitating repeatable project structures. The following sections therefore move from procurement mechanisms to the detailed examination of PPAs, bankability, and risk allocation.

2.6 Power Purchase Agreements

This section addresses Research Question 2 by reviewing the literature on Power Purchase Agreements (PPAs) as the central contractual instrument through which policy intent is converted into a financeable, lender-acceptable project structure. While earlier sections assess macro policy tools (targets, FITs, RPS, auctions), the literature consistently shows that these instruments only translate into actual project delivery when the PPA provides credible long term revenue certainty and a bankable allocation of risk among the off-taker, the sponsor, and the state. The analysis therefore focuses on how PPA design shapes risk allocation, investor confidence, and lender participation particularly in Sub-Saharan African markets where institutional constraints such as weak utility creditworthiness, limited enforcement capacity, currency convertibility concerns, and political regulatory volatility can undermine contractual performance.

In addition, this section links the PPA literature back to Research Question 1 by illustrating that many of the risks negotiated in PPAs are ultimately regulatory in nature (e.g., tariff adjustment mechanisms, dispatch and curtailment rules, permitting and grid-connection obligations, and dispute resolution enforceability).[9] For that reason, the review treats the PPA not merely as a private contract, but as a governance instrument that compensates for institutional voids and clarifies responsibilities where regulation is incomplete or inconsistently applied. Finally, the section also informs the thesis's implicit question by considering whether standardized PPA structures and associated documents can reduce transaction costs and make smaller or frontier markets more investable by enabling repeatable, familiar documentation that lenders and sponsors can price and approve more efficiently.

[9] See "[Power Purchase Agreement]," § 11.9, p. 249, discussing enforcement mechanisms and related contractual protections.

This section examines PPAs in renewable energy, detailing their types, role in project bankability, and the issues they address.[10]

The literature on power purchase agreements (PPAs) is extensive due to their centrality in the development of renewable energy power plants (The World Bank, 2020), (Baines, et. al., 2019), (Egute et. al., 2017). These studies can be divided into two categories: one, those that focus on PPAs in specific countries, regions, states, (USDC, 2016), (Badissy et. al., 2018), (Beshara, 2012) and two, those that provide guidance on how implement PPAs.), (L. Louw and N. Bhengu, 2012), (O'Neil, Fowler, and I. Chernyakhovskiy, 2019).

A power purchase agreement (PPA) is a contractual arrangement between an off-taker and a power generator that establishes a long-term relationship for the sale and purchase of electricity (Power, 2021), (Decker, 2020). This agreement creates a reciprocal financial arrangement between the parties and is a critical foundation for project bankability (O'Neil, Fowler, and Chernyakhovskiy, 2019). The PPA also serves to allocate risk between the parties, acknowledging the importance of recognizing and mitigating potential risks associated with the project.

There are two types of PPAs: physical and virtual. In a physical PPA, also known as a sleeved PPA, the off taker takes ownership of the electricity produced by the project at a specified price for a pre-determined period (Kansal, 2018), (Broom and Boggs, 2020). In contrast, a virtual or synthetic PPA involves a pure financial transaction, where the off taker does not own or bear responsibility for the physical electrons generated by the project. Instead, the off taker exchanges a fixed price cash flow for a variable-price cash flow (Kansal, 2018).

PPAs are crucial for ensuring the success of renewable energy projects, and understanding the different types of PPAs available is essential in making informed decisions regarding energy procurement strategies.

This thesis contends, if one does a close and thoughtful reading of the PPA literature, one will find that they all deal with or try to deal with various issues, or questions, that must be addressed by the parties involved in the agreement. The level of sophistication to capture those issues, and the impact thereof, varies broadly (Shrimali et. al., 2012). The level of sophistication or lack thereof are their respective strengths gaps in the literature. For example, USDC (2020) is probably the most practical and comprehensive of the 'how to' studies and addresses all the issues that any standard PPA should have. These issues or questions that the interaction of stakeholders represent the central existence of the relationship between the related parties. The better these issues are addressed the better the PPA.

The first issue, rarely explicitly expressed, is why is there a PPA? The various articles and studies answer this question differently and have therefore a different emphasis. (USDC, 2020) posits a central condition that "The PPA is key to bankability. For the typical power project, there is only one stream of revenue payments from the buyer under the PPA. If the buyer fails to pay, it will be very difficult for the project to repay its lenders on a timely basis." Professor Haile states that "PPAs

[10] In project finance, bankability is of paramount importance and is largely achieved through properly drafted project documentation, as reflected in the author's Portfolio materials contained in Section 11, Professional Portfolio Appendices.

constitute one of the primary means of financing on-site solar PV systems and have been used without detrimental effects to electric utilities or consumers" (Haile, 2017:34). The nuance here is that financing itself is the key to distributed generation and its development. Unlike the USDC (2020), Professor Haile does not address the issue of bankability but focuses on the general issue of financing and how this is the central reason for a PPA.

Baines et al. (2019) examine Alberta's deregulated electricity market, arguing that strong regulatory frameworks are essential to support private Power Purchase Agreements. They highlight Alberta's unique system where generators can contract directly with private parties as a potential advantage if properly managed. However, while emphasizing high level regulatory needs, the study offers little detail on the micro-level dynamics that shape relationships between generators and customers.

Mr. Teichler and Mr. Levitine's law review article, (Teichler and Levitine, 2005:24), addresses the issue by primarily analyzing the tension between public and private contracts in the infrastructure industry. They state that the reason PPAs are necessary are that "regulatory authorities often attempt to modify or even abrogate private arrangements when deemed necessary to protect the perceived public interest." Thus, a comprehensive PPA stands as bullwork against this tendency.[11] Furthermore, they state that "PPAs remain relevant and, in fact, indispensable to the reliable functioning of competitive wholesale electricity markets…" (Teichler and Levitine, 2005:24).

The second significant concern pertains to the integration of the renewable energy PPAs with project finance. This is a complex matter as both PPAs, and project finance have long established histories in various countries. Nevertheless, their adaptation to the context of renewable energy, particularly within the African region, is a relatively recent development. (USDC. 2020), Merging both concepts has been difficult in many countries. Politicians and regulators have had to adjust to clauses that they are not used to dealing encountering. Fossil fuel PPAs are fundamentally different in that they have "no concept of deemed commissioning or deemed power to allow for certain compensation payments…" (Burke et. al., 2020), (Yarano and Brusven 2007), However, the bankability of solar PPAs hinge upon the concept of deemed energy. (USDC 2020). An important distinction between renewable and fossil fuel power purchase agreements (PPAs) and their integration into project finance lies in the fact that the core principle of the PPA involves the financier maintaining ownership of the PV system while selling the system's generated electricity to the end consumer (Haile, 2017).

The third major issue is what are the policy drivers of the PPA? Policy drivers, in its broadest sense, are targets, statements, goals and or desirable outcomes of the various bodies of a respective government. (Nicolay, 2011). Not all policy drivers are equally weighted by each government, each governmental department, or individuals therein. In addition, often when negotiating a PPA there can and, more likely, conflicting policy drivers within each governmental ministry. (Abrams, 2016). The finance ministry may prioritize tax issues, the energy ministry may prioritize capacity, and the justice ministry may prioritize the details of the force majeure clause and none of them will necessarily coordinate their priorities.

Furthermore, Abrams (2016) delves into the impact of macro policy drivers on the overall success of the policy and power purchase agreement (PPA) in Rwanda. Abrams notes the significance of Rwanda's Energy Policy (2015) in promoting the integration of renewable energy into the national grid. One of the most notable aspects of the Energy Framework is its emphasis on fostering good

[11] See the Model Power Purchase Agreement contained in Professional Portfolio § 11.9, p. 250.

governance. Additionally, Abrams (2016) outlines the three key policy drivers of the Rwanda government, highlighting the objectives of ensuring adequate, reliable, and affordable energy access for all citizens, increasing the proportion of renewable energy in Rwanda's energy mix, and enhancing institutional capacity to enhance accountability, transparency, and the implementation of sustainable energy services.[12]

The prioritization of policy drivers will depend on the strengths and weaknesses of the government and the country. For instance, countries with vast unused land may have a more relaxed approach towards site related issues and be more likely to include these clauses in the main body of the PPA. Conversely, countries with limited land availability may require these issues to be addressed in a separate agreement. According to (IREC, 2015), a site right agreement is essential in providing a photovoltaic (PV) system owner with the legal rights necessary to access, develop, and operate a PV system on a specific property. Negotiations during the PPA process will typically reveal not only the policy drivers but also the priorities of each stakeholder.

The fourth major issue is who and what kind of off-taker is the counterparty? The major components and issues of the PPA will largely depend upon off-taker. Is the off-taker a corporate entity, a government owned utility, or an electricity trader? (WBCSD, 2018). The duration of the PPA is usually 15-25 years. A corporate PPA is usually shorter, for example 15 years, (Beshara, 2012), (WBCSD, 2018), (Yarano and Brusven, 2007). Whereas the off-taker is a government owned utility the tenor usually ranges from 20-25 years (USDC, 2020). This is a crucial differentiation in literature. According to (Nicolay, 2011), his decision on government Power Purchase Agreements, if the off taker is a utility that is owned and controlled by the government, the purchaser is granted the right to buy electricity from a specific plant for a period of 20 years.

The duration of a Power Purchase Agreement (PPA) is a crucial factor in project finance. Professor Nicolay's paper (Nicolay, 2011) provides an insightful analysis of why the tenor of a PPA is significant and how it affects the project's bankability. Nicolay argues that a long-term PPA is essential because it allows. investors to obtain a return on capital and a possible profit, which is crucial to attract financing. He further posits that a twenty year PPA, which follows a classical contracting structure, is long enough to identify and address any potential contingencies.

Nicolay also highlights that the economic value of a PPA is determined by the net present value of the set of differences between the hourly Power Pool price for electricity and the marginal cost of generation minus the fixed monthly capacity payments specified. Additionally, Nicolay is one of the few authors to address the marginal cost of energy, which is an important consideration in project finance. The long tenor of a PPA allows the off-taker to pay the independent power producer the marginal generation cost of each unit plus a fixed monthly payment representing the annualized unrecovered capital cost of the plants represented by the capacity payments.

The fifth major issue is what type of PPA is desired or needed? This issue is mostly addressed in what I referred to above as the how-to category. The most common type of PPA is a direct or physical PPA which is a bi-lateral contract between the power producer and the buyer or off-taker (Decker, 2020), (WBCSD 2018), (Power, 2021), (Broom and Boggs, 2020), (Kansal 2018). It is so common that much of the literature does not even mention virtual PPAs, for example, USDC (2020). The virtual or synthetic Power Purchase Agreement is a less common and more corporate oriented type of PPA. Unlike

[12] Many of these issues are addressed in the Concession Agreement contained in Professional Portfolio Appendix § 11.3, p. 181.

traditional PPAs, the buying organization does not physically receive the renewable electricity that is being generated (Decker, 2020). Essentially, this type of PPA operates like a contract for difference. The agreement sets a strike price, which is higher than the market price for the designated settlement period. If the market price falls below the strike price, the generator pays the off taker the difference. Conversely, if the market price is higher than the strike price, the off-taker pays the difference to the generator (Power 2021). Thus, the generator receives at least the pre-approved strike price.

The literature that directly addresses the issue, including works by Decker (2020), WBCSD (2018), Power, (2021), Broom and Boggs, (2020), and Kansal 2018, provides a useful framework for my thesis. Although these articles are largely descriptive in nature, they still serve as a helpful reference point for my policy suggestions in the power purchase chapter.

In essence, a power purchase agreement serves as the fundamental agreement between an off-taker and an independent power producer for the purchase and sale of energy (USDC, 2020). The PPA is widely considered as the most critical and detailed of all project finance documents Power, (2021), highlighting its importance to the overall success of renewable energy projects.

Scholarly literature surrounding PPAs generally reflects the characteristics of the subject matter. This attention to detail and specificity is necessary to ensure that both parties fully understand the agreement's terms and can mitigate potential risks associated with the project. The literature emphasizes the critical role PPAs play in renewable energy projects, underscoring the need for careful consideration of the various types and terms of agreements available to ensure successful and sustainable project outcomes.

Although the literature recognizes the importance of PPAs for project finance, it rarely offers standardized, transferable contractual models calibrated to the realities of sub-Saharan African institutions. Most studies treat PPAs descriptively examining risk allocation, pricing mechanisms, and financing structures rather than analyzing how these agreements can be systematically standardized to reduce transaction costs, accelerate procurement, and mitigate institutional risk across multiple projects and jurisdictions. This gap is directly relevant to Research Question 2, which asks whether sub-Saharan Africa would benefit from standardized PPAs and associated documentation. By highlighting the absence of widely accepted templates or repeatable contractual structures in the literature, this section underscores the need for a more practical, implementation-focused approach to PPA design.

Moreover, the literature's limited attention to standardization also connects to Research Question 1, as many of the risks negotiated within PPAs such as tariff stability, curtailment, payment security, and dispute resolution are rooted in regulatory and institutional uncertainty. This suggests that contractual standardization and regulatory standardization must be considered together rather than in isolation. Finally, the gap identified here informs the thesis's implicit question by indicating that standardized documentation may be particularly valuable for smaller or frontier markets, where limited institutional capacity and small project pipelines make bespoke negotiations inefficient and costly. Addressing this gap is therefore central to the contribution of this thesis.

2.7 Tax Policy

Although this thesis is focused on sub-Saharan Africa, the tax-policy literature from more institutionally mature markets is reviewed here for a specific, practice-driven reason: it illustrates how governments use *fiscal incentives* to reduce the effective cost of capital and accelerate private investment once basic regulatory credibility exists. This discussion therefore supports RQ1 by clarifying which incentive tools tend to work *after* foundational regulatory and administrative capacity is in place (and why they may be less effective when institutions are weak). It also supports RQ2 because tax incentives often assume "financeable" projects i.e., standardized, bankable documentation (particularly PPAs and related agreements) that investors and lenders can underwrite repeatedly at scale. Finally, this section informs the thesis's implicit question by highlighting a key sequencing issue for smaller markets: where tax-equity depth and administrative capacity are limited, standardized regulatory and contractual frameworks may do more of the early "heavy lifting" in mobilizing investment, with tax tools becoming more relevant in later stages.

This section explores how tax policies in mature countries strategically incentivize renewable energy investments to promote sustainable development. Generally, the use of tax policy to incentivize renewable energy investment is characteristic of more institutionally mature economies. Accordingly, this chapter suggests that such instruments are more appropriately applied at later stages of development in the policy frameworks proposed in this thesis.

The adage in real estate that location is the determining factor of a property's value is well-known, while in tax policy, the equivalent is that incentives matter (Sanderson, 2019). Tax economics widely accepts that lowering taxes on something will increase it, while increasing taxes will decrease it. Hence, several international jurisdictions and the majority of U.S. states have utilized tax policy to incentivize the development and investment in renewable energy.

The tax literature under examination in this study is broadly divided into two categories: tax incentives and tax credits, with some works addressing both aspects (Goulding et al., 2006; Butcher et al., 2006). This categorization is evident in the contribution of various authors and organizations, including KPMG (2014), Rivera (2012), Matate et al., (2010), Menaker et al., (2012), Caniban (2016), ICAT (2019) and Moss (2010).

Compared to other economic mechanisms, tax measures encourage renewable energy development since they have the capacity to be broad based performance measures because they leave market choice to stakeholders and they avoid the risks associated with the government's ability, or inability, to pick the winners (R. Dueck 2007). In addition, tax measures can offer a more inclusive strategy for accomplishing multiple goals, resulting in reduced administrative expenses and a more cohesive outcome (Dueck, 2007). In short, this is done through incentives. Reducing tax burdens either via tax credits or tax incentives steers investors and developers in the direction you want them to go without overtly forcing them to get there.

Tax policy is a complex and highly specialized field that requires precision in defining terms. The literature on tax policy is no exception, and it is generally agreed that tax credits are defined as reductions in the amount of tax that one would otherwise owe. These reductions can take the form of a dollar-for-dollar reduction or a predetermined amount. The U.S. Department of Energy provides a comprehensive definition of tax credits that is widely accepted (USDE 2016).

One clear example of tax credits can be found in Glickman's (2014) work. In his paper, Glickman explains that tax credits are granted to developers who invest funds in qualified projects, allowing them to avoid paying tax on the corresponding amount of income. The majority of tax credit literature focuses on these definitions and examples, as well as the relevant statutes. However, there is also a discussion of the two sub categories of tax credits.

It is important to note that tax policy and its related literature are continually evolving, and precise definitions and descriptions are critical to understanding the complex rules and regulations surrounding tax credits Therefore, it is essential to keep up to date with the latest developments and changes in tax policy to ensure compliance and effective tax planning.

Investment tax credits (ITCs) incentivize developers and investors to purchase or invest in specified renewable technologies, while production tax credits (PTCs) reward producers and utilities for generating renewable electricity. Most research describes these credits similarly, but Ward (2011) argues their effectiveness depends on careful statutory design especially clear sunset provisions so developers can plan around when credits end, and "double-dipping" limitation clauses that reduce credits when projects also receive other government support, helping control subsidy levels and discouraging overlapping local incentives.

The second macro category that is discussed in the literature is tax incentives. A tax incentive is a clause or clauses in a tax code whose purpose is to incentivize or encourage a particular desired behavior or series of behaviors, i.e., investment and development of solar energy (ICAT, 2019). In a relatively commoditized fashion, the majority of the literature focuses on listing, and explaining the various types of tax incentives.

The development of utility sized power plants requires significant capital investment, raising the question of how policymakers can encourage their production. There are three primary methods for achieving this goal: incentivizing power producers to increase revenue, implementing incentives to decrease the cost of production, and stimulating demand for renewable energy production by imposing additional cost on fossil fuels. These approaches have been extensively discussed by several authors, including (Marata et. al., 2010), (Mann, 2013), (Ogunlana & Goryunvova, 2016).

Marata et. al. (2010) provides a thorough analysis of corporate tax incentives in the United States and Spain. However, one significant gap in the article is the lack of comparison between the tax incentives in the two countries. While the authors provide useful insights, comparing a federal system with a federal system is challenging. Renewable energy tax incentives in the United States are primarily state institute, while Spanish tax incentives are predominantly federal. Thus, it is difficult to make meaningful comparisons between these tax systems.

Despite this limitation, (Marata et. al., 2010) identifies five primary corporate related tax incentives that have contributed to the significant increase in renewable energy production in both countries. These incentives include increased corporate tax credits, accelerated depreciation for designated assets, local tax relief, tax relief on construction, and tax breaks on real estate taxes. While these incentives have contributed to the growth of renewable energy production, policy makers must ensure that they are effective in achieving their goals and are sustainable in the long run.

Policymakers seeking to promote utility scale renewable power plants can use incentives that raise revenues, lower costs, or boost demand, and corporate tax incentives have proven effective in expanding renewable generation in countries like the U.S. and Spain provided they are well designed

and sustainable. The literature highlights a range of investor-focused measures that reduce tax burdens and have generally supported renewable growth, including duty-free imports, loss carryforwards, zero VAT, rebates and credits for renewable components, and multi-year corporate tax reductions or exemptions.

As mentioned above, many of the articles are similar in that they discuss most of the same incentives in very similar ways. One, however, emphasizes a very important aspect of tax policy that is not discussed by any other literature. The ICAT (2019) discusses various methodologies that increase the development and investment in renewable energy, one of which is tax policy. and the article analyses the positives of micro tax policies such as tax credits and deductibles.

To incentivize market stability through tax policy, policy makers aim to strike a delicate balance. If tax incentives are set too low, eligible entities may lack the motivation to invest in additional renewable energy capacity, potentially hindering the realization of the technical potential for the specified assessment period (ICAT, 2019). On the other hand, excessively high tax incentives can attract investors and developers with a short-term perspective, leading to increased market volatility and reduced stability. Hence, a well-balanced policy approach is required to maintain stability and encourage long-term investment (ICAT, 2019). Furthermore, the article discusses increasing market stability by shielding certain renewable energy technologies from "future changes in fiscal regime or from additional fees are mainly incentivized by creating a stable" and flexible tax regime (ICAT,2019). For example, anticipating price decreases in component prices, operations, and management and or services fees. The article does a very good job at identifying that taking a narrow "scope of tax incentive (potentially decreases the incentive for eligible entities to install additional RE capacity…" (ICAT, 2019) thus lowering the long-term investment in renewable energy development. Finally, the article suggests that tax policies restricting eligibility to only a few renewable energy (RE) technologies can reduce flexibility in their utilization, consequently constraining the selection of the most suitable technologies (ICAT, 2019).The implications of the foregoing analysis are that sustained renewable energy deployment depends on a tax regime that is not only supportive in the short term, but also credible, stable, and adaptable over the life of a utility scale solar project. In the context of Research Question 1, this reinforces the argument that a standardized regulatory framework for utility-scale solar PV in sub-Saharan Africa should incorporate clear and durable fiscal provisions such as predictable treatment of import duties, VAT, withholding taxes, and any sector-specific levies so that projects are insulated, as far as possible, from arbitrary future changes that undermine bankability.[13] In relation to Research Question 2, fiscal incentives are only fully effective when they operate alongside standardized, bankable project documentation, particularly PPAs and related agreements that can allocate tax change risk transparently (e.g., via change in law provisions) and provide investors and lenders with confidence that fiscal assumptions embedded in the financial model will remain enforceable. Conversely, narrow or inconsistent tax incentives, or eligibility rules that favor only certain technologies, can distort investment signals, reduce competition, and ultimately slow the scale up of renewable capacity needed for sustainable energy development.

[13] Taxation issues and the mechanisms used to address them are initially discussed in the PPA Issues List contained in Professional Portfolio § 11.6, p. 223.

2.8 Bankability

This section analyzes bankability as a central determinant of whether utility scale solar projects in sub-Saharan Africa reach financial close, and therefore directly informs this thesis's research questions. In relation to RQ1, bankability provides a practical lens through which the effectiveness of standardized regulatory frameworks can be assessed, since investors ultimately judge policy success based on whether projects become financeable. In relation to RQ2, the concept of bankability highlights the critical role of standardized PPAs and associated project documents in allocating risk, ensuring revenue certainty, and satisfying lender requirements.

Finally, by examining the drivers of bankability in institutionally constrained environments, this section contributes to the thesis's implicit question by evaluating whether standardized regulatory and contractual approaches can help smaller or frontier markets attract investment by reducing perceived risk and transaction costs.

The issue of bankability is one of the most important concepts in project finance, and in sub-Saharan Africa it is an issue that is scrutinized from the inception of a project until its financial close. According to Hample et al (2011), there is no universal agreement on the meaning of the term as literature lacks a consistent definition. The reason is because bankability is defined by who you are in the development and financing process (Boccolini et. al., 2018). Equity investors define bankability based upon their own leveraged returns, debt investors define it based upon the debt coverage ratio, and developers define it based upon both criteria (Connell,2018). However, a broad definition could be "bankability refers to the financial viability of renewables projects…whether lenders and investors are willing to extend financing to any one project" (Lim 2018:2). This concept is explicitly evident in all the clauses of the Power Purchase Agreement included in the appendix of my work hereto

The thesis's discussion of bankability is operationalized through the drafted PPA included in the professional portfolio; see Professional Portfolio: Power Purchase Agreement (PPA), as well as the PPA Key Terms and PPA Issues List, which translate lender expectations into concrete contractual mechanisms and risk-allocation clauses.

A further comprehensive definition states that project finance relies on the project's ability to generate adequate revenue or returns to repay the project debt (Arowolo, 2006). The literature also points out what it is not, it does not mean that profits are guaranteed at all, but rather that risk is minimized, and returns are relatively predictable (Morris, 2020).

In analyzing the literature in this topic, one can notice that they see bankability in three different categories: financial, technical, and contractual. For example, Norton Rose, (2019) analyzes ten key bankability features in project finance contracts with particular emphasis on the power purchase agreement. They conduct a very lawyerly analysis of each feature from dispatch risk to termination clauses. In essence, Norton Rose (2019), suggests that specific development financing institutions have defined a set of ten crucial criteria that must be fulfilled within a power purchase agreement for an emerging market project. Only when these parameters are met can the PPA serve as the foundation for a viable independent power project from a bankability perspective.

According to Marsh & McLennan, (2017), the financing gap, i.e., lack of bankability, that often occurs, is directly related to proper documentation and deal structure. They highlight the macro issue of covenants. Marsh & McLennan, (2017) argues that covenants, which are essential contractual provisions established by different stakeholders, play a vital role in safeguarding their interests

throughout the project's duration. The key to bankability is to impose financial covenants on related parties that will ensure the viability of enough cash flows to mitigate risk and allow for the prospect of a debt-coverage ratio accepted by the lenders.

An important aspect of bankability that the literature portrays as important is the duration of the agreements (Norton Rose, 2019). The long-term nature of the agreements is paramount to securing financing. Why are long term agreements necessary for bankability? [14](Arowolo 2006:2) contends that "long duration (usually from 20 to 30 years), …[gives] the project sponsor adequate opportunities to recoup investments and achieve repayment of project loan plus interest to the lender."

The second category of bankability deals with the proper implementation of technology. Technical issues are represented by two subcategories: the equipment used in the building of the project and the grid related technology (Dise, 2019). Given the conservative nature of institutional lenders, using building equipment with a long history of solar data is imperative. "Risks associated with using free, incomplete or unproven datasets" will jeopardize the financing of the project (Dise 2019:2). An additional way of articulating the equipment issues has to do with the maturity of the technology (Boccolini et. al., 2018). According to Boccolini et al (2018), the pinnacle of technological maturity is commonly referred to as bankability, which signifies the point at which reputable financial institutions are willing to provide financing at a reasonable interest rate. New technology or new variations on older technology is usually not bankable not because it does not work but because there is not enough data or maturity in the marketplace for lenders to properly evaluate its long-term use. There is a focus on the maturity of data because for lenders, data maturity on technology is considered a quantification and reduces uncertainties to a level considered acceptable by the stakeholders (Boccolini et. al., 2018).

Lenders will generally require certification and testing certificates of modules, mounting stations, and wiring technology (Hample et. al., 2011). In addition, the stakeholders will analyze several bankability suite risk factors (Connell, 2018). These suite risk factors will include product history, third party reviews, operational risk mitigations, and warranty backstops (Connell, 2018).

The second subcategory of technology bankability relates to grid connections. Without a proper grid connection with stable bankable technology the project will not be financed and will not be approved by the utility. A developer will usually enter into a grid connection agreement with the utility. This agreement will often include a comprehensive technical description of the grid, its connection points and to provide the necessary dates and obligations for the completion of the required tasks to establish the connection between the project and the appropriate network (Herbert Smith, 2019).

Simultaneously regarding the technical and contractual issues, the financial aspects of the project will be viewed as central to both the lenders and sponsors' requirements of bankability. Key financial indicators such as the balance sheets of the developer, sponsor and the project model will be the primary factor in their ability to determine bankability (Hample et. al., 2011), (Connell 2018). The tailored project financial model will first be prepared by the developer and then audited by both the equity and debt sponsors. The model will include several financial aspects starting with the levelized cost of energy (ABB, 2013). The literature defines the levelized cost of energy as the net present value of the unit cost of energy over the duration of the asset (Connell, 2018), (ABB, 2013). The input

[14] The importance of long-term contractual arrangements in project finance is reflected throughout the author's Portfolio materials contained in §[Section 11],, page 173, of the Professional Portfolio Appendices.

tab of the model will include several items such as equity contribution, construction debt, various possible debt scenarios i.e., subordinated, mezzanine and secured debt. In addition, preferential equity, shareholder loans, the cost of political risk insurance, interest rates, foreign exchange cost and tax and depreciation chargers.

The above sources are helpful in articulating the core concept of bankability and the lender-oriented criteria through which project finance structures are evaluated. Although much of this literature is not written with emerging markets nor Sub-Saharan Africa specifically in mind, the underlying principles remain applicable because bankability is ultimately assessed by reference to a relatively consistent set of financing requirements (revenue certainty, enforceable risk allocation, and credible counterparties). In this thesis, these concepts are not treated as abstract theory but as a practical lens for answering the research questions.

In relation to RQ1, bankability provides a benchmark for evaluating whether a standardized regulatory framework for utility scale solar PV would meaningfully reduce perceived risk and enable projects to reach financial close; a policy framework is only "effective" to the extent that it produces bankable, financeable projects rather than merely aspirational targets. In relation to RQ2, the bankability literature directly informs the argument that standardized PPAs and related project documents can reduce transaction costs and accelerate financing by providing repeatable contractual solutions to recurring risks (such as payment security, curtailment, change in law, and dispute resolution). Finally, these insights also speak to the thesis's implicit question, because smaller or frontier markets often suffer from limited deal flow and limited institutional capacity; in such contexts, standardization may be particularly valuable in creating lender familiarity and reducing the need to renegotiate core bankability protections for each new project.

Accordingly, the literature reviewed here functions as a framework for the thesis's policy recommendations, while the sub-Saharan African context determines which bankability requirements must be emphasized, adapted, or supplemented to reflect local institutional constraints.[15]

2.9 Risk

This section examines the various risks associated with solar development, from the early research stage through financial close. Understanding these risks is important for the research questions of this thesis, as both the effectiveness of a standardized regulatory framework for utility-scale solar PV (RQ1) and the usefulness of standardized PPAs and related project documents (RQ2) ultimately depend on how these risks are allocated, managed, and mitigated in practice.

In solar development in Africa, the concept of risk is inherent in every aspect and at every stage of a project. It begins with the preliminary research of a country and ends when your financial and contractual involvement in the project ends. Risk must be identified, measured, and continually managed at every level of development, construction and throughout the operations and management stage. Risk ebbs and flow continually throughout the development, and building

[15]See "[Power Purchase Agreement]," §[section 11.9], pp. [22 of the PPA], where the allocation of development and commercial risk between the parties is addressed.

process and determines how much money and time is invested and when it's invested. Since risk is shared, directly or indirectly, known, or unknown, by all the stakeholders, risk must be independently assessed and mitigated by all the stakeholders. I address the concept of risk in my thesis because it plays, or should play, a determining factor in policy and regulations.

The literature about risk, as it relates to solar and project development, takes both a theoretical and a practical approach. As a senior manager and compliance officer of a development company I believe both approaches need to be addressed. Understanding the theory of risk gives a developer and manager the depth and breadth of knowledge to be able to quickly react to the ever-changing environment that is solar development in Africa.

The concept of risk and its definition have been the subject of considerable debate in the literature (Hubbard, 2009). Different theorists offer distinct perspectives, emphasizing various aspects of risk, which in turn shape their analyses and conclusions.

Hubbard, a consultant, and risk management specialist, characterizes risk as “A state of uncertainty where some of the possibilities involve a loss, injury, catastrophe, or other undesirable outcome” (Hubbard, 2009:13). In contrast, Frank Knight, an economist, and specialist in risk, posits that risk’s essence is measurable uncertainty (Knight, 1921). Yackee (2014) offers a concise definition of risk as likelihood of an event occurring, wherein the event would result in unfavorable consequences or expenses for the party concerned.

While these definitions differ, they all agree that risk involves uncertainty and the possibility of negative consequences. Yackee’s definition highlights the importance of quantifying outcomes and probabilities, making it possible to mathematically determine risk. Hubbard’s definition highlights the potential for undesirable outcomes, while Knight’s definition emphasizes the importance of measuring uncertainty.

Overall, the varied perspectives and definitions of risk highlight the complex and multifaceted nature of this concept, and understanding these nuances is essential to effectively managing and mitigating risks in different fields and industries.

In contrast, Professor Vern Walker, who specializes in tort and risk, defines risk as the likelihood of experiencing harm or loss from a hazard (Walker, 1991). Ulrich Beck, a renowned sociologist and risk expert has a distinct perspective on the concept of risk. In his influential work “World Risk Society,” he argues that risks are human-made and that their prevalence increases with the growing use of technology, science, and industrialism, contrary to the common notion that scientific and technological advances mitigate risks (Beck, 1991). Beck’s view on risk is centered on the idea that modernization itself unintentionally produces the major threat that society faces, particularly in the form of climate change resulting from human activity (Burgess et.al., 2017).

How should policy makers approach the concept of risk? Since they are in the unique position of being able to not only understand risk theory, but they can also use that understanding and distribute risk on a macro basis, via regulations and policy, to best promote investments in their respective countries. Their key task is to understand and execute the concept of risk distribution (Calabresi, 1961), (Fennell, 2011). The central policy issue for a state is whether the principal criterion for risk is to be based on individual fault or wide risk distribution (Gregoy & Kalven,1959).

The policy theory of distributing risk can be done in one of three ways. One, they distribute risk as broad as possible, two, distribute risk to those classes of stakeholders most able to pay or three, to direct the risk to those stakeholders or enterprises which give rise to the loss (Calabresi, 1961). Professor Calabresi elaborates on these choices and how theoretically each are applied in society. In addition, he analyzes and discusses the trade-offs of each theoretical choice.

Developers and equity sponsors face complex risk considerations when undertaking projects. A review of the literature reveals two categories of risk: Internal and external (Heiligtag et. al., 2018). The internal category places responsibility on the developer or equity sponsor to determine their own risk appetite (Heiligtag et. al., 2018). According to (Heiligtag et. al., 2018), those actively involved can position themselves as risk-averse, risk-neutral, or risk-taking. To comprehend this aspect of risk, it is crucial to establish general standards and positions that can apply in most cases, while still maintaining the flexibility to adjust risk levels based on the situation and opportunity.

Risk levels tend to fluctuate throughout the development process and can often do so unpredictably. Thus, establishing standards is necessary for maintaining discipline, but the ability to adjust risk levels to adapt to changing circumstances is also crucial.

Unlike government policy makers who can use legislation and regulations to distribute risk, developers and equity sponsors have two choices, either not to invest, which presents an opportunity cost risk or distribute risk contractually. Risk can be shifted or distributed in virtually unlimited ways (Fennell, 2011). The same theoretical principles used by policy makers can be understood and applied by developers. Once risk is accessed it can contractually be shifted to the party best positioned to reduce, mitigate, or eliminate the risk (Fennell, 2011). Because of the uneven power relationship between the government and the developer, this unbundling of risk starts with the developer and must be shifted and distributed to other stakeholders. There are efficiencies to distribute risk. If all the risks stayed with the developer, then no one would develop projects. By sharing or mitigating certain risks “to parties who have a greater ability to diversity, spread, or pool it, or who are simply less averse to risk” (Fennell, 2011:23), you create a more efficient marketplace and therefore attract development and investment.

In practical applications, the question arises of how, when, and where to apply the aforementioned risk theories. As a manager, the primary practical risk that needs to be tackled is operational risk (OpR). Operational risk is commonly defined in the literature as the risk of experiencing losses due to insufficient systems, controls, or human error (Group of Thirty, 1993). Operational risk therefore is tantamount to internal human error. Human error that results from, caused by, and or is tangential to inadequate internal rules, controls, management or in some cases just plain idiocy. Operational risk (OpR) can be classified into five key elements: people, structure, processes, systems, and external factors. It is important to note that significant losses arising from OpR typically stem from a combination of these elements, rather than being attributed to a single element alone (Yokoi-Arai, 2003). What are key factors for operational risk management? People and culture. People must be managed properly, and culture must be created and nurtured over time. In addition, operational risk management is best accomplished with proper oversight and clear definitions of the roles of oversight personnel or groups (Eceiza et. al., 2020), (Loke, 1998). Operational risk is the foundation of all other risk management functions. Once operational risk is in place, properly, all other risk management functions can be addressed.

In project development, model risk lies downstream of operational risk. Despite every aspect of pre-development, engineering, and financing functioning flawlessly, a wrong financial model can result in subsequent loss of risk, flowing from the utility, creditor, and equity sponsor to the project

developer. The literature defines a model as "quantitative method, system, or approach that applies statistical, economic, financial, or mathematical theories, techniques, and assumptions to process input data into quantitative estimates (Aggarwal et. al., 2015) for clarity. The primary purpose of a financial model is to assess a project's financial feasibility, its potential cash flows, and the viability of the debt coverage ratio (Bernath, 2020). Models usually comprise three components, namely information inputs, processing components, and reporting components, as noted by Aggarwal et. al., (2015), Bhandari (2012) and Fight, (2005).

Because of the complexity of the model environment that needs to be navigated, the risk of model failure is relatively high. For example, the model owner must anticipate a change in interest rates, component prices, currency issues, and the time value of money etc. (Verdouw et. al., 2015). This is a computationally intensive exercise that makes valuing the project asset and the financial potential thereof extremely difficult and the risk of error relatively high (Aggarwal et. al., 2015). The developer or owner of the model produces a model to reduce risk and the model itself becomes a risk element.

Model risks[16] occur for three fundamental reasons: the model may have fundamental errors, they have inaccurate inputs and even if not, the model may be used incorrectly or inappropriately (Aggarwal et. al., 2015), (Fight,2005). Because of these potential problems, much of the literature stresses the need for proper model risk governance (Aggarwalet. al., 2015), (Trippe 2020), (Patel 2021). According to (Aggarwal et al, 2015), to establish effective governance for managing model risk, an organization should create a comprehensive Model Risk Policy. This policy should outline the roles and responsibilities of different stakeholders involved in the model risk management process, supported by more detailed standards for modeling. In addition, it is important for the developer to appoint a model owner who is ultimately responsible for model governance.

Risk theory encompasses several downstream aspects, including technical risk, which is particularly relevant to utility-scale solar projects due to their complex technical nature. Technical risks can arise in various ways during the development and construction of such projects, and therefore there are three main areas of technical risks that need to be addressed. These are component risk, transmission or interconnection risk, and dispatch risk, as outlined by (OPIC, 2016) and (Worren, 2012).

Component risk refers to the possibility of one or more components degrading at a faster rate than expected, resulting in reduced electricity output from the solar power plant. Dispatch risk, on the other hand, pertains to the technical ability to evacuate energy from the plant to the transmission station and beyond. This requires an efficient and reliable system to transmit the energy generated by the solar power plant. Lastly, transmission or interconnection risk involves the technical risks associated with connecting the solar facility to the grid and transmitting power to the nearest substation. This risk is more significant in areas with challenging terrain, long distances, or high population densities.

Overall, technical risks are an important factor in the success of utility scale solar projects, and properly assessing and managing those risks is essential if projects are to remain viable over the long term. In Sub-Saharan Africa, however, the most significant and unpredictable risk is often political risk. According to Christy (2020), political risk refers to the uncertainties associated with changes in government policy, business laws, or investment regulations, as well as broader factors such as

[16] The essence of project finance lies in the allocation and distribution of risk through project documentation, as reflected in the author's Portfolio materials contained in §§ 11.1–11.9.

international relations or economic instability that can affect a country's investment climate. As Lindeberg and Morndal (2017) note, one of the challenges with political risk is that it is difficult to define precisely, and the absence of a universally accepted definition or measurement framework contributes to the uncertainty surrounding it. This lack of consensus is also highlighted by Yackee (2014), who observes that there is no widely accepted method for evaluating political risk in a consistent way.

From a practical perspective, political risk is difficult to manage because it can emerge in many different forms and can affect multiple aspects of a project simultaneously. Changes in regulation, taxation, currency policy, or government priorities can alter the economics of a project and introduce uncertainty into long-term investments. The literature therefore consistently identifies political risk as one of the central challenges facing infrastructure and energy projects in emerging markets (Christy, 2020; Lindeberg & Morndal, 2017; Yackee, 2014; Drago, 1993; Jensen & Johnson, 2011).

Political risk can manifest itself in a variety of ways, including expropriation of assets, changes in tax policy, currency devaluation, disputes between different levels of government, import restrictions, or corruption. Any of these developments can significantly affect the financial viability of a project. Because utility-scale solar projects require substantial upfront investment and depend on stable long-term revenues, these risks are particularly relevant for investors and lenders.

For this thesis, the discussion of political risk is directly relevant to the research questions. If political risk is a central feature of the investment environment in Sub-Saharan Africa, then the design of regulatory frameworks becomes particularly important. A standardized regulatory framework for utility-scale solar PV (RQ1) could reduce uncertainty by providing clearer rules regarding licensing, grid access, tariffs, and regulatory oversight. In a similar way, standardized Power Purchase Agreements and related contractual documents (RQ2) can help allocate and manage political risk by clearly defining the rights and obligations of the parties, providing dispute resolution mechanisms, and creating more predictable revenue structures. In this sense, both regulatory design and contractual standardization can help reduce the uncertainty that political risk creates for investors.

The literature also distinguishes between political risk and political uncertainty. Political risk is generally defined as the possibility of adverse outcomes arising from political factors, while political uncertainty refers to situations in which the probability of those outcomes cannot be clearly estimated (Yackee, 2014; Posner, 2013). In practice, however, this distinction is often less meaningful for project developers. As Yackee (2014) notes, managers rarely have access to reliable probability distributions for political events, and investment decisions must therefore be made under conditions of significant uncertainty.

This observation is particularly relevant in the context of sub-Saharan Africa, where developers frequently operate in environments characterized by limited institutional capacity and rapidly changing policy conditions. In such contexts, political uncertainty effectively becomes a form of political risk for investors (Caduff et al., 2021). As a result, project developers typically focus less on theoretical distinctions and more on practical strategies for managing these risks. These strategies may include political risk insurance, partnerships with reputable local companies, maintaining strong relationships with government officials, and diversifying investments across multiple jurisdictions.

Ultimately, the literature suggests that political risk cannot be eliminated, but it can be managed. For the purposes of this thesis, this reinforces the importance of regulatory and contractual design. Standardized regulatory frameworks and standardized PPAs can help create more predictable

investment conditions, improve project bankability, and reduce transaction costs in environments where political and institutional risks remain significant.

2.10 Conclusions

The existing empirical and theoretical literature on solar policy as it relates to sub-Saharan Africa has been inconsistent, with some comprehensive studies being very helpful (Abrams, 2016), (The World Bank, 2020), (IRENA, 2018), (IRENA, 2019), and some tangential articles being less so. (Brown, 2020), (Haile, 2017). In all fairness however, since solar policy is in its infancy in Africa and very few projects are completed each year, it is difficult to expect the literature to be well ahead of policy and development or directly on point. This aspect presents difficulty in research but also presents an opportunity when developing original policy suggestions.

In the existing literature on renewable energy policies, the focus is primarily on well-developed markets such as Germany and the United States, as evidenced by studies by Wirth, (2018), IRENA, (2015), and IRENA (2013). While these studies provide a useful framework for policy suggestions, they may not be directly applicable to Sub-Saharan Africa due to differences in infrastructure and data sets. Therefore, studies that specifically analyze energy situations and policies in Africa, such as those by Pueyo, (2016), Blimo & Cosgrove-Davies (2019), and Niyibizi (2015), can be useful in identifying institutional voids that are unique to the region. However, it is important to recognize that these studies may have limitations, and policy recommendations must be made with careful consideration of the specific context and challenges in Sub-Saharan Africa. Ultimately, by drawing on both well developed market policies and Africa-specific research, policy suggestions can be tailored to effectively address the challenges and opportunities in Sub-Saharan Africa's renewable energy sector.

The literature produced by government entities and government-sponsored organizations, as seen in (IRENA, 2013), (IRENA, 2019), (IFC,2019), (USDC,2016), (ICA, 2019), (USDE, 2011), and (The World Bank, 2020), is well-executed, informative, and professionally conducted. However, these sources tend to downplay or overlook two critical characteristics of emerging markets, particularly in sub-Saharan Africa: institutional voids and corruption. While there may be disincentives to address sensitive topics in relation to other counties, it is essential to shed light on these issues as realistically as possible to propose effective policies. Therefore, while utilizing their fundamental premises and framework, it is imperative to consider the realities on the ground when formulating policy recommendations.

The concept of risk holds immense significance in solar project development, as it lays the foundation for a comprehensive risk management approach. Effectively allocating project risk is a critical task, and my portfolio comprises a series of meticulously crafted documents that play a pivotal role in achieving this goal. Each document within the portfolio represents a carefully balanced distribution of risk among the parties involved, ensuring a fair and equitable sharing of responsibilities.

Beginning with the Memorandum of Understanding (MOU) and culminating in the Power Purchase Agreement (PPA), every agreement in this portfolio delineates the specific level of risk assumed by

each party. In general, each document in my portfolio allocates risk accordingly. The MOU serves as an initial roadmap, outlining the parties' intentions and expectations, while the PPA solidifies the commercial arrangement, defining the terms under which electricity will be purchased and supplied. Throughout this process, the risks are identified, assessed, and allocated based on a standardized approach that considers various factors such as market conditions, compliance issues, currency outlooks, technological uncertainties, and *de jure* and *de facto* regulatory considerations.[17]

By standardizing these crucial documents, the overall risk for all parties involved can be reduced significantly. Transparent and consistent risk allocation framework enhances clarity, minimizes misunderstandings, and fosters a cooperative environment among stakeholders. As a result, this approach instills confidence in investors, developers, lenders, and other key players, thereby promoting foreign solar investments in sub-Saharan Africa and facilitating the transition to sustainable and renewable energy sources. Moreover, the establishment of a robust risk management strategy contributes to long-term viability and success of solar projects, ultimately driving progress towards an efficient regulatory solar project in Sub-Saharan Africa.

The first question asks whether sub-Saharan Africa would benefit from a standardized regulatory framework for utility scale, grid connected solar PV. The second asks whether standardized Power Purchase Agreements (PPAs) and related project documents would improve project bankability and reduce transaction costs. The literature reviewed in this chapter therefore focuses on how policy design, institutional capacity, contractual structures, and risk allocation affect the development and financing of utility-scale solar projects in Sub-Saharan Africa.

The gaps identified across the reviewed literature, particularly the lack of integration between policy design and contractual bankability necessitate a methodology that combines comparative policy analysis with doctrinal examination of project documents and PPAs. These gaps directly justify the comparative, document-based, and insider-informed methodology set out in Chapter 3.

2.11 The Relationship Between the Literature and the Research Methodology

The methodological choices follow directly from the gaps and patterns identified in this chapter. First, the literature on Sub-Saharan African solar policy is fragmented across instruments (targets, FITs, auctions), contractual practice (PPAs), and enabling conditions (grid constraints, utility structure, institutional voids, and risk). That fragmentation justifies a comparative, problem-driven design that integrates doctrinal/legal analysis of policy instruments and contracts with practice-based project-finance concepts (bankability, risk allocation, and credit enhancement). Second, because much of the prior work is either jurisdiction-specific or instrument-specific, the thesis adopts a synthesis approach: it extracts recurring bankability requirements and 'minimum viable' regulatory/contractual features and then tests those features against the realities repeatedly highlighted in the literature (weak institutions, data constraints, grid unreliability, and political/currency risk). Accordingly, the methodology is structured to (i) review and compare leading policy mechanisms and their implementation conditions, (ii) translate those findings into a

[17] See Portfolio Section], "[Power Purchase Agreement]," §[11.9], pp. [32-33], Where major compliance issues are considered.

standardized suite of bankable documents, and (iii) evaluate explicitly and transparently how those standard forms address institutional voids and reduce transaction costs in greenfield utility-scale PV.

2.12 Original contribution

The originality of this thesis lies in its integration and operationalization rather than the novelty of any single policy instrument. The literature recognizes many of the obstacles individually (e.g., weak institutions, grid constraints, tariff design, and risk), but it rarely offers a coherent, implementable package that aligns policy design with project-finance bankability requirements. This thesis contributes an original, standardized framework that links: (a) macro-level policy prescriptions (targets, procurement mechanisms, utility structure and governance); (b) micro-level contractual architecture, operationalized through the drafted Memorandum of Understanding, Land Options Agreement, Concession Agreement, Implementation Agreement, Government Guarantee, and the core Power Purchase Agreement, supported by the PPA Key Terms and PPA Issues List; and (c) a staged implementation logic reflected in the sequencing of these instruments from early-stage project commitment to full financial close. [18]The accompanying Project Information Memorandum further demonstrates how these standardized documents can be presented to investors in a manner consistent with international project-finance practice.[19]

In other words, the contribution is a practical 'bridge' between scholarship and deployable instruments: it translates recurring findings in the literature into a structured, bankable suite of interlocking documents and implementation steps that can be adopted across multiple Sub-Saharan jurisdictions, while remaining adaptable to local legal systems, grid conditions, and sovereign risk profiles.

[18] See Portfolio §§ 11.6 and 11.7. pp 222 and 231
[19] See Portfolio §§ 11.4 page 190

3. Methodology

3.1 Summary

Chapter 3 outlines the methodological framework underpinning this thesis, which examines whether sub-Saharan Africa would benefit from standardized regulatory and contractual approaches to utility-scale solar PV. This chapter situates research within an interpretive and pragmatist philosophical paradigm, recognizing that energy policy and regulation are socially constructed and context-specific (Creswell, 2018).

This thesis employs three complementary methodologies: Public Policy Methodology, Comparative Case Study Methodology, and Insider Research Methodology. This ensures both theoretical rigor and practical relevance. Comparative analyses of Germany, Spain, Italy, Greece, and to a lesser extent, the United States provide empirical and policy benchmarks for Africa's evolving energy landscape.

This chapter also details the use of secondary data, thematic and comparative analytical procedures, and ethical considerations, establishing a coherent framework through which my thesis findings are later developed and interpreted.

3.2 Introduction

This chapter outlines the methodological framework that underpins this doctoral study. It establishes the philosophical foundations, research design, and methodological tools used to examine the two research questions that guide this study:

RQ1: Will sub-Saharan Africa benefit from adopting a standardized regulatory framework for utility-scale solar PV?

RQ2: Will sub-Saharan Africa benefit from standardized PPAs and associated development documents?

These methodological choices are grounded in the recognition that regulatory and institutional structures are socially constructed, historically situated, and context-dependent. This chapter articulates the ontological and epidemiological assumptions informing the research and demonstrates how these philosophical positions logically lead to the application of public policy methodologies, comparative case study methodologies, and insider research methodologies.

3.3 Research Philosophy

According to Saunders et al. (2023), research philosophy refers to a system of beliefs and assumptions about the development of knowledge. This thesis is grounded in a professional interpretivist and pragmatist paradigm (Krauthanusen et al., 2013). The interpretivist dimension acknowledges that knowledge of regulatory and policy frameworks in sub-Saharan Africa is socially

constructed and context-dependent, while the pragmatist stance allows the researcher to adopt a flexible and experienced based methodology that best answers the practical policy questions posed.

Ontologically, the thesis assumes that reality is constructed through social, institutional, professional, and political interactions rather than existing as a single objective truth (Quine, 1948). Epistemologically, the study accepts that understanding policy frameworks requires interpretation, contextual analysis, and critical synthesis of research studies, regulations, legal documents, and practical interactions between the members of the solar community (Fricker, 2007). This philosophical position aligns with policy-oriented and comparative methodologies that emphasize meaning, context and applied outcomes (Bartunek, 2008).

3.4 Research Approach

This research adopts an inductive and analytical approach that best answers my questions. Induction is appropriate because the study develops conceptual and practical insights from existing regulations and policy frameworks rather than testing a pre-determined hypothesis (Saunders et al., 2023).

The research draws on secondary papers, policy documents, regulations, PPAs, related government and institutional publications, to identify possible commonalities, differences, and patterns across developed countries. The inductive reasoning process allows theoretical generalizations about standardized regulatory frameworks, and PPAs that may benefit sub-Saharan Africa and subsequently answer the two thesis questions (Herrman, 1989).

3.5 Research Design and Methodological Framework

In accordance with the adopted research philosophy, this research integrates public policy methodology, comparative case study methodology, and insider research methodology to create a multi-layered understanding of regulatory systems and contractual structures.

3.4.1 Public Policy Methodology

Public policy methodology provides the primary analytical foundation for examining how governments design, implement, evaluate, and reform regulatory systems within complex infrastructure sectors such as renewable energy. This approach is particularly appropriate for this thesis because both research questions concern the design and institutionalization of regulatory frameworks and contractual instruments, which are inherently products of public policy formation and state–market interaction.

Public policy is not merely the articulation of political intention; it is the structured process through which governments translate normative objectives—such as energy security, climate mitigation, or economic development into enforceable regulatory instruments, administrative procedures, and institutional arrangements (Hill & Hupe, 2014). In the context of renewable energy, policy instruments include legislation, regulatory decrees, tariff methodologies, procurement mechanisms, grid codes, standardized contracts, and administrative approval systems. These instruments collectively determine the degree of predictability, transparency, and investment security available to private capital.

Policy Cycle Framework

This thesis draws conceptually on the policy-cycle framework, which conceptualizes policymaking as a sequence of stages including agenda setting, policy formulation, adoption, implementation, evaluation, and reform (Howlett, Ramesh & Perl, 2009). While acknowledging that real-world policymaking is often non-linear, the policy-cycle provides a structured lens through which renewable energy regulatory systems can be evaluated.

Applying this framework enables the research to:

Identify how renewable energy policies were originally formulated in reference jurisdictions;

Assess how those policies were operationalized through administrative and contractual mechanisms;

Examine implementation gaps between legislative intent and project-level execution;

Evaluate reform processes that enhanced regulatory stability and bankability.

This structured evaluation directly supports RQ1, which asks whether sub-Saharan Africa would benefit from standardized regulatory frameworks. A meaningful answer requires understanding how regulatory systems evolve from initial policy intent toward institutional stabilization.

Institutional Theory and Policy Effectiveness

Public policy methodology in this thesis is further grounded in institutional theory, particularly the concept that formal institutions laws, regulations, enforcement mechanisms shape economic behavior by reducing uncertainty and transaction costs (North, 1990). In sectors requiring high upfront capital investment, such as utility-scale solar PV, regulatory predictability is not merely desirable but foundational to project finance viability.

Institutional theory also highlights that weak or inconsistent institutions increase transaction costs, discourage long-term contracting, and elevate perceived sovereign risk. This insight is particularly relevant in sub-Saharan Africa, where institutional voids may undermine otherwise well-intentioned renewable energy policies.

By embedding public policy analysis within institutional theory, the thesis moves beyond descriptive policy comparison and instead evaluates regulatory design as a determinant of investment outcomes. This strengthens the theoretical foundation of the methodological approach and aligns it directly with the bankability focus of the thesis.

Policy Instruments and Instrument Choice

In addition, the methodology draws on the literature on policy instruments and instrument choice (Lascoumes & Le Galès, 2007; Howlett & Cashore, 2014). Renewable energy regulation is not defined solely by targets or ambitions, but by the specific instruments selected feed-in tariffs, auctions, renewable portfolio standards, tax credits, standardized PPAs, or hybrid mechanisms.

Different instruments produce different risk allocations between state and private actors. For example:

- Feed-in tariffs shift price certainty to the developer.

- Auctions shift price discovery to the market.
- Renewable portfolio standards create demand-side obligations.
- Standardized PPAs reduce legal negotiation asymmetry and transaction costs.[20]

Understanding how instrument choice affects risk allocation is central to answering RQ2, which asks whether standardized PPAs and associated development documents improve bankability. The methodological framework therefore explicitly evaluates not only policy existence, but policy instrument architecture.

Evidence-Based Policymaking and Transferability

This study also draws from the evidence-based policymaking tradition, which emphasizes learning from prior jurisdictional experience to inform future regulatory design (Head, 2010). However, the thesis does not assume simple policy transferability. Instead, it critically assesses whether policy instruments successful in developed jurisdictions can be adapted to sub-Saharan African contexts, particularly in the presence of institutional voids.

Comparative public policy literature cautions against "policy transplantation" without contextual adaptation (Dolowitz & Marsh, 2000). Therefore, public policy methodology in this thesis includes a contextual filter: policies are not evaluated as universally optimal, but as conditionally effective depending on institutional capacity, regulatory enforcement, grid infrastructure, and state credibility.

This layered analysis strengthens methodological robustness and prevents normative bias toward developed-market regulatory models.

Relevance to the Research Questions

The expanded public policy methodology is directly aligned with the thesis's two central research questions:

RQ1: Will sub-Saharan Africa benefit from adopting a standardized regulatory framework for utility-scale solar PV?

Answering this question requires:

- Evaluating how regulatory frameworks reduce uncertainty,
- Understanding how policy instruments shape investor expectations,
- Assessing institutional capacity required for implementation.

RQ2: Will sub-Saharan Africa benefit from standardized PPAs and associated development documents?

Answering this question requires:

- Analyzing PPAs as policy instruments rather than purely private contracts,
- Evaluating risk allocation structures,

[20] See Portfolio §§ 11.9 page 249

- Assessing how contractual standardization interacts with regulatory credibility.

By situating PPAs within public policy methodology, the thesis frames contractual standardization as a regulatory intervention, not merely a legal convenience. This move is methodologically significant and justifies the central analytical position of PPAs in the thesis.

Why Public Policy Methodology is Necessary

Without a public policy methodological foundation, the thesis would risk reducing regulatory analysis to legal comparison or practitioner narrative. Public policy methodology provides:

- A structured analytical lens,
- Theoretical grounding,
- Cross-national comparability,
- Normative evaluation tools,
- And a defensible framework for policy recommendation.

3.4.2 Comparative Case Study Methodology

The use in this thesis of a comparative case study methodology underpins the cross-national analysis of regulatory frameworks and PPAs in Germany, Spain, Italy, Greece, and the United States. These jurisdictions were selected because of my professional familiarity with them, their diverse yet mature renewable energy policy environments and their well-established solar PV markets.

The justification for using comparative research extends well beyond professional familiarity. As Hantrais (2009) and Esser & Hanitzsch (2012) emphasize, comparative methodology is valuable precisely because it reveals how different socio-economic, institutional, and political contexts shape policy formation and implementation.

The selected jurisdictions share important similarities that make comparisons meaningful: all are industrialized economies with established renewable energy markets; each has undergone a multi-stage evolution of regulatory frameworks; all have structured PPAs, tenders, and grid regimes that attract private capital; and all have transitioned from early-stage policy uncertainty toward clearer, more bankable frameworks.

At the same time, they differ in ways that make comparisons useful: Germany and Spain relied early on feed-in tariffs, whereas the United States relies heavily on market-based procurement and tax incentives; Italy and Greece adopted hybrid approaches shaped by EU regulatory oversight and national political dynamics; and the United States exhibits a highly decentralized system with state-specific regulatory variation, in contrast to the centralized models in Greece or Spain.

The comparative approach makes it possible to identify patterns, divergences, and transferable practices relevant to sub-Saharan Africa. Combined with my extensive experience across these markets, it significantly strengthened the utility of this methodology. This comparative lens reveals patterns, contracts, and practices that travel well to sub-Saharan Africa (Bartlett et al., 2017).

Following Saunders et al. (2023), case study research facilitates deep contextual understanding and supports analytical generation rather than statistical inference. Through documentary comparison,

the study extracts principles that can guide the formulation of standardized policy frameworks, and PPAs suited to African regulatory contexts (B2B Industry, 2022).

The analysis of these jurisdictions therefore not only demonstrates my methodological approach but directly informs the two central research questions of this thesis. By examining how established markets structured their regulatory frameworks and progressed from uncertainty toward clarity, the comparative method enables a grounded assessment of whether sub-Saharan Africa would benefit from adopting similarly standardized regulatory models (RQ1). Likewise, the detailed study of PPA design, tendering processes, risk allocation, and contractual evolution across these countries provides the empirical basis for evaluating whether standardized PPAs and associated development documents could enhance bankability and reduce transaction friction in the African context (RQ2). In this way, the comparative case study approach provides both the analytical depth and cross-contextual evidence required to address the thesis's core inquiries.

3.4.3 Insider Research Methodology

The insider research methodology acknowledges the researcher's positionality as a practitioner in the renewable energy sector (Amadeo, 2020). This perspective provides access to a nuanced understanding of the industry's operational, legal, and financial complexities. According to Saunders et al. (2023), reflexivity and awareness of potential bias are critical in insider research. However, insider research also presents distinct challenges, including the risk of over familiarity, assumptions that go unexamined, selective interpretation of evidence, and the potential to privilege professional norms over empirical neutrality. Such positionality may also lead to blind spots, where taken-for-granted industry practices are insufficiently questioned.

To address these risks, the researcher employed multiple mitigation strategies consistent with best practices in insider research. These include triangulation of documentary sources to avoid relying solely on personal professional experience; the use of transparent referencing to ensure that claims are grounded in verifiable evidence; and maintaining reflexive awareness throughout the research process to identify and challenge potential assumptions. In addition, ethical standards were followed rigorously, and analytical decisions were documented to create a clear audit trail. These measures collectively ensure that while the insider perspective enriches interpretation, it does so without compromising analytical rigor or objectivity, thereby strengthening the validity of the policy recommendations derived from the analysis (Vlachtsis, 2008).

3.6 Research Sources and Collection

This thesis relies exclusively on secondary sources, consisting of their qualitative, documentary, and interpretive design. These include government policy papers; both local and European regulatory frameworks; energy laws; development documents, and PPAs from selected countries; research reports from multi-national organizations such as the World Bank, and the International Energy Agency; academic and professional publications (Helmer, 2022). As Saunders et al. (2023) note, secondary data analysis enables researchers to leverage authorities, credible materials to generate insights efficiently and ethically.

3.7 Research Analysis Procedures

Research and data analysis for this thesis followed a thematic and comparative process. Documents were reviewed for recurring concepts, structures, and regulatory patterns. Themes were categorized under such as policy formation, implementation, investor and creditor protection, tariff structures, and legal characteristics (Braun et al., 2006).

I employed comparative synthesis to surface best practices and diagnose gaps between the reference countries and sub-Saharan Africa. In doing so, I explicitly assess how institutional voids (e.g., regulatory capacity, financing channels, data reliability, and enforcement mechanisms) could attenuate or condition the transferability of those practices (Gioia et al., 2013).

The analysis proceeds iteratively and abductively, cycling between theory and practice to refine constructs, testing emerging propositions, and translating insights into actionable, context-sensitive policy recommendations that help answer my thesis questions.

Methodologically, this stance is grounded in interpretivist and pragmatist commitments that prioritize situated meaning making and practical usefulness over universal generalization, consistent with Bartunek's argument for scholarship that bridges theory and professional appreciation (Bartunek, 2008).

3.8 Ethical Considerations

This study involved no human participants, collected no personal data, and did not conduct interviews, surveys, focus groups, or observational fieldwork. All materials analyzed were publicly available secondary sources, including policy documents, regulatory frameworks, academic literature, development finance reports, and contractual templates. Accordingly, the research posed no risk of harm, confidentiality breach, or data protection concerns.

Given the exclusive reliance on documentary and publicly accessible materials, the researcher was able to self-certify the project as complying with the University of Sunderland's ethics procedure. Under the University's ethical review framework, research that does not involve human subjects, vulnerable populations, personal data, or sensitive information may be self-certified, provided that academic integrity, transparency, and proper citation practices are maintained. This study satisfied those criteria. Although no primary human data were collected, ethical rigor was maintained through several additional safeguards.

First, all secondary sources were handled in accordance with principles of academic integrity. Proper attribution and Harvard style citation were applied consistently to ensure intellectual honesty and to avoid plagiarism or misrepresentation of prior scholarship.

Second, the researcher's insider positionality within the renewable energy sector required heightened level of reflexive ethical awareness. While professional experience informed contextual understanding, informal professional conversations were not treated as research data and no findings, quotations, or conclusions were derived from them. This boundary was intentionally maintained to ensure that no unpublished, confidential, or commercially sensitive information influenced the analysis.

Third, particular care was taken when discussing government institutions, utilities, and contractual arrangements in sub-Saharan Africa. The analysis is framed in structural and institutional terms

rather than directed at individuals or specific actors. This ensures that critique remains analytical rather than personal, consistent with scholarly norms and professional responsibility.

Fourth, although some contractual templates referenced in the thesis resemble real-world project documents, no proprietary, confidential, or non-public documentation is reproduced. Portfolio documents included in later chapters are presented as generalized, standardized frameworks rather than as jurisdiction-specific or commercially sensitive instruments.

Finally, the study adheres to principles of transparency and replicability. All claims are grounded in cited documentary sources, and analytical reasoning is made explicit, enabling academic scrutiny.

Considering the above, the research meets the University of Sunderland's ethical standards for self-certified desk-based doctoral research. The absence of human subjects, the exclusive use of publicly available data, and the maintenance of reflexive and professional boundaries collectively ensure that the study complies fully with institutional ethical requirements.

3.9 Limitations

The main limitations of this study arise from its exclusive reliance on secondary data and the absence of primary empirical interviews. While secondary sources such as policy documents, regulatory frameworks, concession agreements, PPAs, environmental studies, and multilateral reports offer credibility, breadth, and verifiability, they nonetheless constrain the ability to capture the lived experiences, tacit knowledge, and context specific insights of key stakeholders. Developers, government officials, utility executives, financiers, and community representatives often hold perspectives that do not appear in formal documentation. Their exclusion limits the depth of interpretive understanding and may restrict the study's ability to fully account for informal practices, institutional voids, negotiation dynamics, or the political economic realities influencing project implementation.

Another limitation concerns the unevenness of available policy documentation across countries. Some jurisdictions publish highly detailed regulatory and contractual materials, while others have fragmented, outdated, or opaque documentation. This asymmetry introduces comparative imbalance and may influence the analytical weight assigned to particular cases. To mitigate this, the study applied triangulation across multiple secondary sources and incorporated iterative interpretation, following Silverman (2020), to strengthen internal validity; however, some differences in data richness inevitably remain.

A further methodological constraint stems from the interpretivist and desk-based nature of the study. Without fieldwork or empirical observation, the analysis cannot directly test causal relationships, measure stakeholder behaviour, or validate how policies function in practice. Consequently, the findings should be viewed as analytically informed interpretations rather than empirically verified causal claims.

Future research directions

As the market matures; in order to address these limitations, future work should incorporate empirical research particularly semi-structured interviews, field observations, or case based ethnographic engagement. Primary data would enable testing and refining the conclusions presented here by capturing the perspectives of regulators, developers, lenders, community leaders, and EPC contractors. Additionally, conducting longitudinal interviews or process-tracing studies could help

assess how policy reforms evolve over time and how institutional dynamics influence project outcomes. Mixed methods designs could combine the strengths of this study's broad comparative approach with richer, context-embedded empirical evidence. Such methodological extensions would significantly strengthen the robustness, external validity, and practical applicability of the findings.

3.10 Chapter Summary

This chapter sets out the methodological foundation for the thesis, grounded in interpretivist and pragmatist philosophies and informed by Saunders et al. (2023). The integration of public policy analysis, comparative case study design, and insider research methodologies provides a coherent, rigorous framework for analyzing the potential benefits of standardized regulatory and contractual arrangements in sub-Saharan Africa's utility-scale solar PV sector (Lora et al., 2010).

These methodological choices are explicitly aligned with the thesis's research questions, namely:
RQ1: Will sub-Saharan Africa benefit from adopting a standardized regulatory framework for utility-scale solar PV?
RQ2: Will sub-Saharan Africa benefit from standardized PPAs and associated development documents?

By structuring the design, data collection, and analytical strategies around these two questions, the chapter demonstrates how the chosen methodologies enable a systematic evaluation of both regulatory standardization and standardized PPAs, and their potential to support more effective, scalable, and bankable solar PV deployment across sub-Saharan Africa.

4. Institutional Voids

Navigating The Intricate Terrain of The Nascent or Absent Institutions, Volatile Macroeconomic Conditions, Political Instability, and Pervasive Corruption

In emerging markets such as sub-Saharan Africa, a unique amalgamation of challenges comes to the forefront, encompassing factors such as nascent or absent institutions, volatile macroeconomic conditions, political instability, and pervasive corruption (Khanna & Palepu, 2010). These distinctive political and economic attributes within emerging and frontier markets are often referred to as institutional voids (Gao & Jones et. al., 2017). One of the most important tactics one can use when investing and or working in emerging and frontier markets is recognizing, working with and or overcoming institutional voids. Institutional voids often can act as significant barriers to successfully navigating the difficult terrain of the development stage when building utility size solar plants in Sub-Saharan Africa. The existence of institutional voids has the potential to escalate transaction costs and capital expenses, as stated by (Giroud, 2018).

Therefore, the result of these potentially increased costs is higher nominal and relative risk for the stakeholder involved in a project. In addition to increased transaction cost, institutional voids can affect when and ultimately if a developer enters a given market (A. Giroud, 2018). It is important to note that institutional voids affect and should be considered by not only investors but policy makers alike. For all stakeholders to be successful in their respective roles, they all must identify, overcome, and ultimately repair institutional voids.

On a practical level, how does one identify an institutional void? How will they potentially affect a project or business? An institutional void can manifest itself in several ways. For example, road conditions in Mozambique, particularly in the north of the country, are extremely poor (Michael, 2006). It's difficult to travel more 200 meters on most roads in Mozambique without encountering large potholes, large cracks, or missing parts of the road (Turner). This will have a strong impact on many businesses. For example, inter alia, a 10MW solar project would require approximately 40,000 solar panels that would be transported on large 18-wheel trucks for potentially thousands of kilometers (Parker, 2023).

Therefore, during the site visits for a feasibility study, road conditions would be analyzed and discussed. Certain potentially excellent sites would be rejected because none of the equipment could be transported because the roads would not hold up under heavy truck conditions. Or if the road conditions were acceptable but the road is only one lane, therefore if used by such large trucks would either completely stop other commercial or pedestrian traffic use or create a safety hazard by not allowing emergency vehicles to use the road.

Other infrastructure gaps, such as low or medium voltage grids lines or in certain areas no grids at all can have an enormous economic and political effect. A country or region without high voltage lines has an institutional void that affects numerous businesses. Heavy manufacturing, large data storage systems, cloud systems, and any other businesses that require consistent, dependable, and high-level electricity use such as hospitals, and science labs would either not be able to exist in these areas or must incur large capital cost over and above cost in more developed countries. This void can and often does have enormous opportunity cost for a country or region.

There are other contributing factors to more institutional voids, for example large information gaps, weak intellectual property rights, lack of economic intermediaries, lack of faith in the legal system, weak or volatile political systems, or high levels of corruption can and often does affect investments in emerging markets (Turner). Hence, investors and policy makers will be required to clarify the potential market failures and analyze how to respond to these institutional voids since they so greatly affect how they interact in each country or region (Turner).

Institutional voids should not only be viewed as a barrier but should also be viewed as an opportunity to be filled or exploited. In terms of energy gaps, the policy prescriptions that I will prescribe will in this thesis, in effect, attempt to fill or exploit certain institutional voids. It's my contention that, in order to be successful, it is imperative for one recommending policy prescriptions for the Sub-Saharan African energy market must be able to recognize, respond to and exploit the institutional voids of the region.

In my attempt to positively add to the policy prescriptions for the solar energy market, I will attempt, inter alia, to consider these many characteristics of institutional voids. In my analysis of policy ideas, I will try to access each policy idea considering the many voids that exist in Sub-Saharan Africa.

5. Power Purchase Agreements

This section is an Exploration of The Linchpin in Renewable Energy Investments in sub-Saharan Africa: The Power Purchase Agreement.

One of the essential ways of increasing foreign and domestic investments in renewable energy in Sub-Saharan Africa is helping make the interactions with government, off-takers and government backed agencies more predictable. Investors, by their very nature, are willing to take risks but want to lower their structural risks by making as many aspects of the investment as predictable as possible. One of the costliest and time-consuming tangential aspects of renewable energy in Sub-Saharan African are the project finance documents. During the development of any utility size solar project, the developer will have to engage with, prepare and or pay for numerous legal documents. Some of these documents will include a facilitations agreement, a government guarantee, an implementation agreement, a concession agreement, a certificate of incumbency, various lender agreements, shareholder agreements, an engineering, procurement and construction agreement, an operations and management agreement and, I would contend the most crucial, the power purchase agreement or, as industry nomenclature would have it, the PPA.

Improving predictability of interactions with government, off-takers and government backed agencies is crucial for attracting both foreign and domestic investments in renewable energy in Sub-Saharan Africa. Although investors are naturally willing to take risks, they seek to reduce structural risks by ensuring predictability in as many aspects of the investment as possible.

However, the project finance documents required for renewable energy projects in Sub-Saharan Africa are costly and time consuming, which presents a challenge. Developers of utility scale projects are required to engage in the preparation and payment of numerous legal documents, such as facilitation agreements, government guarantees, implementation agreements, concession agreements, certificates of incumbency, lender agreements, shareholder agreements, engineering procurement and construction agreements, operation and management agreements, and power purchase agreements (PPAs), which are considered to be the most crucial document in the industry (Energy Central, 2021).

Other than the cost associated with engineering, procurement and construction, the preparation of legal documents is often one of the largest expenses for small, medium, and sometimes large solar projects. Unfortunately, there is, currently, no uniform set of bankable documents used in Sub-Saharan Africa, requiring developers to prepare and negotiate all documents from scratch (Law Library of Congress, 2017). This process can be financially and time-intensive, placing significant burdens on developers and presenting a significant barrier to solar implementation in the region. It is one of the reasons why Africa, despite having some of the world's highest levels of radiant energy, has one of the lowest levels of solar implementation year after year (World Energy Resources: Solar, 2013).

My contention is that the implementation of a uniform, internationally recognized power purchase agreement in sub-Saharan African countries would significantly reduce project development risks. This would not only lower development costs but also increase investment certainly, leading to a rise in the number of small and medium-scale projects on the continent.

The goal of this thesis is not to create a flawless PPA but to examine and emphasize the critical sections required for a PPA to be considered bankable by international multilateral, development

financial institutions, and commercial lending communities. However, in the indices hereafter, I will give an example of a bankable PPA that I drafted.

The positive impact of my role as a participant researcher in this context is significant, especially considering that over the last twelve years, I have been involved in drafting, negotiating, or contributing to the creation of a bankable Power Purchase Agreement (PPAs). This aspect of my job provides me with an insider perspective that might not be as readily appreciated by someone not actively engaged in the field.

6. Navigating Renewable Energy Policy Mechanisms

6.1 Feed-In Tariffs

This section provides an exploration of FITs, a pivotal policy support mechanism with proven efficacy in promoting renewable energy adoption globally.

There are several different policy support mechanisms, or combinations thereof, that can potentially be successfully used in Sub-Saharan Africa. Of the available ones that have been efficacious in other jurisdictions, feed-in tariffs (FITs), have been the most widely used and the most sustainable (Davies & Allen, 2014).

A Feed-in Tariff (FIT), also referred to as an Advanced Renewable Tariff, is a contractual price or rate that an Independent Power Producer is entitled to receive from the off-taker for a predetermined duration. The FIT includes the cost of development, energy production, and profit, as explained by (Motl, 2010).

Fixed duration FITs, also known as market-independent policies, are not reliant on fluctuating market prices, as noted by (Couture & Gagnon, 2009). Each FIT policy is made up of six primary elements, namely: a) open connections, which means that anyone who fulfills the predetermined conditions can connect, b) a guaranteed price, c) the price is contingent upon a specific technology and location, d) designated projects are promoted with premium rates, e) contract durations are long-term, and f) periodic rates review, as outlined by (Couture & Gagnon, 2009).

In many industrial countries FITs have been very effective. The clarity of policy elements has effectively reduced the risk of development, reduced operating risk, and given needed certainty to investors and creditors alike (Kazeem, 2018). Why have FITs been so successful? It is mainly “because feed-in tariffs are empirically proven to promote the fastest expansion of renewable electricity power at the lowest cost. They also do so more simply, transparent, democratic than other schemes for promoting renewable energy.” (Mendoca & Jacobs, 2009), In addition, FITs are performance based, meaning that off-takers pay for the actual generation of power versus paying for equipment installation as in other schemes (Mendoca & Jacobs, 2009).

As discussed earlier, not all renewable energy policies can be successfully implemented in Sub-Saharan Africa due to institutional voids. Therefore, it is important to examine the potential challenges that the elements of FITs might pose in this context. One of the primary features of FITs is that they cover the cost of development, production, and a reasonable profit for the developer, which can often be prohibitively expensive. This issue becomes even more challenging in countries with tight budgets, as they might find it difficult to come up with extra money to pay the developer, especially if they must use hard currencies like the dollar or euro.

Furthermore, the long-term nature of FITs means that they may not always keep up with technological advancements or changes in pricing, which could pose significant challenges for countries without the technical expertise or bandwidth to manage these processes effectively. Industrialized nations themselves struggle with these issues, and thus, it may be nearly impossible for less developed countries to manage these processes efficiently.

If the target capacity caps are either too large or not geographically allocated correctly as time goes on and you have the inevitable increase in capacity, it will create turmoil for the existing grid and therefore destabilize current and future energy supply. The introduction of feed-in-tariffs also carries

the potential to cause substantial disruption within the energy markets they enter, affecting their previous dynamics (Davies & K. Allen, 2014). Grid management is one of the most difficult and sensitive tasks a utility and or energy ministry can undertake. It requires excellent technical expertise, superior management skills, and consistent long-term funding. At the present time all these requirements would be very difficult to accomplish for many if not all sub-Saharan African countries.

Numerous utilities in Africa, despite having highly skilled engineers on staff, grapple with the burden of substantial debt (Mfula, 2018). Conversely, there are others with the requisite financial management expertise but lack the necessary engineering capacity (Turner). Furthermore, large scale solar projects for utilities demand easily dispatchable baseload energy to supplement their intermittent nature. Regrettably, many African nations that predominantly rely on hydroelectric power have faced challenges due to severe droughts, which have adversely impacted the consistency of this required baseload energy (Gabbatiss, 2016).

Feed-in tariffs have been implemented in over forty countries around the world and have been one of the primary reasons for the success of renewable energy markets in German and Spain (Cory, T. Couture & Dreycik, 2009). As a result of the policy successes in Germany and Spain, several countries and many states in the United States have adapted similar policy prescriptions. Nonetheless, as mentioned, FITs present significant challenges. What can we learn from the most successful countries regarding both their successes and their challenges that can sustainably be applied in Sub-Saharan Africa? Conversely, what can we learn from the mistakes that successful and not so successful countries have made?

For this thesis, we should characterize FITs into basic groups; basic feed-in tariffs, tariff differentiation and adjustment and lastly design options for improving the quality of electricity supply (Jacobs, 2016).

As mentioned above, design options for basic FITs have two features, the off taker is obligated to buy all the electricity contracted for and the independent power producer is guaranteed a specific amount of money per unit of electricity (Jacobs, 2016). In addition, the administrator or legislator will designate which technology will be eligible for the FIT benefits.

Germany's successful implementation of the FIT structure began with a modest law in 1990, which outlined the basic format as mentioned earlier (Gesetz fur den, 2012). This law mandated network operators to purchase renewable electricity, provided that it was not produced by a large utility and established incentive prices for those purchases (Davies & K. Allen, 2014. Over time, this law evolved into one of the most sophisticated FIT regimes worldwide, which now spans over 80 pages of administrative law (Jacobs, 2016).

Over time, this law evolved into one of the most sophisticated FIT regimes worldwide, which now spans over 80 pages of administrative law (Jacobs, 2016). The adaptability and evolution of the German FIT scheme have contributed to its remarkable success, they too would need to continuously amend and adopt their regulations, just like Germany did, to create a sustainable FIT regime (Davies &. Allen, 2014).

6.2 Capacity Caps

This section delves into the nuanced implementation of capacity caps, examining their potential impact on independent power producers, off-takers, and their overall effectiveness of renewable energy programs.

As part of any FIT law, many renewable energy policy makers will implement capacity caps limiting the amount of power sold by the independent power producers and bought by the off-takers. These caps can have two possible restrictions; one, the overall energy capacity installed or two, the overall size of the power plants i.e., limiting the megawatt (MW) capacity (Department of Minerals & Energy, 2003). In many countries they will start their programs with relatively small cap sizes and build up from there once they see the effectiveness of the overall program (Okutoyi, 2021).

Germany's 1990 FIT included a program-size cap, (Cory, T. Couture & C. Dreycik,) Germany increased the size of the caps with their corresponding tariff amendments. The 1998 amendment provided additional specifications and extensions to the system-size cap, with the intention of safeguarding transmission system operators, as mentioned by (Cory, Couture & Dreycik, 2009). The German system also included plant size caps that was also adjusted with each progressive amendment (Cory, Couture & Dreycik,2009).

Spain has gone through a similar pattern of progression as Germany has, starting in 1999 with a basic FIT pattern that included program caps and energy payments would cease once the market reached its cap size (Plan de Formento, 2001). The initial laws were relatively rigid as to the technology it applied to but were much more flexible in responding to market demand in between legislative amendments (Plan de Formento, 2001). The In the following 8 years Spain became one of the top two leaders in solar PV. According to (Cory, Courture, and Dreycik, 2009), the significant growth of solar photovoltaics in 2007 and 2008 led to an unplanned legislative modification in 2009. The oversupply of solar PV, surpassing the 2010 target, was primarily caused by a design flaw within the 2007 feed-in tariff legislation. How would countries in Sub-Saharan Africa manage cap size requirements? What can we learn from the fact that even Spain overshot their targets because of design errors? I'll address this in an upcoming section. However, managing energy complexity has not been dealt with well in the region and should be seriously considered when proposing policy changes.

In France, capacity targets and FITs were instituted legislatively in parallel (Panorama, 2018). The FIT mechanism was constructed with technology specific program-size capacity targets (Cory, Couture & Dreycik, 2009). They also instituted not only hard caps but 'soft caps' that were not legislatively instituted but were in effect ranges of cap targets managed by the energy department based mostly on regional demand. As stated by (Cory, Couture & Dreycik, 2009), in the event that the cumulative installed capacity surpasses the technology-specific targets, the government retains the authority to discontinue feed-in tariff payments for new installations or even impose a complete prohibition on the installation of additional capacity France instituted both program size and plant size capacity targets. The overall targets were sufficiently ambitious and adjusted over the years so as not to hinder the growth of the renewable sector (Cory, Couture & Dreycik, 2009). I will discuss capacity caps in more detail later. In theory, it will be a very important part of any FIT program in the region. The main reason being that given the supply demand mismatch and the lack of off-setting baseloads it will be very important for most Africa countries to manage the growth of solar and other renewable energy development.

6.3 Tariff Pricing Methodology

This section examines the challenge of balancing prices to avoid overcompensation yet attract developers and investors for meeting energy targets.

Choosing an economically efficient and sustainable electricity price is a challenging task for countries instituting a FIT. Setting the price too high may be perceived as overcompensating developers, while setting it too low risks not attracting enough developers and investors to achieve the intended renewable energy targets. In Africa, it is also crucial to consider comparable pricing in neighboring countries, as paying significantly more or less than neighboring countries could have economic and political implications (Couture & Dreycik, 2009).

Two general forms of FIT pricing methodologies exist in industrialized countries: value-based and cost based. The value-based method uses either the value to the utility or the value to society as a benchmark when fixing tariffs (Couture & Dreysik, 2009). This method assumes that one kwp of electricity is equivalent to any other kwp source and is based on avoided cost of electricity, where utilities commit to buying electricity at prices equal to or better than the cost of another existing electricity source. The cost-based method only considers the actual cost of underlying technologies (Cory, Couture & Dreycik, 2009).

Germany, France, and Spain, the top producers of PV solar-sourced electricity in Europe, started their FIT policies with the avoided cost methodology. Germany's feed-in tariffs were related to the electricity price for final consumers from 1990-2000, and Spain's FIT law took the avoided cost of electricity sector into account, based on the concept of power generation, transport, and distribution. (Cory, Couture & Dreycik, 2009).

France's FIT laws and pricing methodology combined the long-term avoided cost for electricity generation from conventional energy sources and an extra payment for achieving additional objectives in the field of public services in the electricity sector. France's law used a price calculation of internal rates of return for various solar PV systems (Cory, Couture & Dreycik, 2009).

It is worth noting that these pricing methodologies are relatively complex and require considering various factors, such as regional comparable prices, grid stabilities duration of support, capacity caps, long-term renewable energy targets, financial stability of off-takers, and balancing the importance of attracting enough investors and developers without being perceived as unjustly rewarding the international investor community (Cory, Couture & Dreycik, 2009).

6.4 Charting the Landscape

This section describes Tailoring FIT Rates with Varying Tariffs Based Upon Size.

Another way to determine FIT rates is to establish them based upon total electricity output or maximum capacity of the plant or project. Basic economics tells us that larger projects have cost efficiency, economies of scale, that will, in most cases, allow for lower tariffs and smaller projects will command higher tariffs to be economically viable. Many countries, therefore, determine tariff prices, inter alia, based upon the maximum electrical output of the project.

Germany first instituted tariff differentiation per plant size under their 1990 FIT legislation (BGB1, 1990). Whereas larger plant sizes were awarded smaller tariffs and smaller size plants were awarded slightly larger tariffs. For example, plants that were under 500 kwp had a tariff of 75 percent of the retail electricity price and those plants that were above 500 kwp had a tariff of 65 percent of the retail electricity price (BGB1, 1990). As the industry matured the legislation added different categories with varying corresponding prices.

Spain also offered differentiation based upon plant size (Red Electrica De Espan, 2009). Unfortunately, they started out mispricing the market. Unlike Germany which had a 15.38 percentage difference between plant sized below and above 500 kwp, Spain offered 39.6 €cent/kwp for installations up to 5MW and only 21.6€cent/kwp for larger projects, (BOE, 1998) a whopping 83.33 percent difference. As we learn from Adam Smith, incentives matter, therefore the market chased smaller scale projects and shunned larger scale projects. These price differentials were adjusted over time however they had a significant impact on the market.

Although I will discuss this in a later section directly relating to Africa, I believe price differentials will play an important part in their solar policy. The main reason for this price differentiation in plant sizes is to avoid what would be considered windfall prices and not to create the unintended consequence of having the market focus on one sector of the market to the disadvantage of another (Cory, Couture & Dreycik, 2009).

6.5 Location Tariffs

This section describes Policies with Location-Specific Tariffs.

Most geographically diverse countries have and should differentiate their renewable energy programs based upon location. In any large and geographically diverse country or region, wind speeds, solar radiation and water sources may and will vary greatly. Therefore, polices and subsequent FITs should also vary according to this geography. In addition, various regions in a country will be more urban, sub-urban or rural and their subsequent energy supply-demand ratio may vary greatly. Also, the economies may and often will vary greatly and therefore will also have to be considered when establishing FIT policy.

The process of taking all the above variables into account is determining the ‘quality’ of the location (Cory, Couture & Dreycik, 2009). For instance, northern Nigeria has significantly higher solar radiation than many areas in the southwestern part of the country near the coast. However, the coast has higher wind speeds. There, FIT should be lower for solar plants in the north and higher in the south but higher in the north for wind projects and lower in the south-west due to their varying ‘quality.’ As per the opinion of Cory, Couture & Dreycik, (2009), even with the introduction of location-specific tariffs, projects situated in areas with favorable resource conditions generally tend to achieve higher profitability.

In our example countries, only Germany and France used location specific tariffs; Spain did not. Germany used what they called a yield model or referenzertrags model whereby they considered various location specific conditions and adjusted renumeration based upon the quality of the location (Cory, Couture & Dreycik, 2009). The better-quality location yielded a lower tariff, and the lower quality location yielded a higher tariff. France had a similar methodology based upon the

radiation intensity levels in the various regions in the country. Thus, the southern part of France had lower tariff rates and the northern part, that has much lower radiation levels, had a higher tariff. Given the enormous geographical diversity that is Africa, this policy consideration will certainly be a part of my policy prescription for Africa.

In the table below I have outlined location specific FIT that were legislated in France (Cory, Couture & Dreycik, 2009).

Annual Duration of Operating Time	Years 1-10 €cent/kWh	Years 11-15 €cent/kWh
2400 <	8.2	8.2
Between 2400 & 2800 hours	8.2	Linear interpolation
2800	8.2	6.8
Between 2800 & 3600 hours	8.2	Linear interpolation
3600>	8.2	2.8

6.6 Tariff Price Flexibility

This section presents the mechanisms that automatically adjust FITs at predetermined intervals, dissecting the implications and effectiveness of such a policy approach.

There have been several PPAs and or jurisdictions that have included tariff mechanisms that automatically reduce the FIT at pre-negotiated intervals. In short, FITs start at X price and then are decreased annually by Y percentage. What is the efficacy of this policy? First, on a macro basis it serves as an incentive for the industry cost reduction, second, it gives and incentive for investors and developer to speed up the development process because the sooner the project is connected to the grid the quicker, they can take advantage of the current higher prices (Cory, Couture & Dreycik, 2009). Lastly, gradually lower prices throughout the duration of the PPA helps politicians and other policy makers justify what may be considered high current prices and public pressures not to unduly reward investors and developers.

In 2000 the German government first instituted tariff prices flexibility on various renewable energy technologies including solar PV (Fulton & Mellquist, 2011). The FIT policy sets out to decrease prices annually for the duration of the contract (Fulton & Mellquist, 2011). For the next 10 years there were legislative amendments that both increased capacity targets and adjusted annual prices that continued this policy of flexible prices that linked prices to growth rates (Fulton & Mellquist, 2011). The tariffs experienced a progressive reduction, diminishing at a consistent rate, and this pattern continued in the subsequent years. This is to retain the incentive for manufacturers to systematically reduce production costs and to offer more efficient products every year. The rate of degression is based on the empirically derived progress ratio (from the theory of technology learning) for the different technologies (Held, Regwitz, Resch, Nemac, & Vertin, 2010).

As shown by the table below, as the overall capacity caps increased over time the prices decreased in a corresponding fashion (Cory, Couture & Dreycik, 2009).

Scenarios	MW Installed	Price Decreases
+1GW	3500	9%
+2GW	4500	12%
+3GW	6500	15%
+4GW	7500	21%
+4GW	7500	24%

In 2007 the Spanish Energy Minister wanted to adopt what he called, the German system, whereby FIT prices would decrease during the duration of the contract (Cory, Couture & Dreycik, 2009). The policy proposals took until 2011 to pass and be implemented (Cory, Couture & Dreycik, 2009). As you can see from the table below, price reduction rates coincided with market cap rates increase (Cory, Couture & Dreycik, 2009).

Percentage Increase in MW rates	Price Decrease Rates
5%	2%
10%	3%
15%	4%
20%	5%
25%	6%
30%	7%
35%	9%

The French government began price degression at the same time they instituted their feed-in tariff legislation in 2000 (Lesieur, 2012). At first the plan was not applied to all technologies. It applied to photovoltaics in 2003 with a 5% decrease per year (Lesieur, 2012). By 2011 this flexible degression applied to all technologies and was in full bloom by 2011. The following table illustrates the French flexible degression system (Cory, Couture & Dreycik, 2009).

Demand in MW	Tariff Degression
65MW	9.5%
55MW	7.5%
45MW	6%
35MW	4.5%
25MW	3.5%
15MW	2.6%
5MW	0

6.7 Fixed Price Model-Inflation Adjusted

This section introduces a subsidiary model enriched with the dynamics of inflation adjustments.

Above, we have discussed the fixed rate price model of FIT. A subsidiary of that model is the fixed price model with full or partial inflation adjustments (Couture & Gagnon, 2009). The primary reasons for inflation adjustments in FITs are to shield developers and equity sponsors from the decline in real value of the project revenues and to further encourage investments in renewable energy projects. How are the adjustments implemented? There are some systems that have a pre-established formula that is adjusted annually or semi-annually. For example, Ireland instituted an inflation adjusted program in 2006 whereby the FIT is adjusted per their CPI on an annual basis (Couture & Gagnon, 2009). Another methodology is to adjust only a certain portion of the FIT leaving the balance in the fixed rate price model. Another methodology, used by Spain, is to adjust the inflation index based on their CPI minus a certain number of pre-negotiated basis points (Couture & Gagnon, 2009). Conversely, France has an option that implements an inflation adjustment from 40% to 100% of the base load energy (Couture & Gagnon, 2009).

In most circumstances, long-term investors in projects are paid back their principal anywhere from the 5th through the 8th year of the investment (Turner). Therefore, with inflation adjustments some may contend that they therefore unduly reward the investor in the outer years of the contract. Conversely, using inflation adjusted FITs offers a significate degree of risk comfort to equity sponsors and project developers.

6.8 Front-End Loaded FITs

This section describes a strategic front-loading of rates in the earlier years of the contract.

As the name implies, in this methodology, the price in the nearer years of the contract is higher than the later years of the contract. For example, in 2007 in the United States, the State of Minnesota implemented a policy whereby the first 10 years of the 20-year contract a FIT that was higher than the subsequent 10 years (Draft to City Council, 2019). According to (Couture & Gagnon, 2009), in Slovenia, both tariffs and FIT premiums decrease by 5% following the initial five years of the project's lifespan. Furthermore, they decrease by an additional ten percent below the initial tariffs and premium after ten years.

What are the market advantages of a front-end loaded policy? The policy allows the equity sponsor to pay back the debt in the first number of years with higher FITs when frankly they are most needed. Also, it has the advantage, like fixed FITs, of having predictable revenues. Therefore, the predictability and front-end nature of the methodology reduce the pricing risk for equity sponsors and developers.

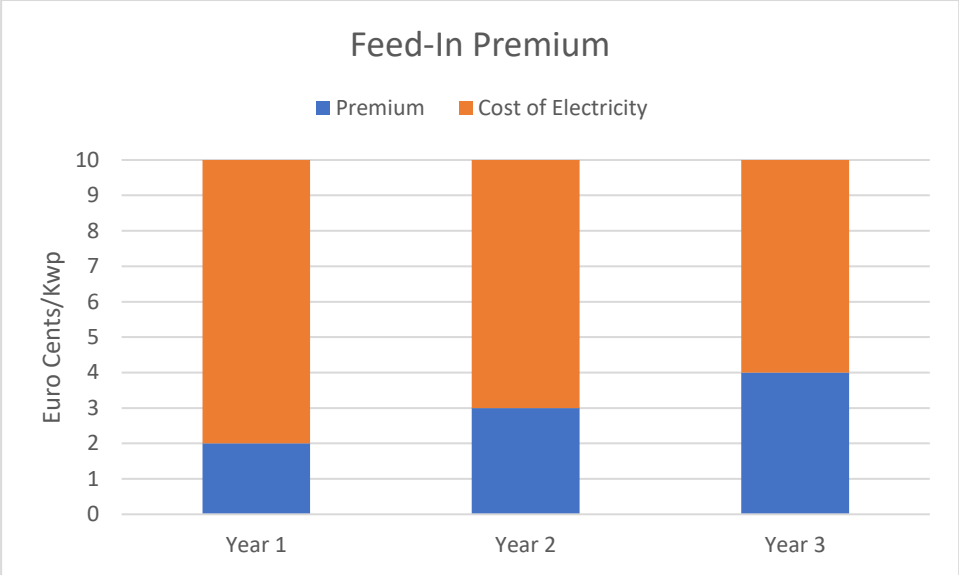
6.9 Premium Feed-in Tariffs

This section describes a FIT policy regulation where price levels are intricately linked to the market rate of electricity.

Premium feed-in tariffs or market-dependent feed-in tariffs offer a bonus above the market rate of electricity. Simply put, your FIT level will move up, down or remain flat, based upon the underlying

market price. What is the rationale behind counties employing this approach? The utilization of this methodology can be attributed in part to compensating for the increased risk involved and partly to the higher probability of disparity between the total remuneration and the actual project cost, as explained by (Couture & Gagnon, 2009). In addition, many market professionals argue that premium-FITs are more compatible with deregulated and competitive energy markets, and they the total payments better reflect electric cost over the life of the FIT contract (Couture & Gagnon, 2009). Lastly, premium FIT reduces the risk for equity sponsors by providing a floor vs. the market cost of energy.

Below is an example of a simple three-year premium FIT that illustrates cost and possible premium levels.



Several countries have given the option of a premium FIT model; Czech Republic, Slovenia, Estonia, Denmark, and Spain. All have been instituted after having a fixed or non-market-based system or in conjunction with a fixed FIT (Couture & Gagnon, 2009). Croatia has followed a similar methodological pattern. They introduced a non-market based, or fixed, FIT in 2007 (Dukan, 2017). Because their FIT was considered low and not attracting enough investors, in 20016 they ended their fixed FIT and introduced feed-in tariff premiums. As per (Dukan, 2017), within this policy framework, the producer is granted an additional premium above the prevailing electricity market price. The specific premium amount will differ across projects, as it is determined through a bidding procedure.

According to (Cory, Couture & Dreycik, 2009), Spain was the first country to pass premium FIT legislation. In 1977, as part of their electricity liberalization, Spain not only allowed Independent Power Producers (IPPs) to sell their renewable energy to the national grids at pre-established FIT rates but also provided an option for them to participate in a premium FIT scheme. This scheme gave IPPs a premium over cost, which was adjusted annually based on market fluctuations in the Spanish electricity market.

Despite the implementation of the premium FIT, only a few IPPs opted for it, and the vast majority chose the fixed scheme. The Spain government made further adjustments to the overall FIT

legislation, the Royal Decree 436/2004, in 2004, which greatly improved the conditions for the premium FIT (Spanish Royal Decree, 2004). As per the findings of (Cory, Couture & Dreycik, 2009), the study highlights that tariffs were raised, a forecast obligation for renewable electricity generation was implemented, and legal uncertainties were effectively resolved.

To account for the societal and environmental advantages of renewable energy sources and mitigate economic uncertainties surrounding renewable generation projects, Spain implemented a premium feed-in tariff (FIT). This approach aimed to reflect these benefits and fostered an attractive market for investors and independent power producers (IPPs), leading to sustained development and investment in Spain's renewable energy sector over multiple years (Held, et al., 2010). As a result, Spain attracted many investors and IPPs to develop and invest in their market for several years.

Overall, Spain's premium FIT scheme, combined with other supported policies, successfully attracted investors, and helped to stimulate the renewable energy sector in the country.

In 2007 in Germany, they begin debating, inter alia, implementing a premium feed-in tariff like the one already instituted in Spain. Their intention was to further incentivize the renewable energy market and attract more domestic and foreign developers. "A later report of the German ministry of environment on improved integration of renewable energies in the electricity sector explicitly envisaged the possible future implementation of a premium feed-in tariff." (Held, Regwitz, Resch, Nemac, & Vertin, 2010:4) The German government subsequently did a few more studies, which culminated in a study done by the Fraunhofer ISI research institute on the design of the plan (Held, Regwitz, Resch, Nemac, & Vertin, 2010). This study became the basis for their plan which was finally implemented in 2011 (Held, Regwitz, Resch, Nemac, & Vertin, 2010).

German FIT policy was implemented in three basic phases; the first phase focused on scaling renewable electricity generation, phase two focused on managing the decline in prices which led to a sharp increase in installations and phase three focused on managing further cost declines, foreign competition in the German market, a sharp reduction of FIT payments and a market premium option (Fulton, 2012). As per this new market premium option, it allowed the IPPs the ability to sell in the general spot energy market and to receive a designated premium (Fulton, 2012). The reference price has two parts, the average market spot price and the premium if any. (Fulton, 2012). The average price is determined by the average price for the previous month's spot price (Fulton, 2012).

The table below illustrates actual average prices for five technologies over a four-year period. The premium declines over time to reflect the decline in transaction cost during those periods.

Year	Onshore Wind	Offshore Wind	Solar P.V.	Other
2012	1.2	0.00	1.2	.30
2013	1.00	1.00	1.00	.275
2014	.85	.85	.85	.25
2015-on	70	.70	.70	.225

Although there are positives to a market based FIT system, it is one of the more complex FIT methodologies to implement legislatively and more so in its market application. To implement correctly and effectively, policy makers must have more than a basic understanding of the mechanics of FITs, and the operations and management ability to fairly monitor the policy on an ongoing basis. I will discuss the above policy complexity and how it relates to Africa in an upcoming section.

In the table below I outline and summarize the development of feed-in tariff methodology (Cory, Couture & Dreycik, 2009).

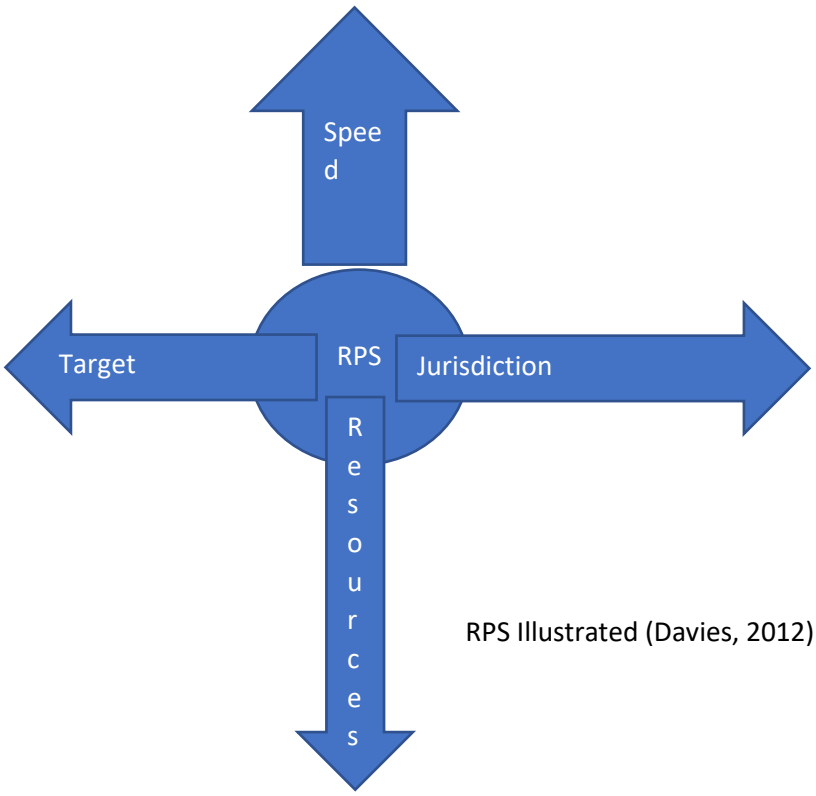
Design Options for Independent Power Producers (IPP)	Design Options to Increase Investment Security	Design Options
• FIT based upon avoided cost. • Support for cost-efficient technologies • Short or long tariff payment duration • Size Suggestions	• FIT calculation base upon IRR • Incentives to increase portfolio technologies. • Technology FIT differentiation. • Long FIT payment duration	• Premium FIT • Forecast obligations. • Demand oriented tariff payments. • Combination of various technologies
Primary Objective • Security of supply • Energy Mix • Framework for IPPs	Primary Objective • Environmental Protection • Increase in the percentage of renewable electricity	Primary Objective • Market integration
Legislation Type • Multiple Model Laws • Pricing Approaches	Model Legislation • German FIT 2000	Model Legislation • Spanish FIT of 436/2004

6.10 Renewable Portfolio Standard: [21]

This section introduces a U.S. focused policy that effectively incentivizes, facilitates compliance and cost effectiveness.

Renewable portfolio standards (RPSs) (et ut; renewable energy goals, renewable energy standards, clean energy standards, quota systems, renewable obligations, and renewable mandates) are macro regulations that require the electricity supply companies and thus off-takers to increase the amount of electricity from renewable energy sources. RPS methodology usually places that burden of regulation on the electricity producers, i.e., utility companies. These utilities earn certificates per unit of renewable energy generated and then pass these certificates along to regulatory bodies as proof of their compliance (Barbose, 2018). Converse to FITs, RPS regulations attempt to generate price competition among independent power producers and thus try to lower relative prices per kwp. Generally, RPS policies have four basic characteristics; they set percentage goals for renewable energy, they specify when those goals must be met, they define what technology applies under the regulation and lastly, they establish an overall structure of compliance (Davies, 2012).

[21] In most Renewable Portfolio Standard (RPS) jurisdictions, project development commonly relies upon Land Lease Option Agreements, PPA Issues Lists, PPA Key Terms, and Power Purchase Agreements, as reflected in the Professional Portfolio Appendices, §§ 11.2, 11.6, 11.7, and 11.9, pp. 177, 223, 232, and 250.



RPS Illustrated (Davies, 2012).

There are many tactical differences to many RPS regimes. Many vary as to technology, i.e., some count solar P.V. and wind but not solar thermal. All jurisdictions that have legislated RPS policy have different types of regulations. Most policies are mandatory, but some are voluntary. All have different percentage targets, and many have different duration targets (Cory, Couture & Dreycik, 2009). In addition, targets vary greatly depending upon practical aspects like their grid capacity, geographical issues, connectivity to electrical sub-stations and population demand. Also, compliance enforcement methods, and reporting all differ depending upon each regulatory regime (Cory, Couture & Dreycik, 2009).

How are policy successes judged? Has RPS been a policy success and if so, why? Is the policy clear? Has the policy helped to increase the nominal amount, on a relative basis and or a percentage of renewable energy? In theory, RPS should be more cost-effective, why? RPS policies generally rely on energy credit systems, also called renewable energy credits (RECs), which usually have a lower cost structure (Cory, Couture & Dreycik, 2009). The fundamental concept behind RECs is to enable companies under an RPS to fulfill their obligations by acquiring credits from facilities that do not require them for compliance. This ensures the utilization of the most cost-effective resources for meeting regulatory requirements and, consequently, reduces policy expenses (Cory, Couture & Dreycik, 2009). RPSs are developed on a percent basis and therefore have a built-in braking system, they usually include provisions limiting their cost, and lastly administrative agencies that supervise RPS systems only must set a target and let the market respond or not which inherently limits administration cost (Cory, Couture & Dreycik, 2009).

Unlike FITs, the quintessential RPS country is the United States. RPS in the United States is primarily a state driven, not federal, policy. The first state to pass and adopt this type of legislation was Iowa in 1991 (Greenstone & Nath, 2019). To date, 29 states and the District of Columbia have adopted mandatory RPS policies and additional seven states have adopted optional standards and applies to 55% of the total U.S. retail electricity sales (Greenstone & Nath, 2019). As mentioned above, all jurisdictions that have instituted RPS policies have vastly different policies tactics for various mainly vastly different strategic reasons. The percentage targets vary wildly; from Arizona and the state of Washington at 15% of their total energy output to Oregon at 50%, California at 60% and Hawaii at

100% of their total energy output (Cory, Couture & Dreycik, 2009). The duration targets also vary wildly; Maryland has relatively short-term targets i.e., five years from now converse to the state of Oregon which has a target of 2040 (Cory, Couture & Dreycik, 2009).

Each state has a designated technology which includes wind and solar to a certain extent, but others may include hydro etc. (Cory, Couture & Dreycik, 2009). What they all have in common is that all "providers must demonstrate compliance with the program through Renewable Energy Credits, or RECs, which certify that a given unit of electricity production qualifies to meet the standard. Most RECs are awarded by various regional authorities encompassing several states, which issue unique serial numbers for every megawatt hour of generation produced by registered generators." (Fulton, 2012:16).

As asked above, has RPS been successful? Largely yes. The penetration of the program has been wide, i.e., mandatory programs in 29 states and Washington D.C., which together account for approximately 62% of the renewable energy electricity generation and an additional seven states have non-binding targets under similar programs (Fulton, 2012). In addition, percentage targets are being continually raised and more states are contemplating similar programs (Fulton, 2012). Conversely, there is little if no evidence that RPS has lowered energy prices (Fulton, 2012). According to the Energy Information Administration's Annual Energy Outlook (EIA, 2019), recent data indicates that solar and wind plants have the potential to generate electricity at approximately six cents per kWh, whereas nature gas combined cycle plant typically generates at approximately four cents per kWh (Fulton, 2012). Most studies done on the levelized cost of energy (LCOE) basis have indicated that there has only been a minimal impact on overall net electricity prices, and some have even found that they have increased electricity prices by approximately 2% (Fulton, 2012).

Additionally, other studies have found that they often overstate their net impact on total generation "because they often include generation that existed at the time of the policy passage," thus skewing the overall electric generation count (Fulton, 2012:16). To date, overall electricity prices are approximately 11% higher in states that have enacted RPS programs (Fulton, 2012). The main reason for the nominal price increases seems to be a mismatch between supply and demand that the policies generate. The policies attract lots of IPPs but limit the supply, thus causing the mismatch. In addition, it also seems that the states are slow to respond to this supply-demand mismatch thus causing further price rises. Below is a table that shows the target details of each mandatory states RPS policies (Cory, Couture & Dreycik, 2009). These targets may change over time but do so slowly and are subject to enormous political infighting that contributes to the supply-demand mismatch.

State	Percentage Target	Target Year
Arizona	15%	2025
California	60%	2045
Colorado	30%	2020
Connecticut	44%	2030
District of Columbia	50%	2032
Delaware	25%	2026
Hawaii	100%	2045
Iowa	105MW	1999
Illinois	25%	2026
Maine	100%	2050
Maryland	50%	2030

Massachusetts	35%	2030
Michigan	15%	2021
Minnesota	26.5%	2025
Missouri	15%	2021
Montana	15%	2021
Nevada	50%	2030
New Hampshire	25.2%	2025
New Jersey	54.1%	2030
New Mexico	100%	2045
New York	50%	2030
North Carolina	12.5%	2021
Ohio	12.5%	2021
Oregon	50%	2030
Pennsylvania	18%	2021
Puerto Rico	100%	2050
Rhode Island	38.5%	2035
Texas	10 GW	2025
Vermont	75%	2032
Washington	100%	2045
Wisconsin	10%	2015

(Cory, Couture & Dreycik, 2009).

Approximately 11 empirical studies have been conducted to assess the overall effects of RPS policies across various renewable technologies (Shrimali, Jenner, Groba, Chan & Indvikm, 2012). However, when considering all the components of these policies, the results vary and present a range of findings. Some studies demonstrate positively significant impact of RPS policies on renewable deployment (Menz & Vachon, 2006), (Yin & Powers, 2010), while others suggest insignificant effects (Carley, 2009) or even a negatively significant impact (Shrimali & Kneifel, 2011), (Shrimali, et al, 2012).

Various studies consider certain RPS features only, for example, compliance payments, renewable energy certificates (REC), unbundling, and geographical effects they generally show positive effects on electricity capacity (G. Shrimali, S. Jenner, F. Groba, G. Chan & J. Indvikm, 2012). Conversely, with other technologies and other micro-policies, the studies don't find a statistically significant effect on overall policies (Shrimali et al, 2012). Despite the adoption of an RPS scheme by over 30 states, there is still a lack of clarity regarding the practical effectiveness of RPS policies as a mechanism (Shrimali, et al, 2012). I will discuss in an upcoming section how this system may or may not be used effectively in Sub-Saharan Africa.

6.11 Bilateral Agreements

Bilateral agreements, also known as over the counter (OTC) agreements, take two basic forms; one, state to state bilateral agreements whereby state, or country, actors sell energy to one another at various border points to help each other smooth out their energy supply-demand mismatch (Raineri

& Franco, 2013). In most emerging and frontier markets, even those with a better than average energy portfolio, still may have regional energy deficits and will enter into bilateral agreements with neighboring countries to fix their energy supply deficits at various transmission points.

These bilateral agreements have been used in various countries for years. In 1965 Brazil and Uruguay entered into their first bilateral agreement whereby each country's state-owned utility would buy and sell hydro produced energy at four different points along their respective borders (Raineri & Franco, 2013). Such agreements are employed to enhance system integration by allowing power producers to adjust their actions based on market price signals, which arise from the interaction of supply and demand (Cory, Couture, & Dreycik, 2009). More recently, "in 2010, Brazilian President Luiz Inacio Lula da Silva signed an energy trade agreement with the President of Peru, Alan Garcia, between the two countries." (Fulton, 2012:18) In essence, this agreement provides mutual energy support for both countries and swap energy between weak and strong points of their respective border adjacent transmission stations.

The second type of bilateral agreements are those between independent power producers and large off-takers, usually, but not exclusively, state-owned utilities. To date, they usually appear when the country in question has not formulated and legislated a formal renewable energy program i.e., FIT or RPS etc. Both parties negotiate an arm's length long term agreement whereby the developer is responsible for the pre-development, financing and building of the project and the off-taker signs onto a 20 to 25-year fixed price agreement (Jacobs, et. al., 2018).

The positive aspects of bilateral agreements are that they can take any form both parties agree to as long as the final agreement is bankable, i.e., can be financed by a third party. There is an inherent flexibility and creativity that allows the agreement to consider the specific geographical, financial, demographic and risk aspects of the country in question. Conversely, bilateral agreements that are not based upon existing legislated policy usually take much longer to develop and finance than using explicit and long-standing policy. In addition, they usually lend themselves to higher-than-average requests for bribery and corruption. This is because of their relatively loose, and unknown structure. Also, bilateral agreements can and often do have higher costs for the developer given that many of the terms of the power purchase agreement have not been agreed upon and concretized in advance of the pre-development and financing stage thus raising the investment risk. Because of the uncertainty, legal costs tend to be higher in bilateral agreements and depending upon the size of the project significantly affects the profitability of the project. Given the flexible nature of bilateral agreements, this tactic will be an important aspect of my suggested policies for Sub-Saharan Africa that will be discussed later.

6.12 Decoding the Feed-in Tariff Evolution

This section explores lessons from European pioneers, analyzing FIT patterns as indicators of future global energy trends.

Before making policy suggestions for Sub-Saharan Africa, it is important to analyze the development of feed-in tariffs (FITs) in major European renewable energy countries like German, France, and Spain. While such progressions may not be the sole determining factor for investors, lenders, or policy makers, they can provide valuable insights into potential future trends.

However, it is crucial to recognize that every country faces unique challenges, such as varying risks levels, geographical barriers, and differing levels of financial stability among off-takers. Therefore, a comprehensive analysis of all these factors is necessary to predict the success of any policy. If done correctly, the analysis of FIT progressions can increase the potential for growth levels over time. There are many factors that go into, or should go to, the final FIT price. The state of California and the country of South Sudan do not, and should not, have the same FIT. There are many risk factors that go into a FIT; internal institutional voids, challenging geography, high levels of corruption, and the ability to finance energy projects, to name a few. In addition, governmental experience and expertise in the energy sector, radiation levels in the case of solar P.V., access to high levels of transportation, grid sustainability, the ability to scale the capacity levels and access to engineers and other renewable energy professionals. All the above factors play a part in the FIT.

In short, the progression of FITs is just the pattern of final prices. There may be periods when this progression slopes upward but that generally will be rare. Historically, in most jurisdictions, the progression of FIT slopes downward, or simply subsequent project installations receive a lower price. The rate and of which will be different in different countries because of many macro and micro factors. Why does and why has this happened? The macro issues really are linked to both the capacity utilization and manufacturing efficiency of the industry. Starting in about 2003 manufacturing capacity of renewable equipment i.e., wind turbines, inverters, mounting stations, and solar panels started to increase drastically (Cory, Couture & Dreycik, 2009). With this increase, the manufacturers developed a scaling efficiency that allowed them to start to lower their prices. This puts pressure on engineering, procurement, and construction companies (EPC) to lower their prices. Seeing this, off-takers therefore put pressure on developers and sponsors to lower their fees and expectations of return. This efficiency went hand in hand with the subsequent increase in production.

In addition, in most years, component prices have also decreased accordingly. Lastly, starting in about the same time, i.e., 2003, projects started to get larger and increased over time. The cost of developing a 10MW project does not increase exponentially if the size of the project grows to 100MW. Therefore, with the increased access to ever cheaper equipment, developers began to develop larger projects.

During the 1990s, Germany witnessed a gradual increase in installed capacity, starting from approximately 1MW in 1991 and reaching 42 MW by the end of 1999. By the conclusion of 2004, the installed capacity had already exceeded the significant milestone of 1 GW, and in the subsequent years, the capacity experienced annual doubling (Cory, Couture, & Dreycik, 2009). In 2009 and 2010 solar P.V. installed capacity doubled, ending the year with 17GW installed (Schwabeneder, Dallinger & Moisi, 2018). As mentioned above, one of the main reasons for the downward sloping of FIT prices is the drastic increase in capacity. Taking the most drastic 10-year progression decrease, from 2004 to 2013 as shown in the table below (Netztransparenz DE, 2015), we see how the German off-taker and therefore consumer benefited greatly from a 69.83% rooftop and 76.82% ground mounted FIT decline. What can be learned from Germany's experience?

Germany, France, and Spain included, benefited, inter alia, from extremely good macro trends; an increase in manufacturing capacity, subsequent efficiencies, and a large increase in supply in equipment and developer activity. On a micro basis, Germany did several things that stimulated their renewable market; they abolished the cap on the share of electricity derived from renewable energy, they began to distribute feed-in tariff benefits evenly to all high voltage grid operators and they no longer linked the FIT to retail electricity prices (Held & Ragwitz, 2010). In general, German regulators

managed their capacity growth and their own renewable energy manufacturing business extremely well that helped their overall growth and helped lead to the FIT pattern we see below.

PV Type	2004	2005	2006	2007	2008	2009	2010	2011	2012
Large Rooftop €cent/kwh	54	51.30	48.74	46.30	43.99	33.00	26.57	21.56	18.33
Ground Mounted	45.70	43.40	40.60	37.96	35.49	31.94	25.77	22.07	18.76
PV Type	2013								
Large Rooftop €cent/kwh	16.29								
Ground Mounted	10.59								

(Held & Ragwitz, 2010).

7. Suggested Policies

7.1 Introduction

The sustainable implementation of any country's renewable energy policy is contingent upon the early adoption of clearly defined rules and regulations that will act as a catalyst to mobilize both the public and private sectors to invest in, develop and complete utility size solar projects. Key elements of any successful solar policy would be to maximize predictability, create an environment of trust, reduce both investment and political risk, and reduce institutional voids. In addition, governments must take into consideration that IPPs and their sponsors should be presented with the ability, on a risk adjusted basis, to be able to adequately predict project cash flows and to provide an environment for an acceptable return on investment (The Republic of Namibia, 2014).

To develop a utility sized solar PV policy framework for Sub-Saharan Africa, I suggest a six-stage approach: starting with demonstration projects and then moving on to implementing feed-in tariffs, renewable portfolio standards, local currency power purchase agreements, tenders, and finally, energy storage requirements.[22] However, it is important to consider the unique challenges that Africa faces when developing such policies.

My main goal is to formulate practical policy recommendations for the development of efficient and sustainable utility-scale PV projects in African countries. These projects aim to boost energy capacity, reduce supply-demand gaps, and stimulate economic growth. To achieve this, I gather insights from European countries like Germany, France, and Spain. However, I acknowledge that direct application of these policies to Sub-Saharan Africa or specific African nations may not be feasible, given the distinctive challenges and variations in infrastructure, institutions, culture, and economies.

Therefore, I will tailor my recommendations to fit each African country and its regions, rather than proposing a one size fits-all approach. By doing so, I aim to provide suggestions that can be carefully adopted and applied to meet the individual needs of each African country, thus facilitating the development of efficient and sustainable utility-size solar PV projects in the region.

7.2 Navigating the Landscape of Challenges

This section describes the intricate relationship between economic, cultural, legal, and social conditions, and its effect on policy considerations.

Effective renewable energy policy, in any country, should always be constructed in the backdrop of the economic, cultural, legal, and social conditions. They cannot and should not be ignored or whitewashed. These conditions and or challenges should be recognized and become an indispensable partner of each law, policy, or regulation. There is often a tendency by policy makers, advisors, and regulators to ignore difficult challenges that place the country in question in a bad light. Why? Because they may think by recognizing it and bring it up in the same context as an ostensibly positive policy that they are insulting leaders and our population of the country. Quite to the contrary. I believe that disregarding or failing to consider it can ultimately prove detrimental for

[22] The legal implementation of the author's policy recommendations is reflected in the Professional Portfolio Appendices, §§ 11.1–11.9, beginning at p. 173.

policymakers or advisors. In essence, neglecting the realities on the ground often leads to ineffective or short-lived policy recommendations.

Why do we need to consider Africa's challenges when suggesting solar policy? Policy suggestion A may work in Germany because it's a good policy, but it also works because fundamental institutions work in Germany. It has excellent roads, efficient ports, a mature financial system, and almost unlimited appetite for better than average debt yields. In short, Germany has very few institutional voids or it has institutional voids that affect different parts of the economy. That same excellent solar policy idea may not work in Mozambique because they have extremely poor roads, inefficient ports, a poor financial system and no internal appetite for above average bond or debt yields. Therefore, policy suggestions would have to be tailored to these challenges, i.e., take into consideration that they would need foreign financing in dollars, foreign technical workers, or suggest building in places that are not geographically undesirable.

When suggesting solar policy in Africa, it is essential to identify and address the significant challenges that arise in the region, many of which stem from institutional voids. These voids manifest as underdeveloped or absent markets, extreme information asymmetry, idiosyncratic bureaucracy, limited or non-existent skilled labor, and inadequate regulatory environments (Chipp, Wocke, Stranberg, & Chiba, 2019). To create effective solar policies, these obstacles must be carefully considered and overcome, fostering an environment conducive to sustainable solar energy development in Sub-Saharan Africa.

Institutional voids can differ in kind, type and degree depending upon the country. Some countries have a lack of mid-level managers, some countries will have insufficient road systems, and in the case of utility size solar energy projects, many will have insufficient or non-existent regulatory systems. All of which increases the cost of doing business in each country. That increase in cost can manifest itself in many ways; for example, the time it takes to register a company in Africa can be multiples of what it would take in industrialized countries (The World Bank, 2022), a regulatory or development process that would take months in Europe would, and often does, take years in Sub-Saharan Africa, and since there can be a lack of skilled professional labor one would have to import skilled workers from outside the country.

The table below compares transaction cost for various business activities between the U.S., Germany, and Nigeria (Khanna & Palepu, 2016:230):

County	Time required to register a Business(days)	Time it takes to build a warehouse. (days)	Time required to enforce a contract (days)	Time required to register property. (days)	Time it takes to start a business (days)
U.S.	6	40	300	12	6
Nigeria	9	350	457	82	34
German	9	100	394	40	18

The lack of adequate physical infrastructure makes it very difficult not only to develop, build and commission a utility size solar field but makes it especially difficult to set policy. In addition, without

proper infrastructure it is extremely difficult for all economic participants to interact and function effectively. It's not only that the country's current physical infrastructure is lacking but the inability to plan is also the problem. Setting policy for renewable energy projects is a decadal exercise and not knowing where, or whether, the independent power producer will be able to transport tens of thousands of solar panels on 18-wheel trucks will hamper even the most modest plans. Therefore, this infrastructure and infrastructure service gap must be considered when setting policy. As per a study conducted by the World Bank, the inadequate state of infrastructure across various regions in Africa has led to an annual reduction of two percentage points in national economic growth and significant decrease of up to 40% in business productivity. Despite Africa's abundance of mineral and other national resources, this has resulted in the region having the lowest productivity levels (Mayaki, 2019).

Geography can be a major hindrance to the economy of a country in general and solar development in particular. "In majority cases, both transit and landlocked countries are developing. Just like landlocked countries, they have poor infrastructures, sluggish administrative mechanism and, most importantly, have no incentive to improve infrastructures for the convenience of adjacent landlocked countries." (Bhattarai, 2019:20). Many countries in Africa have underdeveloped and older port systems. These underdeveloped port systems make it difficult and costly to ship large containers of solar equipment, especially when dealing with large projects. There is a cost efficiency to using very large ships that, unfortunately, cannot dock in many ports in Sub-Saharan Africa. Therefore, most of Africa cannot avail themselves of the cost efficiency of using extra-large ships. Nonetheless, being a country with access to major waterways is a distinct benefit. It allows the country the ability to trade in a way landlocked countries cannot. (Bhattarai, 2019) The economic multiplier effect can be relatively large (Smith, 2020).

Conversely, there are sixteen countries, or proximately one third of the African continent, that are landlocked (Sipangule, 2017). Landlocked countries are negatively affected in many ways. Among Africa's landlocked nations, 14 of them are classified as having a low ranking on the Human Development Index (HDI), which considers crucial factors such as life expectancy, education, and per capita income (Rosenberg, 2019). In addition, landlocked countries often have decreased access to trade, pay higher fuel costs, and are vulnerable to food price volatility (Rosenberg, 2019).

As a solar developer, I have firsthand experience with the challenges that landlocked countries present throughout the entire project development process. One of the most significant issues is the higher transportation costs that must be anticipated, which can increase tariffs as goods must be transported through at least one other country, and in many cases two or three other countries. Additionally, the reliance on neighboring countries adds a level of uncertainty and risk to the projects. Even if relations are currently stable, it is impossible to guarantee that they will remain so throughout the project development and building phase.

This dependency on neighbors can add additional risk in the eyes of both the developer and their financing partners, who must assess and depend on the political stability of not only the host country but also its neighbors during the development and building phase. The resulting added costs and risks will ultimately be passed to the utility, the government, and ultimately the consumer, making it essential to carefully assess the political and economic risks of any project in a landlocked country.

As I write this thesis, I am currently engaged in the development of a co-generation project in (landlocked) central Zambia, which aims to harness both solar and wind power at a same location. As part of the development process, the government utility and the lenders require us to conduct a feasibility study, a comprehensive analysis that considers all relevant information related to the

development, construction, and sustainability of a project. One of the main concerns we face in this project is the feasibility of transporting 20 one-hundred-and-twenty-five-meter turbines, 20 sixty-five-meter rotor blades, and approximately 140,000 solar panels from any port in Southern Africa to central Zambia.

To address this concern and successfully execute the project, we are exploring potential solutions and evaluating transportation options that adhere to both cost-effectiveness and sustainability principles. As we proceed with the project, this transportation aspect will be a critical consideration in the EPC Agreement (that appears in my Portfolio).

The agreement will outline the responsibilities of the EPC Contractor in ensuring the efficient and timely transportation of equipment, as well as the necessary contingencies to address any unforeseen challenges during the process. Additionally, the EPC Agreement will address the coordination and collaboration required between all stakeholders involved, such as logistics partners, local authorities, and suppliers, to guarantee the smooth flow of equipment from the ports to the project site.

By incorporating comprehensive provisions related to transportation logistics within the EPC Agreement, we aim to mitigate potential risks and establish a solid framework for the successful implementation of the co-generation project in central Zambia. This proactive approach will enable us to meet the requirements set forth by the government utility, the second off-taker and the lenders, ensuring the overall feasibility and sustainability of the project.

After conducting extensive analysis and research, we concluded that the equipment will be shipped from China and Europe to the skeleton coast in Namibia and then transported to the site via a 1600-kilometer truck caravan. This transportation route will add significant cost and risk to the project, which will be borne by the developer, equity sponsor, debt sponsor, government, and consumers.

Namibia was chosen as a thoroughfare despite the added cost because it has the best road infrastructure quality in Africa, and there are no significant physical dangers or government instability in the region (Namport, 2022). In contrast, projects that require transportation through countries like Sudan, Libya, or Eritrea are often not pursued due to the high costs and physical risks involved (Schwab, 2019). The opportunity cost to the economies of these countries is likely enormous, although difficult to measure. As a small developer we have turned down at least 10 projects whose reasons partly had to do with geographical issues; landlocked countries, extremely steep and narrow passageways, and site distances far from needed commercial areas.

7.3 Governance

This section unravels the pervasive impacts of corruption and poor governance on society, economic relationships, and sustainable development.

One of the most difficult issues that plagues Sub-Saharan Africa is the issue of corruption. Corruption has an all-encompassing effect on society. It distorts economic relationships, both private and public, it inhibits democracy, it stunts economic growth, it increases inequality, it corrodes the political fabric of society, and it reduces faith in government. “Corruption is one of the greatest challenges of

the contemporary world. It undermines good government, fundamentally distorts public policy, leads to the misallocation of resources, harms the private sector and private sector and development, and particularly hurts the poor." (Bojang, 2017:6). As a developer of utility size solar power plants in Africa, corruption is the most difficult issue that we face. We can overcome technical issues, we can overcome infrastructure issues, and we can even overcome bankrupt utilities and governments, but corruption is the paramount obstacle to progress in Africa. Part of the problem is that it's everywhere: medical care, schools, law enforcement, construction, infrastructure development and every aspect of government from clerks to the leader of the country (Omwega, 2004). The other important aspect of corruption is that it is often cultural which makes it more difficult to eradicate (Husted, 1999). When a country, region or city has been doing business in the same way for generations and does not realize there is something wrong with it, it is very difficult for outsiders to affect cultural change in that society.

In the process of developing, building, and maintaining utility size solar projects in Africa, it is imperative to have at least a decent relationship with at least some if not most of the appropriate government officials. These officials range from local clerks, to engineers, to ministers in various departments to the president or prime minister. Anyone of these people in the bureaucratic process can be a major obstacle to developing and finishing a project in a reasonable amount reasonable time (Kassahun, 2011). One of the problems with corruption in Africa is that when someone has their hands out you do not know who they represent. The clerk may be asking on his own behalf, or he may be asking on behalf of his office manager. The deputy energy minister, whose signature you need on your file, may be asking on her own behalf but she may be asking on behalf of the energy minister himself. And when the energy minister asks, he may be asking on behalf of himself or on behalf of the prime minister. This aspect of corruption makes it extremely difficult to combat, remedy and eradicate (Kassahun, 2011). In addition, if you ingratiate yourself with someone honest, who is willing to cooperate and do his or her job then everyone else in the process assumes you are paying that person and not them, which creates other more difficult problems. The person who thinks he or she is not being paid will become your enemy and your major obstacle to progress and will never believe that you are not paying his colleagues (Kassahun, 2011).

Another major obstacle that retards economic growth and progress in Africa is poor governance. Poor governance contributes to the perception of higher investment risk, reduced faith in elections, and ineffective rule of law. According to the World Bank "there is strong evidence the governance and institutions affects growth performance of the Africa" (Chinqwaramusee, 2016:2). Good and effective governance has several qualities: Accountability, political stability, effective but not necessarily large bureaucracy, regulatory quality, the rule of law and the control of corruption (Chinqwaramusee, 2016). Poor governance in Africa can have the opposite qualities of many if not all the above. What are the causes of poor governance? There are many causes of poor governance in Sub-Saharan Africa. Many researchers blame colonialism for many of the problems in Africa; however I think at this point in history it's difficult to fall back on that excuse (Frankema, 2015).

Peter Hitchcock (1997) contends that post-colonial African researchers often are influenced by theory versus on the ground facts. Many countries in Africa have had independence for decades and some longer (Michalopoulos & Papaioannou, 2020). Cape Verde first gained independence in 1460, granted it is an outlier but most of the other Africa countries started to gain independence from 1947 onwards. Most of whom gained independence in the 1950s and 1960s (Frankema, 2015).

In addition, researchers in post-colonial Africa often explore the complexities of development after independence (Nigusie & Ivkina, 2021). These discussions often provide insights into how historical legacies subside and interact with present-day culture and trends (Nigusie & Ivkina, 2021).

Throughout my extensive travels to Africa, I have had the opportunity to meet numerous government officials ranging from clerks to prime ministers and presidents. Regrettably, in my experience, poor governance is often caused by a combination of factors including incompetence, inadequate incentive structures, ignorance, corruption, institutional voids, and deficient infrastructure. While no single country holds a monopoly on poor governance, some countries exhibit strengths while others struggle with all the aforementioned issues, and very few are effectively run.

Two of the most vexing issues that inhibit the transmission of electricity, and the development of utility size solar projects are grid capacity and the financial management and effectiveness of electric utilities.

In an ideal world public electric utilities function in a regulated market where they are responsible for, extending where needed and, maintaining electrical service to both urban and rural customers (Attia & Shirley, 2018). Conversely, the vast majority of Sub-Saharan African utilities are not properly regulated, have very serious cost recovery issues, and therefore suffer debilitating financial constraints, face unenforced or unfunded mandates, and certainly do not provide universal service to all its potential customers (Attia & Shirley, 2018). In addition, what is called 'last mile distribution' i.e., the transmission of electricity from its source to the last rural customer, is difficult and expensive and therefore either not done or not done well in Sub-Saharan Africa.

The problems mentioned above can clearly be seen in Africa's largest utility. South Africa's Eskom provides approximately ninety percent of the country's electricity supply, is the biggest originator of government debt, and owes its creditors approximately twenty-nine billion U.S. Dollars (Phillip, 2019). Wholly owned by the South African government, Eskom has an oversupply of staff but an undersupply of electrical engineers and technical expertise (Phillip, 2019). In addition, Eskom's operations and management of its plants have been curtailed due to mismanagement and severe financial constraints. Like many utilities in Africa, the management of Eskom is wedged between politics and good governance. Unfortunately, like most state-run utilities in Sub-Saharan Africa, Eskom is insolvent, but politicians have pressured them to keep up certain services and to keep their staff count (Phillip, 2019). A paper sponsored by the World Bank contended that the provision of electricity in Africa faces obstacles due to the financial capacity of utilities to meet the demand and the ability of households to afford electricity services. (Kojima and Trimble 2016), (Blimpo & M. Cosgrove-Davies, 2019). One of the main reasons for the financial condition of most utilities in Africa is that most residential customers are unprofitable. M. Blimpo & M. Cosgrove-Davies, 2019). Utilities find themselves in a challenging predicament where the wholesale cost of electricity remains high, regulated retail tariffs are low, and typical residential users consume electricity at a relatively low rate (Blimpo & Cosgrove-Davies, 2019).

7.4 Grid Systems Overview

This section presents the components of an electrical system, including power generating plants, transmission lines, substations, transformers, and distribution lines.

An electrical grid is a systems network that is comprised of the power generating plant, the transmission lines, the substation, transformers, and the distribution lines (Kehide, 2020). There are two main problems with grids in Sub-Saharan Africa; first, the capacity is well below the ability to supply electricity to the current population and second, the technical robustness of the grid and the operations and management thereof are so poor that in effect it can only supply a small percentage of the current population. Bringing the grid infrastructure to a satisfactory level, along with adequate power generation to meet the continent's demands, will require investments in the trillions of dollars (Jackson, 2015). Regarding the effectiveness of grid expansion in Africa, Grant McDermott, a professor at the Norwegian School of Economics, expressed that large, centralized grids remain the most efficient and economically viable method for electricity delivery in contemporary economies (Jackson, 2015).

The obvious problem is that grids do not extend from the generation plant to rural areas where much of the population lives in Sub-Saharan Africa. The not so obvious problem is where countries have high coverage rates, but the population is not connected to the grid for various reasons. Nigeria is a perfect example. Nigeria has a grid coverage rate of close to one hundred percent, which one would think would mean that everyone has electricity (Blimpo & Cosgrove-Davies, 2019). Quite the contrary, fewer than twenty percent of households report having continuous electricity (Blimpo & Cosgrove-Davies, 2019). The problem ranges from being connected to the grids but being subject to brownouts because the utility is not efficient enough to transfer electricity on a continuous basis to having electrical grids running through the community but not having the households connected to the grid.

Approximately a year ago, this researcher's company developed and financed a utility size, 8.5MW, project in northern Burundi. Burundi has several grid and capacity related problems; the grid doesn't not extend to all rural areas, the maintenance of the grid is subpar, and most importantly the total capacity in the country is only 53MW for eleven million people (Nkurunziza, and Minami, 2020). As a comparison, the State of Israel which has eight million people has an electric capacity of 18,500MW (Haim & Hirsch, 2021). The area where our project is located has a grid location in the local area, however none of the local population is connected to the grid. Therefore, increasing capacity and or maintaining the grid does not help the local population.

These are many challenges that developers, investors, creditors, and policy makers face in their effort to manage and grow solar energy development in Sub-Saharan Africa. As stated above, all these issues should be considered in suggesting or setting energy policy.

My suggested policies for Sub-Saharan Africa regarding utility size solar P.V. projects will be done in seven stages. These suggested stages are the phases that I think African countries should develop and implement their policies. These phases are in order and affirmatively consider all the macro issues and difficulties that have been discussed heretofore. My suggestions are made in the following order so that the policies are built on one another and therefore are developed in a long-lasting and sustainable fashion.

In phase one I will discuss the efficacy of bundled vs. unbundled electricity structures. In Phase two I will discuss and analyze the reasons for having a demonstration project. In phase three I will discuss the implementation of feed-in tariffs. Phase four I will discuss and analyze the benefits of combining feed-in tariffs with renewable portfolio standards. In phase five I will suggest implementing a combination of hard currency and local currency power purchase agreements. In phase six I will discuss the implementation of effective auction systems. In phase seven, I will discuss the effects of

tax incentives on the development of solar power plants and lastly, I will suggest adding an energy storage requirement to their renewable policies.

Understanding Power Dynamics: Phase One; Bundled vs. Unbundled Systems: This section delves into the complexity of Sub-Saharan Africa's electrical systems, highlighting the pivotal shift from bundled to unbundled structures.

Most electricity networks have historically been vertically integrated (Bolle, 2006). Vertically integrated systems, also known as bundled systems, comprises an electrical system whereby the market interactions of purchasing, transmission and distribution of electricity are all bundled, or integrated, into one government owned corporate entity. This corporate entity is also called the off-taker. The off-taker in a bundled system bears all the responsibility for buying, and many times producing energy, transmitting energy, keeping the power plant connected to the grid and ultimately distributing energy to the end user.

Vertically integrated electrical systems are in effect government monopolies. Government monopolies, as we have learned, are not necessarily the most efficient, cost effective or best for consumers. My first stage policy recommendation is for a restructuring reform in Sub-Saharan African countries that would unbundle their electricity networks. Most developed countries have abandoned bundled systems, however eighty percent of Sub-Saharan Africa, largely, still have vertically integrated monopolies (Van't Hooft, 2017).

What is unbundling? Unbundling is a structural, legal, and regulatory reform that involves separating the key functions of generation, transmission, and distribution. There are two types of unbundling: vertical and horizontal.

Vertical unbundling, also called legal unbundling, is the corporate and governing separation of generation, transmission, and the distribution of electricity (Understanding the Electricity Sector, 2019). Horizonal bundling, also called ownership unbundling, is the separation of these three main functions into multiple entities (Understanding the Electricity Sector). These entities can be public, private, or other ownership structures. (Understanding the Electricity Sector)

The restructuring and reform of the many vertically integrated electricity systems in Sub-Saharan Africa countries can have numerous benefits. The main macro benefits of an unbundled system are increased competition, removing conflicts of interest, better corporate governance, better efficiency, and increased transparency. In addition, there is a probability that as integration of generation eases there is usually a decline in the cost of capital which can and usually, because of increased competition, is passed on to the consumer (Pollitt, 2007).

According to Pollitt, (2007), one key benefit of unbundling in the electricity sector is the enhancement of resilience. By involving multiple actors, the diversification of power sources becomes possible, leading to a reduction in risks associated with energy supply. In the event that a generation company faces a power shortage due to mismanagement or supplier problems, the presence of other generation companies allows for compensation, ensuring a more stable and reliable availability of electricity.

A noted American economist, Dr. Thomas Sowell, often says "There are no solutions, only trade-offs." (Sowell, 2022:1). Given this position, which I agree with, I would be remiss in not mentioning the trade-offs or cost of unbundling. One of the possible trade-offs of unbundling is the necessity of

increasing regulatory oversight. Why is this a trade-off? It has been my experience that most Sub-Saharan African countries can't afford, either financially, or as to bandwidth to effectively increase regulatory oversight (M. Pollitt, 2007). The process of unbundling has the potential to raise the initial costs for the government as it necessitates the implementation of new computer systems to effectively coordinate the various separate segments, including transactions (Pollitt, 2007). In addition, initial costs to the government may increase if the transition from vertical to unbundled systems results in smaller transmission, generation and distribution companies who won't command lower cost of capital. During the transition, governments may see some strategic energy assets being sold to foreign entities (Pollitt, 2007). Lastly, when unbundling occurs where the state keeps ownership of all the asset companies you may have an increase in governmental interference in their operations not a decrease (Pollitt, 2007). This potential increase in governmental interference may not help efficiency but may ultimately decrease transmission efficiency (Pollitt, 2007).

The table below is a graphical breakdown of the benefits and tradeoffs of unbundling (Pollitt, 2007).

Category	Possible Benefit	Possible Trade-off
Effect on Competition	Reduces possibility for discrimination of non-government competitors	May facilitate mergers of vertically unbundled transmission assets
Effectiveness of regulations	Improves cost and transparency of the network	May be a need to increase regulatory oversight of transitions
Privatization	May make privatization more competitive	May delay privatization of network when government retains assets
Security of Supply	May increase security of supply	may create information problems between generators and transmitters
Transaction cost of unbundling	If done correctly may reduce transaction cost	May increase cost initially because of the need to have better computer systems
Cost of Capital	Cost of capital may decline when transmission companies get access to cheaper capital	Cost of capital may increase if unbundled companies are smaller and don't have access to cheaper capital
Synergy	Management of unbundled companies may have incentives to improve their businesses	Initial loss of synergy due to smaller company sizes
M & A	Sale of assets more likely and may yield efficiencies	May lead to strategic assets being sold to foreign entities
Government Intervention	Unbundling, particularly horizontal, will likely reduce government intervention	If they only achieve vertical unbundling where the assets stay in government hands, the process may lead to more government intervention not less

As mentioned in previous sections, many European countries i.e., Germany, France and Spain have strong, relatively efficient, institutions, and ample balance sheets. This situation allows them to

reform government sectors relatively quickly or in one stage. Conversely, Sub-Saharan African countries generally have many institutional voids and extremely weak balance sheets, a lack of hard currencies and are rife with corruption. Therefore, in an attempt to be most effective, I want to suggest unbundling in stages.

This approach to unbundling will require extensive policy reform, following by legislation to solidify the required steps. This reform needs to be done prior to its implementation.

Step one in this policy change should be to reform the vertically bundled national utility system into a partial vertical unbundling whereby generation is separated from the combined company of transmission and distribution. Both companies remain government owned entities. This starts the process of competition and is a stage that decreases conflicts of interest.

Step two in this policy change should be full vertical unbundling. In this stage the government still retains ownership but separates the national utility into three companies: a transmission company, a distribution company, and a generation company. This stage paves the way and is a step towards increased competition in the marketplace.

Step three involves enabling the division of the three primary functions of electricity, namely generation, transmission, and distribution, into several separate entities. This division allows for a combination of public and private ownership. According to Understanding the Electricity Sector, (2019), a country with five or six generation companies of similar scale is more likely to face intense competition in generation compared to a country that has only one large and one small generation company. To successfully implement a process of unbundling, significant policy reform is required, followed by regulations to formalize the necessary steps. It is crucial that these reforms are completed prior to implementation. The first step in this policy change should involve partially unbundling the vertically integrated national utility system, by separating generation from the combined company of transmission and distribution, while both entities remain under government ownership.

This stage initiates the competitive process and reduces conflicts of interest. Moving to step two, the government-owned companies: a transmission company, a distribution company, and a generation company. This step is crucial in paving the way for increased competition in the marketplace.

In the final stage, step three, the government should allow for the separation of the three primary functions (generation, transmission, and distribution) into multiple entities, with the potential for public and private ownership. According to Understanding the Electricity Sector, (2019), a country that has multiple generation companies of even size is likely to experience stronger competition pressure than a country that has only one large and one small generation company.

The figure below shows the stages starting from vertically integrated to fully horizonal unbundled (Understanding the Electricity Sector, 2019).

Classification/Stages	Characteristics
Bundled Electricity System	Generation, transmission, and distribution all under one government owned utility
Partial Vertical Unbundling	Two companies; Generation company and transmission-distribution company
Full Vertical Unbundling	Three government owed separate utility companies: generation, transmission, and distribution

Full Vertical and horizontal unbundling	Multiple generation, transmission, and distribution companies both private and publicly owned

7.5 Phase Two: Demonstration Projects

This section presents an understanding of how demonstration projects can play a pivotal role in showcasing institutional capabilities and mitigating risks associated with solar energy policy development.

I would define a demonstration project as one that would demonstrate to international funders, equity sponsors, developers, engineering procurement and construction companies and the public that the country in question has the institutional ability to have a project completed in a timely manner.

A major challenge for governments in developing a sustainable solar energy policy is the reluctance of foreign developers and equity sponsors to enter the market as pioneers due to the significant risks involved.

Although regulations may be considered sound policies that have proven successful in other countries, there remains a significant execution risk. Even with good policies in place, various government stakeholders such as the utility, the ministry of energy, the ministry finance, the executive office, the tax office, or legislators, may poorly execute them. These processes may face delay due to corruption, political infighting, or incompetence, resulting in further complications.

To alleviate execution risk and provide assurance to funders, equity sponsors, and developers that your country is a welcoming and accommodating place to undertake a challenging process, I recommend that each country initiates a demonstration project. This project need not necessarily align with your intended policy. At present, the policy itself is of lesser importance; the goal is to minimize execution risk throughout the entire chain of government engagement.

To be successful, a demonstration project must achieve several important goals. First, the project must be large enough to be representative of your future energy capacity needs. There is no static number. The size of a demonstration project should be different in Burundi then in Nigeria. As of 2021, Burundi has an electricity capacity of approximately 56MW (IEA, 2021), and Nigeria has an electricity capacity of approximately 13,417MW (IEA, 2021). Therefore, a significantly different size demonstration project would be warranted. In addition, given the size of Nigeria, instead of doing one relatively large demonstration project they could do a few smaller projects in different regions of the country.

I believe that the pre-development phase duration is the most critical aspect of the demonstration project. This phase spans from the MOU signing until financial close, while the building phase varies according to project size.[23] For developers, the pre-development phase represents the most significant risk, as capital spent during this time is a sunk cost in case of project failure, which is common at this stage. The length of the pre-development phase directly affects project risk, making

[23] The use of the Memorandum of Understanding (MOU) is reflected in Professional Portfolio Appendix § 11.1, beginning at p. 173.

it essential for the country to minimize it. One way to mitigate this risk is to establish a clear and precise timeline for both parties to complete each stage of the pre-development phase. This approach would enable the country to minimize risk while also providing a structured framework for the project's development.

One crucial objective should be to foster inclusivity when selecting a developer. It's typical for countries to favor prominent and well-funded developers and sponsors, but this is not always the best approach. In sub-Saharan Africa, the pool of well-known and well-funded developers and sponsors is limited, and very well-funded developers tend to focus on large projects where they can deploy significant amounts of capital.

However, the first project in most African countries is usually not substantial enough to attract such developers. It is more critical to complete the project than to have a blue-chip developer involved. Small developers tend to be more willing to take risks and work in emerging and frontier markets perceived as higher risk. In addition, smaller developers are willing to develop smaller projects. Therefore, it is essential to consider smaller developers in addition to larger ones to ensure that the project is completely efficient and with reduced risk.

The fourth major objective is to establish a pricing structure that fully accounts for first mover risk. Unfortunately, governments often prioritize politics over economics when pricing energy projects. An attractive risk reward balance is crucial, particularly for demonstration projects, which are often the first or second of their kind. Negotiations must consider first mover risk, with a focus on completing the project promptly and rewarding the first mover, rather than setting arbitrary pricing that may look good internally. Even if the first project is successful at a higher price, such as $.15/kwp, subsequent projects are likely to be larger and more numerous, with a lower price point of around $.07/kwp. Thus, the weighted average is only slightly impacted, and it is more important to account for the first mover risk in pricing negotiations.

The key goal is simplicity of process. Therefore, instead of conducting their first project through a tender or auction process, the government should strive to establish a bilateral agreement. Depending on the number of demonstration projects, one, two, or three brokers should be engaged through a bilateral agreement, corresponding to the decided number of projects (Tahini & Saab, 2015).

The key should be that the process and steps therein should be clearly stated from the outset and not decided as the process moves forward. For example, see the table below.

Stage	Document or Study	Suggested Time from first contact
1	MOU	0-1 month
2	Land Options Agreement	1-3 months
3	Feasibility Study	3-6 months
4	Grid Study	6-9 months
5	ESIA (Environmental & Social Impact Assessment)	6-12 months
6	Concession Agreement	9-12 months
7	Government Guarantee	12-15 months
8	PPA Power Purchase Agreement	15-18 months
9	Transmission Agreement	18-20 months
10	Interconnection Agreement	20-22 months

11	Financing Documents	22-28 months
12	Financial Close	Month 30

7.6 Phase Three: FIT Policy Implementation

In this phase, FITs emerge as a powerful tool for expanding energy capacity. Here we navigate through key considerations, methodologies, and policy recommendations.

Upon examine the pricing policies of Germany, Spain, and France in the context of solar energy production, one policy stands out as the most effective approach for Sub-Saharan Africa: Feed-in Tariffs (FITs). At this stage, FITs provide inexperienced and resource-constrained countries with the greatest potential to expand energy capacity compared to any other policy. However, these policies must be tailored and combined with other policies to achieve optimal results, which I will discuss later.

When implementing FITs, several issues must be addressed to ensure effectiveness and sustainability, particularly given the backdrop of numerous institutional voids. Therefore, I would recommend using FIT regulations that include capacity caps.

To manage the introduction of intermittent energy sources, Independent Power Producers and off-takers are subject to capacity caps, which restrict the overall energy sold and bought, respectively. These caps can take two forms: limiting the overall energy capacity or setting a maximum size for power plants and MW sold. At this stage, it would be prudent to prioritize a limit on overall size. This is particularly important in Africa, where many utilities are struggling to meet demand and are financially unstable. By starting small and gradually building capacity, the program can be made more sustainable and effective over time. This approach will provide a more feasible path to growth compared to other alternatives (Many electric Utility, 2019).

In addition, by limiting the MW capacity in the beginning of their program, as they grow capacity, they will be able to benefit over time from equipment price decreases. Also, taking this path allows for a more flexible way to respond to market demand or market change. Lastly, balancing the amount of base loan energy with intermittent energy, particularly in places with limited capacity can be very tricky therefore starting off having a small intermittent footprint will be well suited to most African countries.

It is very important for whatever policy is chosen that the countries have a consistent, predictable, and sustainable pricing methodology. The goal in choosing a methodology is to have a price that is economically efficient and sustainable, that is not too high where you distort the market and unduly reward investors but not too low where you risk not attracting the requisite number of developers and investors to make the process sustainable. In addition, it's important to keep in mind the rational pricing of similarly situated African countries. Which means that pricing in Burundi for their first solar project will not be expected to be the same as the 30th project in South Africa.

Therefore, given all the above issues, at this stage I would suggest that countries adopt a cost-plus methodology for FIT policies. What is a cost-plus methodology? You determine the generation cost of a technology i.e., solar P.V. and allow for a reasonable profit on top of the generation cost. Why use this method at this stage? A cost plus methodology is a relatively simple process that can identify a simple factor, i.e., cost and allow for a profit based upon demand and the size and risk of the country

at a particular time. This allows for the cost factor to change as relevant inputs change, and profits change as the risk factors change. All things being equal, both factors will decrease as time goes on.

How are costs determined? The best input to use to determine a fair cost structure is to use; (Simplified Methodology, 2021).

- Total operations and investment cost
- Interest rates
- Full electricity load hours
- Fuel cost (no fuel cost for solar)

Once this cost is determined, it is amortized over the duration of the power purchase agreement i.e., 20 or 25 years. The 'plus' portion of the cost-plus equation is now determined based upon country risk, whether they have done a project in the past, if so, how many projects have they done, the size of their electricity market, and the supply demand mismatch in the country in question. Therefore, the profit portion will not be the same for all countries and all regions.

Given the cost-plus model, I would suggest that each country consider the concept of location tariffs. Most countries in Africa are geographically diverse. Many have coastal areas, some have deserts, forests, low-lined areas, and mountain regions. Several of them are land-locked and some have rainforests. A country like Mozambique has all the above. Therefore, the cost-plus methodology should consider geographical differences within each country. A project in northern Nigeria, where the radiation level is much higher in Lagos on the coast. However, Lagos being on the coast, the cost of transportation will be much lower. These issues should be a factor in determining the cost and profits of a project and therefore will yield a difference price based upon the geographical variable.

The length of the tariff period significantly impacts the project's bankability. The duration of a tariff is as important as its actual price, as highlighted by Davies (2012). Feed-in tariffs with excessively long timeframes may expose eligible producers to windfall revenues, while contract duration that are too short might not provide adequate incentives for market entry. In general, renewable energy tariffs have a duration between ten and twenty-five years. However, in Sub-Saharan Africa tariff durations where the off-taker is the state-owned utility are usually twenty or twenty-five years. Because of the risk associated with Africa most investors want a long enough duration to recoup their initial investment and have a long enough duration of predictable cash flows to make it worthwhile. Even if the investor does not want to stay invested in the project for the full duration you still retain a lot of value with the sale of a twenty-five-year PPA with e.g., twelve years left on the contract.

Another suggested policy relating to FITs at this stage is to have front-end loaded FIT. FIT can, and often is, one price per year for the entire duration. However, front-end loaded FITs are FITs that pay more in the early years than in the later years, i.e.,10c/kwp for the first ten years and .06c/kwp for the last ten years or any variation thereof. The financial reason for constructing a FIT in this fashion is for the investor to recoup his or her face-value investment back in a shorter period. The political reason is for the appearance of a long-term contract to better mirror the expected price decrease of equipment and services that most likely will occur. Thereby allowing policy makers to claim that they lowered energy prices for the consumer. There are extreme examples of front-end loaded FIT whereby they start extremely high and are lowered each year which give the appearance lower prices however the investor uses the net present values of the average price for the duration to calculate their internal rate of return.

7.7 Phase Four: Renewable Portfolio Standards (RPS)[24]

This section discusses the adaptability of RPS regulations, drawing inspiration from successful implementations in the United States.

At this stage I am suggesting that countries institute Renewable Portfolio Standards (RPS) where they mandate regulations that require the country to increase energy production from renewable energy, in this case solar. Practically, the country should mandate load-serving entities (LSEs) to deliver to the consumer, both individuals and commercial entities, to deliver a certain percentage of their energy production to come from solar sources.

RPS have been instituted in several states within the United States and has been one of the main reasons for the success of solar in many states in the U.S. One of the reasons it is successful, and I believe why it will work in Africa, is its simplicity. The regulation could be drafted in one or two sentences and updated easily as they make progress. For example, the state of Montana simply stated.

As per Montana renewable energy law, during each compliance year from January 1, 2010, to December 31, 2014, it is mandated that every public utility and competitive electricity supplier procure a minimum of 10% of the electrical energy sold to retail customers in the state from eligible renewable resources (Mont. Code Ann, 2010).

The state of Rhode Island's mandate is similarly simplistic where it states,

"Starting in compliance year 2007, all obligated entities shall obtain at least three percent (3%) of the electricity they sell at retail to Rhode Island end-use customers, adjusted for electric line losses, from eligible renewable energy resources, escalating, according to the following schedule" (R.I. Gen, 2011:1).

RPS will allow the energy ministry and regulatory bodies to adjust the percentage mandate depending upon their overall targets, their grid capacity, and balance the targeted percentage with their current and targeted baseload energy. In addition, RPS designs can be mapped and scheduled in many ways (Davies, 2001). The mandates can grow and be either simplistic or grow in complexity as the country's energy portfolio grows.

7.8 Phase Five: Local Currency PPA

This section explores how we understand the transition from dollar and euro PPA to local currency PPA that mitigates currency risk for the off-taker.

It has been customary for state-run utilities in Sub-Saharan Africa to sell their electricity to their customers in their own local currency. However, independent power projects are mostly financed in either U.S. Dollars or Euro (Swaay, 2013). This reality creates a potential currency risk for the off-takers that often keeps them from agreeing to large solar projects and thus inhibits the use and growth of renewable energy. An example of this situation is the relationship between the Kenyan

[24] In most Renewable Portfolio Standard (RPS) jurisdictions, project development commonly relies upon Land Lease Option Agreements, PPA Issues Lists, PPA Key Terms, and Power Purchase Agreements, as reflected in the Professional Portfolio Appendices, §§ 11.2, 11.6, 11.7, and 11.9, pp. 177, 223, 232, and 250.

Shilling (KES) and the U.S. Dollar. Between 1990 and 2013 the KES has lost approximately 400% (Swaay, 2013).

According to Swaay (2013), the dependence on foreign savings to fund infrastructure development in Africa leads to a detrimental exchange risk. The reasons for this situation are that both local debt and equity markets have not been robust enough to finance these projects and have not had the appetite to consider project finance investments. However, I believe in many countries this situation is changing.

If the previous four phases are implemented, I believe the risks would be lower in a requisite amount to be able to accomplish this important task. My policy suggestion is for public utilities to start by engaging IPPs to sign part dollar, part local currency contracts in order to start the process of having full local currency PPAs. I believe over the course of a few years they would get into a situation of full local currency PPAs. I suggest this for several reasons.

The first reason that I think it is now possible is that domestic investment and savings institutions are now reaching a capacity where they can invest significant amounts of money in project finance. Second, there is a wider availability of sovereign credit ratings for many African countries (Swaay, 2013). Third, unlike in the past, many multilateral institutions are now issuing debt in local currencies (Swaay, 2013). Fourth, there are many currency specialists who are now providing hedging facilities for many African currencies. Lastly, specialized institutions are now providing guarantees for local currency lending that will partially protect the equity sponsors and developers.

7.9 Phase Six: Auctions

This section introduces the utilization of successful auction policies to efficiently drive renewable energy projects.

At this stage of a country's energy development, it is my opinion that they should be able to implement successful auction policies. The widespread use of auctions in renewable energy projects is relatively new. By 2009 there were only nine fully implemented auction programs (IRENA, 2013). Two years hence the number had increased to twenty-one, and by 2013 the use of auction for renewable projects had been used by forty-four countries (IRENA, 2013). As of 2018 the use of auctions reached nearly 67 countries (Patel, 2018).

There are three basic types of auctions that are used for solar projects.

- Sealed-Bid Auctions: During these types of auctions all the power producers submit their bids simultaneously that include a particular price and quantity. Most importantly none of the bidders know the price of the other bidders (Patel, 2018).
- Descending Clock Auction: In this type of auction, the auctioneer makes public a price for a certain amount of energy desired. According to Patel, (2018), the bidders submit bids based on their desired quantity that they wish to subscribe for. The auctioneer lowers the price until both price and quantity are perfectly matched.
- Hybrid Auction: This type of auction is done in two phases. In the first phase they use the descending clock auction and in the second phase they use a sealed auction. The main purpose is to make use of the advantages of both types of auctions (Patel, 2018).

The main aspirations of auctions are to achieve the best value for the public and reveal the real market cost of an individual project by:

- being transparent.
- being methodological.
- encouraging fair competition.
- achieving equal and fair opportunity to auctions.
- inviting participation of stakeholders.

According to the European Commission (2013), a properly structured auction has the potential to foster strong competition among bids, which in turn reveals the true costs associated with individual projects, promoters, and technologies. This approach promotes cost-efficiency in determining support levels and minimizes the amount of support required.

In its simplest form an auction/tender begins by inviting two or more potential developers to a process which has an open bidding function, but where each individual bid is held in confidence; thus, incentivizing competitive pricing. The usual format allows for the announcement of the total capacity desired, the expected location, the nearest transmission station and where the off-taker selects enough bidders to satisfy that capacity.

On a macrolevel, to have a well-designed auction, the off-taker or government entity needs to balance several competing elements and consider several policy tradeoffs. The design elements and policies may encounter, and must overcome or manage, some or all the following issues.

- Demand: The design should consider how much demand they may engender by whatever specific auction policies are put forward. The tender should want to attract a requisite amount of demand but not completely overwhelm their ability to service said demand.
- Qualification requirements: The barriers to entry need to be structured to encourage healthy competition and discourage underbidding which will distort pricing (Climate Action, 2018).
- Selection Process: There is a considerable balance that needs to be achieved by keeping the overall tender process understandable, transparent, and making sure that the government's main objectives are achieved by the auction (Climate Action, 2018).
- Balancing Risks: The auctioneer must balance their own risk of the auction and the perceived potential risk of the power producers. Thereby helping to generate interest on behalf of the power producers.

Price Competition: There will be the need to balance the requirements of the auction participants so as not to unduly favor larger, more well-established, and better capitalized power producers over smaller firms who may be more desirous to work on smaller projects in frontier countries. One of the most important aspects of developing and negotiating an effective auction system is planning stakeholder participation. Depending upon the type of government, the size of the project, the location of the project and the amount of demand desired, getting the desired stakeholder participation is of considerable importance.

Proper stakeholder participation can strengthen the process and result of the auction and contribute to the goals of the auction in many ways by:

- Establishing by-in on behalf of other government ministries. In complicated renewable energy projects, participation and affirmation of many government agencies is essential for the success of the project. The finance ministry, the energy ministry, the environmental

ministry, the federal reserve, and the import-export ministry, or department, are all stakeholders and must be managed and brought into the process at the earliest possible time,

- Informing the local community of the potential project and its possible effect on the public,
- Enhancing transparency to all stakeholders including the energy producers, government agencies, and the public,
- Build trust and collaborate as much as possible with all relevant stakeholders at the proper time during the development process,
- Establish a transparent process that provides clear and complete information for all stakeholders to properly assess the credibility and reliability of the results. In addition, to disclose the process and procedures of the auction to all the stakeholders (Climate Action, 2018).

What is the best auction for most Sub-Saharan African countries to begin with? What are the best characteristics to use? What are the best methodologies to implement?

Considering the institutional voids that exist in many If not all sub-Saharan African countries, simplicity of policies and implementation are the key to success.

The first stage of any successful auction policy is that it is based upon an acceptable and widely recognized law or regulation. The regulation should be clear, simple, and understandable by all stakeholders.

The methodology that should be used is a sealed-bid auction. This type of auction is best used because it is relatively simple to implement and is the best method, because of the bidder's anonymity of price, to shield against corruption. There are two types of sealed-bid auctions; first price or pay as bid auction (Climate Action, 2018). First price auction types are used for single technology auctions therefore it is the only type that should be used here.

Who should be the auctioneer or authority in charge? In most Sub-Saharan African countries, the best person to implement and run the auction is the regulator. The energy regulator oversees both implementing energy laws and regulations and supervises the regulations once they have been implemented. In addition, the regulator is best placed to be the auctioneer because she stands between the energy ministry, the utility, and the independent power producers.

Auction policy should set out the following characteristics.

- Volumes auctioned: The policy should clearly set out the amount of MW desired. The balance here should be between the amount of energy needed to full short and medium demand growth and the intermittent of solar energy and its effect upon the grid.
- Time period installed: The policy should designate how much of the desired MW is to be implemented each year.
- Authorities in Charge: The ultimate authority should be the Minister of Energy, and the auctioneer should be the CEO of the regulator who would be responsible for the design and implementation of the auction.
- Selection Process: The selection process sets out pre-requisites such as having an environmental license, grid access, completing a feasibility study etc. This process, like everything else, should be clearly understood.
- Bidding Procedure: This characteristic will spell out the type of bidding i.e., sealed bid, descending clock auction etc.

- Duration of the Tariff: Most utility size projects have a tariff duration of twenty to twenty-five years. In my opinion the first auction policy should be twenty-five years given the desire to make it attractive as possible for power producers.
- Financial Deposits: The auctioneers should set modest deposits at every stage of the auction. The deposits should not be too large to make it impossible for smaller developers to participate or too small to make a difference. The purpose of the deposits is to only attract relatively serious participants.
- Phases: To keep the auction as simple as possible a two-phase selection process will be the most efficient. The first phase should be a pre-qualification phase and then a second phase being an evaluation phase based mostly upon price (Climate Action, 2018). The objective of the two-phase process is to create an opportunity to select power producers with enough experience and financial wherewithal to reduce the risks that might upend a successful implementation process (Climate Action, 2018).
- Compliance: Compliance in this context is done in two ways; a) setting up a system that is compliant with i.e. the Foreign Corruption Practices Act of the United States (15 U.S.C. ch. 2B § 78a et seq) or the (U.K. 2010 Bribery Act), and b) setting clear standards that spell out when developers will be excluded from the process and when contracts, once achieved, will be terminated.

7.10 Phase Seven: Tax Incentive Policies

This section introduces the strategic implementation of tax incentive policies to catalyze investment and enhance the bankability of utility-sized solar projects in Sub-Saharan Africa.

Tax deductions and tax incentives for solar energy are designed to increase investments and development of solar installations. They are also used to improve the financial bankability of renewable energy projects. “Tax incentive policies can be effective when linked to the generation of electricity and not just the installation of capacity.” (New Climate Institute, 2019:13).

Engineering procurement and construction (EPC) costs usually account for approximately seventy to seventy five percent of the total project capex, and total tax cost ranges from ten to twenty percent of EPC cost (Turner, 2021). Therefore, applying tax deductions and incentives, inter alia, to EPC components will be effective in incentivizing the investment in solar projects. In addition, applying tax incentives and deductions to indirect tax portions of a project will also greatly affect the investment in solar projects.

What are some of the possible tax incentives and deductions that can be effective in helping to increase the investment and bankability of utility size solar projects in sub-Saharan Africa?

- Corporate Income Tax Incentives: Tax incentives that provide tax deductions for a corporation that invests in and receives profits from solar energy power plants will help to increase solar investments. As an illustration, Belgium offers an enhanced corporate deduction that is specifically applicable to the profits of the taxable period in which newly acquired or established assets are involved, as stated by (KPMG, 2015). In China the average corporate tax rate is fifteen percent. The tax authority in China established a three-year exemption of corporate income tax followed by a fifty percent reduction for an additional three years of the average rate that only applies to renewable energy projects (KPMG, 2015). In addition, it is important to have a mechanism where if deductions cannot be off-set by

profits each year, i.e., profits are not large enough for the deduction, then the losses in the form of deductions should be carried forward (KPMG, 2015). Tax loss carry forwards can be very effective in utility size solar projects can be very effective given that most solar projects usually have less profits, and a lower investor rate of return, in the first two to three years than the later years (IFC, 2015). Being able to carry the losses forward to later years can help make the project more bankable.

- Value Added Tax (VAT): VAT is a pure consumption tax that is applied, and paid for by the purchaser, at various stages in the supply chain. In theory, VAT could apply to all the goods and services of a solar power plant. There are various methods that can be applied to incentivize investments in solar projects. The standard VAT rate in China is 13 percent (Dezan Shira, 2019). China has a program to increase investments in solar by establishing a "50 percent refund of VAT is paid on the sale of self-produced PV power," during a designated time (KPMG, 2015:16). The Republic of the Philippines has a VAT rate of 12 percent (Bureau of Internal Revenue). To increase the investments into renewable energy they enacted a policy that "the sale of fuel or power from RE sources shall be subject to 0 percent VAT. All RE developers are entitled to zero-rated VAT on purchases of local supply of goods." (KPMG, 2015:16). The policy has been an effective incentive because it has been applied from the pre-development process, building and sale of energy (KPMG, 2015).
- Accelerated Depreciation: Depreciation is a method whereby the cost of an asset is allocated and deducted on your taxes over a certain period. Given the time value of money, the shorter the time period of depreciation the more valuable the depreciation schedule will be for the investor. There are several countries that have accelerated depreciation policies as applied to solar energy projects. The applicable methodology that is used is called the written down value (WDV). In short, WDV is the periodic depreciated value of an asset for a set period. The salient examples, as they apply to solar projects, can be seen in India, France, Mexico, The Philippines, Italy, and the United States (KPMG, 2015). The WDV in use in most countries ranges from 4 to 80 percent. For example, in Mexico "Investments in machinery and equipment for the energy production derived from renewable energy will be fully depreciated in a 12-month period." (KPMG, 2015:16).
- Ad Valorem Tariffs: An ad valorem tax is a tariff on a specific unit or amount of the value of a hard asset or commodity imported into a country (Lockwood, 2000). The problem for solar energy producers in Africa is the way most of the tax laws are drafted in sub-Saharan Africa. Currently, ex-South Africa, there are very few installed utility-size solar systems and yet the tax policy has not caught up to the stated goals of their renewable energy policies. Therefore, the ad valorem taxes range from zero to 2.9 percent with few exceptions, none of which apply to solar components (World Tariff Profiles, 2019). This requires independent power producers to negotiate tariff exemptions on each component every time they develop a project. It has been my experience that exemptions can be attained but it lengthens the time of the development process and adds to the cost of the project.
- Tax Holidays: A tax holiday is a policy whereby some or all the taxes related to a power plant are instituted for a period. The purpose is to incentivize development and investments in solar installations. In India, they have offered a 10-year tax holiday for renewable power plants whereby no taxes are paid on any energy generated from the plant (KPMG, 2015). The plants are obligated to pay a minimum alternative tax, approximately ranging from 20.4 to 21.4 percent based on their income. However, this tax can be balanced and spread out over a span of 40 years (KPMG, 2015). Some tax holidays are driven from the top down i.e., policy or regulations set by government agencies and some tax holidays are negotiated bi-laterally

between the developer and the government (Turner, 2021). The Philippines has instituted a tax holiday that exempts income from taxation for the first seven years of the project (KPMG, 2015). Any additional investments into the project are also entitled to additional income tax exemptions that "do not exceed three times the period of the initial availability of the ITH." (KPMG, 2015:16).

- Investment Tax Credits tax credits allow the investor of the solar installation to deduct a certain percentage of the cap ex from their overall taxes. For example, if the total cap ex for the field is ten million dollars and the allowed tax credit is ten percent then the investor would owe one million dollars less in taxes the following year. The policy should explicitly state which expenses can be claimed. In addition, many jurisdictions institute a step-down clause. A step-down clause lowers the value of the tax credit over a stated period of years i.e., the first year the tax credit is ten percent, the second year is eight percent, the third year is six percent and the four years on the credit is zero, i.e., stepping down in value. The United States has a very successful tax credit policy called the Investment Tax Credit which is based upon the Energy Policy Act of 2005 (119 Stat. 594). The U.S. policy allows the investor to exclude twenty six percent of the total cost of project cost (which includes equipment, permitting and installation) cost (Taylor-Parker, 2019). The is a step-down clause whereby in 2020 the investor gets to have a tax credit of twenty six percent, in 2021 a tax credit of twenty two percent and zero thereafter (Taylor-Parker, 2019). In addition, the U.S. tax credit policy allows the following expenses to be credited; all solar equipment, freight shipping, consulting fees, professional installer fees, electrician fees, engineer fees, tools used for the project that are bought or rented, permitting fees, wiring, screws, bolts, nails etc. (Taylor-Parker, 2019). Correlation is not causation however, since the solar investment tax credit has been instituted in the U.S., they have had fifty-two percent average annual solar instillation growth.

7.11 Phase Eight: Electricity Storage

This section explores how solar energy policy evolution in Africa leads to electricity storage solutions, addressing solar energy limitations.

Solar energy policies that have been developed through the last seven stages will be able to deliver to a Sub-Saharan African country a reliable, secure, and affordable energy market. This last stage will help to reduce volatility in energy prices and reduce the country's reliability on fossil fuels. This last stage of energy transition should require, to some extent, the use of electricity storage. Several market insiders are of the opinion that electricity storage will become one of the central facilitating technologies in the upcoming energy transitions (IRENA, 2017).

Simply, electricity storage from solar arrays works by using batteries and other storage technologies that are used to store unused electricity for later use when solar systems are not working. Thus, further balancing the supply and demand of energy production. There are several types of storage technologies that can be used. The table below shows the main types of storage technology (IRENA, 2017).

Technology Type	Sub-Type

Electro-Chemical	Lithium batteries, flow batteries, sodium-Ion batteries
Pumped Hydro Storage	Closed-loop storage hydroelectricity storage
Thermal Storage	Chilled Water Thermal Storage, Concrete Thermal Storage, Heat Thermal Storage, Ice Thermal Storage
Electro-mechanical	Compressed air Storage
Chemical	Hydrogen, and Liquid air storage

The aforementioned five storage technologies encompass nearly all the types utilized in utility-scale systems. Among these types, pumped hydro storage (PHS) systems currently account for approximately 97% of the total installed capacity of electricity storage systems, as stated by (IRENA, 2017). In addition, there are three basic duration types of storage: short-term, daily, and long-term storage (IRENA, 2017). The table below outlines the three types and shows a description of the duration choice (IRENA, 2017).

Duration	Description
Short-term Storage	Short-term in this context means that processing and discharge last no longer than five minutes. Short-term storage is usually via electricity storage systems, mechanical flywheels, and superconducting coils.
Daily Storage	Daily storage means several minutes to several hours. Daily storage is used with pumped hydro or compressed air storage.
Long-term	Long-term means periods of weeks to months. Usually with gas storage, mechanical storage or pumped hydro storage

The use of energy storage has the potential to transform the energy market by allowing renewable energy sources to be used in the same way as fossil fuels. In regions like Sub-Saharan Africa, where diesel fuel is widely used despite being expensive and environmentally harmful, energy storage can also help to lower the average cost fuel consumption. For example, for state utilities in these regions, the ability to generate and store solar energy during the day for use at night would be a game changer. However, many African state utilities are financially unstable, making it difficult to finance large-scale energy projects. Even if they were able to secure financing, high borrowing rates would make these projects unviable. By enabling greater use of renewable energy and reducing carbon emissions, energy storage has the potential to provide long-term cost savings for these utilities.

Lastly, the synergies between the seven previous policy phases and storage, if done correctly, will give each country the ability to better manage their supply demand ratio, their overall energy growth, their grid management, and the ability to slowly reduce their reliance on fossil fuels.

7.12 Phase Nine: Risk Management

This section underscores the importance of risk management in solar project development in Sub-Saharan Africa, addressing challenges such as environmental hazards, institutional weaknesses, corruption, violence, infrastructure issues, and political instability.

Effective risk management is essential for solar project development in Sub-Saharan Africa, and it should begin before any funds are allocated or resources are committed. With over thirty-five years of experience as a finance and development professional working across four continents, I believe that Africa, in many ways, presents more risk factors than any other region in the world. The risk includes environmental hazards, institutional weaknesses, corruption, higher incidence of violence, infrastructure challenges, and political instability. To succeed in solar project development in Sub-Saharan Africa, stakeholders must carefully assess and mitigate these risks at every stage of the project lifecycle.

What is risk management? The classical business school definition of risk management is the identification, assessment, and control of said risk to its effect upon an enterprise, organization, or partnership (Kaplan & Mikes, 2012). There are various general kinds of risk; internal risk, external risk, strategic risk, preventable risk, political risk, and the risk of a black swan event (Kaplan & A. Mikes, 2012). With that said, the practical application of risk management in solar development, if done well, is to soberly assess and manage each stage, the research stage, the feasibility stage, the development stage, the building stage and the maintenance and operation stage. Each stakeholder i.e., the developer, energy ministry, utility, finance ministry, equity sponsor, and lender, will attempt to manage and mitigate their respective risks.

In practice, managing risks involves shifting them onto one or more of the other stakeholders involved. However, it is important to note that each stakeholder also aims to transfer their own risks onto the others. Thus, the act of transferring risks back and forth between stakeholders is a form of risk management. For developers, mitigating potential risks means relying on stakeholders with whom they must maintain a functional, if not positive, relationship. Ultimately, this balancing act of transferring risks between parties is a critical aspect of effective risk management.

For developers, every dollar spent represents an increase in financial risk, as it raises the opportunity cost of not investing that same dollar into a potentially more profitable project. Pre-development costs, or parts thereof, are usually reimbursed upon the financial close of a project, but failed projects, those costs represent a sunk cost. As a result, developers are the only stakeholders who bear the hard cost outlays during the pre-development phase. In contrast, other stakeholders are primarily concerned with managing the risks associated with time and future financial uncertainties.

Therefore, there is an inherent conflict of interest and incentives during the pre-development stage. Developers want to spend as little as possible to mitigate their financial risk, but make as much progress as possible, and the other stakeholders either don't care or want the developers to spend as much as possible to prove they are serious about the project.

Whether they know it or not each stakeholder represents or behaves in a way that represents a particular legal theory of risk. According to Professor Calabresi of Yale Law School, there are several legal theories regarding the distribution of risk (Calabresi, 1961).

There are three major legal theories of risk that can be applied to the stakeholders in a utility size solar project in Sub-Saharan Africa: Enterprise liability, spreading of losses justification and the deep pocket theory.

Enterprise liability is the legal liability concept, in its broadest terms, whereby losses that are created in society or caused by an entity should be borne by that entity's actions (Klemme, 1976). In a general sense, enterprise liability is a subset of strict or absolute tort liability (Klemme, 1976). Like strict liability, the enterprise is considered a tortfeasor simply because she engaged in a particular activity that was the cause of a loss (Klemme, 1976).

What justifies this theory? In the field of economics, we acknowledge that money is both fungible and finite. Hence, the optimal approach for a community to collectively determine the utilization and distribution of these limited resources in the most efficient manner to satisfy the desires and wants of the majority of its members is through an open and competitive market system. According to Klemme (1976), this entails ensuring that the burden of addressing any problems or distortions in the legal and market domains is placed on those who caused them, thereby avoiding unfairness. In addition, the basic theory of enterprise liability relies upon the 'but for' test (Harper & James, 1956). But for the actions, or inactions, of the enterprise the resulting loss would not have occurred. However, the main theoretical problem with the but-for test is it will always suffer from an infinite number of but for events or causes (Klemme, 1976). If enterprise X caused a certain loss, but for the introduction by enterprise Y to the one who was damaged then the action would not have occurred etc.

Lastly, the enterprise liability theory aims to discourage the occurrence of future harm, as stated by Klemme (1976). It strives to achieve more effective preventive measures compared to the force and fault theories. The overarching objectives of the enterprise liability theory are to equitably distribute losses, maintain the integrity of economic relationships, and motivate stakeholders to take proactive steps in preventing harm. As mentioned above, the stakeholders (developers, energy ministries, utilities, EPCs, equity sponsors and lenders) in a utility size solar energy project don't usually articulate to themselves or others what the theory of risk management or risk mitigation they wish to exercise. However, it usually is represented in their behavior and incentives they place on their organizations.

Not every theory of liability can be easily placed at the feet of each stakeholder, and some may apply to two or more of them. Part of the difficulty is that most utilities in Sub-Saharan Africa are theoretically bankrupt and even the few who are not, certainly, do not collect full amounts for the electricity they deliver. In addition, most governments in the region also do not have the financial stability to absorb significant, unexpected, losses and furthermore don't have the requite number of hard currencies, dollars, and euros, to pay for their own anticipated liabilities. In addition, it is very difficult to get them to agree to pay liability insurance premiums to cover unanticipated tort liabilities.

With that said, which of the stakeholders would want to use a strict liability like enterprise theory? Commercial entities are used to, at least in theory, planning for potential losses due to their own malfeasance. Well-funded entities either self-insure or pay for third party insurance i.e., lay off the risk on a third party for a cost. Conversely, underfunded enterprises or entities may agree in theory, but do their best to negotiate, cajole, and pressure other stakeholders to pay for their future malfeasance.

Therefore, the only enterprises that want strict liability are well funded entities that are willing to pay for their own mistakes but not others. In the case of our stakeholders that would be engineering, procurement and construction companies, lenders, and equity sponsors. In theory, developers, like me, always espouse strict liability theory at conferences and cocktail parties but we rarely negotiate as such. We do our best to secure government guarantees, we do our best to recruit development

finance institutions to lend us money because we know they will protect the project's viability, we do our best to have the government's central banks protect our currency exposure, we apply for non-dilutive grants, and negotiate tax breaks that protect us from all possible exposure. We are strict liability proponents in theory and deep pocket theorists in practice.

In the context of solar development in Sub-Saharan Africa, the spreading of the loss's justification theory is a relevant risk mitigation approach. This theory diverges from the strict liability theory of enterprise liability and over time, they are less harmful. According to the legal writer Klemme (1976), this tort theory is founded on a non-fault basis and draws on efficient economic principles. Specifically, the theory posits that the burden of loss is reduced if more entities or people share that loss and that the longer the duration the loss is borne (primarily due to the time value of money), the smaller the actual burden will be to all stakeholders.

What are the supposed economic benefits of such a theory? There are two main advantages of the spreading of losses justification; taking a, relatively, large amount of money from one tortfeasor can lead to macro-economic dislocation versus equitably spreading the losses over a, relatively, large groups and small losses are preferable because the feeling of loss is less if more suffer less than one suffers an enormous loss (Klemme, 1976).

In practical terms, it is generally more readily accepted that the former advantage holds true. However, the latter rationale aligns with a variation of the economist's theory regarding the diminishing marginal utility of money. Although this theory has fallen out of favor among contemporary economists, it suggests that losing a relatively small sum of money could have a comparable impact on an individual as losing a much larger amount that leads to a similar change in their social standing. This highlights the subjective nature of the perceived significance of financial losses on an individual level (Klemme, 1976).

In considering the spreading of losses justification theory, stakeholders who are thinly capitalized or have reason to believe their actions or institutional voids may contribute to the commission of malfeasance are likely to be proponents of this approach. Government entities and developers are examples of such stakeholders. Government entities, such as utilities, regulators, and energy ministries, are often subject to institutional voids, poor balance sheets, and corrupt practices, making them vulnerable to significant potential losses. Meanwhile, developers typically have limited financial resources and are risk-averse, making them more likely to seek risk mitigation strategies. While interpersonal risk spreading may not be ideal, it is considered a better alternative than the potential enterprise disruption that could result from strict liability losses.

The last theory dealt with here will be the deep pocket justification theory. Deep pocket jurisprudence is based upon three psychological assumptions and one economic theory. The deep pocket hypothesis is based upon the following presumptions: the focus on the needs of the damaged party rather than on the act itself, the defendant's ability to pay and the connection between the award and its effect on the stakeholder (Vidmar, 1993).

The economic theory "a dollar taken from a rich man hurts him less than a dollar taken from a poor man" (Calabresi, 1961:465) is bolstered by the progressive tax codes in almost all countries. In short, progressive tax codes impose a higher rate of tax on higher incomes than lower incomes (Amadeo, 2020). The theories are the same; the more you have the better your ability to pay.

Courts generally have a difficult time with the deep pocket theory. Many courts, particularly in the United States, have held that its jurisprudence falls short of legal logic (Huck v. Wyeth, 1984). When

allocating risk for malfeasance Schwartz, et.al (2018) states that the fundamental principle in allocating risk for wrongdoing is that individuals should be held accountable solely for their own misconduct.

Those of the stakeholders who would want deep pocket theory are a little easier to understand at this point. An EPC, the lender, or equity sponsor, all of whom, relatively, have deep pockets. They certainly would not want to be, unjustly, held at a risk not of their own making just because they have more money than the other parties to a deal.

Throughout the pre-development, construction, and operations and management periods, stakeholders typically work to minimize risk by shifting it onto other parties. However, in practice, they often engage in negotiations and discussions to find a way to share the risk among themselves. To do so, they may employ a variety of strategies, including using grants, liability insurance, political risk insurance, government guarantees, and currency hedging, to mitigate their own risk exposure.

Numerous financial institutions, insurance companies, hedge funds, private equity firms, and developers leverage risk models as a tool to manage their exposure to risk. These models serve various purposes, from assessing the likelihood of potential risks to calculating the potential impact of different scenarios.

To utilize these models, organizations generally employ specific methodologies and approaches that have been developed and refined over time. They may also establish governance and management frameworks to ensure that the models are used appropriately and that the results are interpreted accurately.

Despite their usefulness, it is worth considering whether the models themselves present a risk. Like any tool, risk models have limitations and are only as effective as the data and assumptions on which they are built. Therefore, it is crucial to periodically review and update the model to ensure that they remain reliable and useful.

Unlike quantitative hedge funds or reinsurance companies, modeling risk for project finance is less mathematical and more methodical, less black box and more governance based. Project finance stakeholders use them to enhance and encourage investment discipline and not to make blind mathematical decisions.

How would one define a risk model? In its simplest form, a risk model is a quantitative representation of probable events based upon historical data. Various relevant inputs are given probability of occurrence and mathematically weighted to come to a probable conclusion. They may range from simplistic formulations to extremely complex mathematical formulas enhanced by computer software (Aggarwal, et. al. 2015). There are usually three general components to a risk model: input information, processing, and reporting (Aggarwal, et. al. 2015).

Risk model methodologies may vary, however their use in project finance should include and be based upon appropriate techniques and information that is specifically tailored to the long-term project in question i.e., solar, wind or hydro power plants. Clearly the information in a solar plant or a wind project would differ greatly (Aggarwal, et. al. 2015). The methodology would also include appropriate market practices, frequency of events, duration of financing, and possible third-party risks. In addition, they would include risk assessment practices, delegations of model management and ownership and frequency of board or investment committee involvement, normally called management and infrastructure.

An important aspect of risk modeling is model risk governance. Generally, each stakeholder should have a risk governance committee. That committee would propose and enact responsibilities, set overall policy and modeling standards that, after enacted, the committee would monitor on a regular basis.

Depending upon the stakeholder, their respective board of directors or investment committee should have overall responsibility. As an example, their responsibility could possibly be as follows:

- Set risk tolerance.
- Governance structure.
- Allocate requisite resources.
- Approve of the chosen methodology.
- Chose model owner, who will take individual responsibility for the regular management of the model.
- Publicize, internally, all agreed upon procedures (Aggarwal, et. al. 2015).

The primary objective of using a risk assessment model is to minimize potential risks and avoid decisions that may endanger the financial stability of an organization. However, it is important to note that if a risk model is not developed or managed property, it could pose a threat to the enterprise. This underscores the need for careful consideration and implementation of risk models, as they are only effective when built on reliable data and robust assumptions. Inadequate models may lead to flawed decisions that could ultimately harm the organization they are meant to protect.

What is model risk? The United States Federal Reserve in their guidance report stated “The use of models invariably presents model risk, which is potential for adverse consequences from decisions based on incorrect or misused model outputs and reports. Model risk can lead to financial loss, poor business and strategic decision making, or damage to a bank’s reputation.” (Board of Governors, 2011:3). Generally, model risk occurs for three main reasons; the inputs are inappropriate, the model, even if done correctly, is used incorrectly and where fundamental errors have produced inaccurate outputs (Board of Governors, 2011).

It is beyond the scope of this thesis to create a mathematical risk model however I believe it would be helpful to outline possible appropriate inputs for a model used to reduce the risk of a utility size solar project in Sub-Saharan Africa.

Risk models are implemented in accordance with certain specific specifications; therefore, input information is crucial to the success of the model. The following is an outline of possible input variables that could be used in a project finance mitigation model:

- Potential tariff rates.
- Loan durations.
- Bridge (construction) financing details.
- Balance sheet risk of the stakeholders.
- Political risk possibilities.
- Potential force majeure possibilities.
- Grid risks.
- Geographical risks i.e., land locked, mountain range, desert topography etc.
- Risk of violence, both internal and external.
- Currency exposure.
- Potential pre-development delay.

- Potential construction delay.
- Climate change affects operations and management period.
- Human resource risks, i.e., lack of adequate middle managers, or skilled workers.
- Engineering risks, i.e., faulty feasibility or grid studies.
- Corruption risks.
- Engineering, procurement, and construction risks.
- Manufacturing supply and demand risks.
- Product risks, i.e., degradation risks.
- Potential macro-economic risks.
- Categorical or numerical variables.
- Ranking of possible scenarios.
- Discount rate possibilities.
- Distribution samples i.e., P50, P60 etc.; (Yescombe, 2014).
- Tabular data, i.e., risk allocation to position data.

Formal risk models are not used by many of the stakeholders in Sub-Saharan Africa. However, the principles are widely used. Risk models are not panaceas to eliminate risk. However, if used prudently and properly they can help stakeholders in the process mitigate their risk and act as a guild in helping them make decisions at every stage of the development process (Vinter, 2007).

8. What is a PPA?

This section focuses on the PPA's role in renewable energy project viability, detailing its key components.

In order to successfully finance a renewable energy project, a multitude of legal contracts and agreements must be generated, including concession agreements, memorandums of understanding (MOUs), feasibility studies, grid studies, request for proposals, engineering, procurement, and construction agreements (EPC), operations and management agreements, interconnection agreements, lender agreements, equity sponsor agreements, shareholder agreements, and PPAs (Louw & Bhengu, 2010).

Of all these documents, the PPA is arguably the most critical because it directly affects the revenue portion of the project, which is of utmost importance to stakeholders. Additionally, the PPA is essential to project bankability, making it the lifeblood of the project and a determining factor of its viability. Therefore, it is crucial that the PPA is carefully drafted to balance the competing interests of each stakeholder. It must reflect the product of negotiations between the developer, sponsor, debt holder, off-taker, and government to ensure its effectiveness (Louw & Bhengu, 2010).

In most utility-sized solar projects, the power purchase agreement is a key legal contract that governs the sale and purchase of electricity. Its main functions include the allocation of risks between all participating parties, providing a framework for energy dispatch, and ensuring reasonable profits for sponsors and developers (Project Investor, 2007).

The PPA may also be referred to as an off-taker agreement, as it acts as a facilitator for the sale and purchase of electricity (Project Investor, 2007). The PPA may also be referred to as an off-taker agreement, as it acts as a facilitator for the sale and purchase of electricity (Project Investor, 2007).

Through the PPA, developers and equity sponsors can sell electricity to an off-taker with an adequate credit rating, typically lower than the utility's retail customer rate. The agreement usually has a duration of between ten and twenty years.

Usually, the PPA follows an important series of strategic and tactical decisions made by both the developer and the utility (Project Investor, 2007). Some of these decisions may include the amount of power needed, the various sources of power, the financial strength of the off-taker and the developer, the type of technology used i.e., solar, wind or hydro, and the geographical location of the proposed power plant (Project Investor, 2007). The PPA is the most detailed and complex of the key transaction documents and is usually the sole cash-flow providing agreement (Abrams, 2016).

8.1 Bankability

This section outlines the importance of the concept of bankability and its importance to a PPA.

The concept of bankability refers to the financial and commercial viability of the project in general and the PPA in particular. Practically this means whether the project and documents are acceptable to lenders and equity sponsors, i.e., the ability to attract financing. “The lack of bankable renewable energy projects can be attributed in part to poorly drafted power purchase agreements or PPAs” (Lim, 2018:1). The PPA is the key bankability document because it secures the projects revenues, and it addresses the project's uncertainties (Lim, 2018). Therefore, the bankability of the project and the PPA that it relies upon is driven by a series of complex contractual clauses that are meant to reduce the risk to the lender and thereafter the equity sponsor and or the developer.

Each bankable PPA has several necessary characteristics. These features are especially important in Sub-Saharan African countries given that many of the state-owned utilities have below investment grade creditworthiness. Therefore, lenders will pay attention to these clauses to make sure they include all the necessary provisions. Below I will elaborate on the essential transaction provisions. This discussion aims to showcase how these provisions contribute to advancing general knowledge, promoting sustainability, and generating a meaningful impact in the realm of Power Purchase Agreement drafting and thesis proposals, ultimately rendering a PPA bankable.

8.2 Force Majeure:

A crucial aspect of PPAs is the force majeure clause, which acts as a shield against unforeseen circumstances that might disrupt project obligations.[25]

A *force majeure* clause (“Superior Force”) is a contractual provision that protects each party from being held liable for failing to fulfill their obligations if events beyond their control make it impossible to do so (Giroud, 2018). In other words, the clause reallocates the cost and risks of the project during

[25] The issue of force majeure is addressed in Section 11.9 (p. 239) of the thesis and further evidenced in the Power Purchase Agreement (PPA), p. 27.

the period of the unforeseen event. The effects of force majeure can impact one or all parties to the contract, though not necessarily in equal measure.

There are three basic bankable categories that are important to include in a PPA; local political force majeure, foreign political force majeure, and natural force majeure (Giroud, 2018). [26]Local political force majeure generally relates to triggering events that are caused, directly or indirectly, by the host country. These events could include riots, terrorism, nationwide strikes etc. (Giroud, 2018). In addition, this category would include a change of law that would impede the payments to the project or the off-taker's ability to accept the energy. Foreign political force majeure covers foreign acts that have an adverse impact on all parties' ability to perform the obligations of the PPA (Giroud, 2018). This would include such events as strikes in another country that affect the supply chain to the project or acts of war against the host country. Lastly, natural force majeure relates to what are called acts of G-d such as extreme weather events, and or national conditions that have a material adverse impact on the ability to fulfill the obligations of the PPA (Giroud, 2018).

In renewable energy projects in Africa, it is common that a force majeure clause will protect a foreign investor from the risk of government taking or interference (Giroud, 2018). This type of clause protects the developer and not the off taker thereby excusing the developer and or investor from their obligations. However, any well written force majeure clause will include clauses that will protect both or all parties from extreme weather-related events that interrupt the flow of energy i.e., earthquakes, cyclones etc. In addition, the allocation of risk will often depend upon the assessment of risk in the project country and political risk insurance of the equity sponsor.

To ensure the viability of a force majeure clause, certain provisions and triggering events need to be included. These provisions should entail a general relief clause for force majeure, allowing for the suspension of obligations if either party is unable to fully or partially perform or comply due to uncontrollable circumstances. Furthermore, a notice and efforts to continue clause should be incorporated, obligating the parties to notify each other and make reasonable efforts to continue fulfilling their obligations in the Power Purchase Agreement (PPA). [27]By including these elements, the force majeure clause becomes more robust and conducive to establishing a bankable agreement.

A labor disturbance clause should be included whereby the settlement of strikes, lockouts and other possible serious labor issues that would impede the buying and selling of energy that would constitute an event beyond the reasonable control of either party. In addition, if any of the events that facilitate the abrogation of obligations of either or both parties whereby the events in question last beyond the duration of the PPA, then either or both parties need to notify the other party of the termination of the agreement (Nicolay, 2011).

Lastly, when drafting a force majeure clause for a PPA, it is important to mirror the regulatory approach to handling exceptional circumstances, as suggested by (Nicolay, 2011). However, it should be noted that in many instances, there are limited or no regulatory statutes specially addressing

[26] The issue of bankability in project finance is reflected throughout the author's Portfolio materials, particularly in §§ 11.1–11.9, which collectively address the principal contractual and risk-allocation mechanisms used in project-financed transactions.

[27] Notice-and-efforts-to-continue provisions are commonly included in Power Purchase Agreements. See Portfolio § 11.9, Model Power Purchase Agreement.

situations where all parties are released from their obligations due to triggering events beyond their reasonable control.

Government Guarantees/Credit Enhancements: This section examines the use of credit enhancements and government guarantees as risk mitigation strategies for below investment-grade African utilities.

As mentioned above, in Sub-Saharan Africa and other emerging market jurisdictions, the creditworthiness of most utilities is usually below investment grade. Therefore, the availability of credit enhancements and or a clear government guarantee has become a significant part of a risk mitigation strategy and therefore bankability of any PPA (Satterlee, 2017). Since most utilities in Africa are government or quasi government owned and most have creditworthiness issues, for a PPA to be bankable there needs to be credit enhancements. The most important of which usually is a Partial Risk Guarantee (PRG) (Heller, 1978). Political Risk Guarantees (PRGs) provide protection to private lenders or investors, typically in the form of shareholder loans, in the event that a government or government-owned entity fails to fulfill its contractual obligations concerning a private project (World Bank Guarantee). [28]

Depending upon the creditworthiness of the host government, lenders will rely upon a clause in the PPA which protects them from nonpayment of the utility. This government guarantee will combine with other credit enhancements to mitigate the risk of the project. Another provision that acts to enhance the bankability of the PPA is a Letter of Credit (LOC) (Petric, 1988). The LOC will often have relatively short durations or be negotiated whereby they are used for only the first few years of the project so the lenders see that there is a pattern of payments that can be analyzed.

An additional credit enhancement tool is the use of an escrow account. In its simplest form, an escrow account is a contractual agreement whereby a third party collects and disburses money for a transaction according to terms agreed upon by all parties to an agreement (Garrison, 1951). In our case there is commonly a clause in the PPA requiring a particular number of future monthly or quarterly payments that would require to be collected and posted with a third party i.e., a bank that would be used to pay for the contracted energy supply. This can be used for the project sponsors to draw upon in case the off-taker does not pay during a particular period.

8.3 Dispute Resolution

In the complex landscape of the PPA, the 'Resolution of Disputes' section serves as a crucial compass for all stakeholders involved.[29]

[28] Government and multilateral guarantee structures are reflected in the Portfolio materials contained in § 11.8.

[29] The issue of dispute resolution is addressed in Section 11.9 (p. 239) of the thesis and on p. 31 of the Power Purchase Agreement (PPA), under the heading "Dispute Resolution."

To account for the possibility of disputes between parties in a complex agreement, it is essential that a power purchase agreement (PPA) includes a 'resolution of disputes' section in clear and unambiguous language. This section outlines the steps that each party must take if a dispute arises, as none of the parties typically want to go straight to litigation over a minor disagreement or misreading of a contract clause.

Ideally, the PPA should provide for a good faith attempt to resolve disputes in the first instance within a specified period, such as 30 days. By doing so, the parties can avoid unnecessary costs and delays and maintain a positive working relationship throughout the duration of the agreement.

If there is a disagreement, the parties should be required to notify each other of the dispute in question by a specific period in writing so that there are no further misunderstandings. A 'referral to an expert' section should be included when the dispute in question of a technical nature. This section should clearly spell out the details of how the expert should be used and when. A clear distinction should be drawn between the governing law section and the dispute resolution section (Dispute Resolution, 2019). The former deals with the substantive law of the agreement and can and is often governed by the jurisdiction of the project i.e., the host country, the latter, to be bankable, needs to be a third-party country.

The first, and arguably, the most important part of this section is the choice of forum. Theoretically, there are several options for the parties to choose from i.e., litigation, arbitration, expert determination, adjudication etc. However, for the PPA to be bankable there is only one realistic option: international arbitration. The generally acceptable method is to choose international arbitration in a neutral country that uses or is acceptable to international arbitration associations. The lenders don't want to be assured of a decision in their favor, but they want to be assured of fair legal proceedings. In addition, they don't want the prospect of a minor dispute costing the sponsor enormous sums of money in a legal dispute. Generally, arbitration is far less costly than litigation. Lastly, it should be agreed upon, in clear language, that arbitration is a binding arbitration agreement.

8.4 **Change of Law**

The main purpose of a PPA is to lay out a stable legal relationship between the parties. The 'Change of Law' clause is a cornerstone of this stability.

At a macro level, any agreement requires all parties involved to provide each other with a certain level of stability. This ensures that the contract can be carried out effectively throughout its entire duration. In the case of the projects, the project company is obliged to deliver a predetermined amount of electricity from a specific source, such as solar energy. In return, the utility company, and by extension the government, agrees to purchase electricity and create an environment that supports this partnership without any obstructions. By providing this stability, all parties can fulfill their obligations and ensure the successful execution of the agreement.

The inclusion of a 'change of law' clause in agreements explicitly specifies which party assumes the risk associated with any alterations in the legal framework of the host county. A change of law clause ensures that the laws in effect at the time of signing a project agreement will remain applicable throughout the agreement's duration as explained by (Giroud, 2018).

There are three basic concepts to a change of law clause; a) an outright change in the law itself, b) a material modification of an existing law, and c) a new interpretation of an existing law by anyone of authority that can affect the project (Giroud, 2018). In addition, this would include an increase in existing applicable taxes that would negatively affect the projected revenues and profits of the project company. The PPA should be clear to note that in this context 'law' should be defined to include legislation, statutes, executive orders, guidelines, and legal instruments (African Legal, 2013).

Essentially, the change in law clause is about allocating risk and the resulting loss thereof. Therefore, if a change in law does occur and there is a resulting change in revenues, fixed or variable cost, the results of said changes are passed on to the off-taker (Abdelhamid, 2008). The resulting change in risk is for the purpose of keeping the project company in the same financial position as of the date of the PPA. In current market practice, for PPAs to be bankable, most lenders will require the off-taker to absorb this risk. In addition, good drafting will make clear the timing of renumeration, when final adjustments to payments will occur and whether the off-taker has the right to examine the project company's books and records or not.

The issue of timing will most likely be an important negotiating point between the parties. The question will be from what date any change of law should be considered. The current market practice will often be the date of signature of the PPA. [30]However, the off-taker will often push for the change of law to occur on the commercial operating date (COD). COD is the date on which the plant is fully built and delivers electricity. The difference between the signing of the PPA and the COD for a medium utility size solar plant could be anywhere from three to five years. Obviously, a lot can change during that period which could change the economics of the project significantly.

Lastly, most debt funders will want a change of law section to separately discuss any change in taxes. As noted by Abdelhamid (2008), any alteration in tax law could have a significant impact on project revenue, potentially rendering the project financially unsustainable and thus not bankable. The PPA should be as clear as possible regarding the types of possible tax increases and their effects; an increase in income tax rates, a change in import taxes, the creation of a new tax, or a removal of a current tax benefit (Abdelhamid, 2008).

8.5 Dispatch Risk

This section addresses grid energy delivery risks, focusing on mitigating dispatch risk through 'Take or Pay' and 'Take or Pay' strategies. [31]

The primary objective of a project company is to deliver electricity to the off-taker and receive payment for the contracted amount. However, energy project finance carries inherent risks at every level. To mitigate dispatch risk, there are two widely accepted approaches: take or pay or take and pay.

Under the take and pay methodology, the off taker agrees to purchase all the electricity generated by the solar plant at a pre-contracted price specified in the Power Purchase Agreement (PPA). As

[30] See the signature provisions contained in the Model Power Purchase Agreement in Portfolio § 11.9.
[31] The issue of dispatch risk is addressed in Section 11.8 in the Portfolio Section (p. 234) of the thesis and further evidenced in the Government Guarantee, under the heading "Government Payment Guarantee."

explained by (Hull & Lund,2020), this means that payment is based on the actual receipt of output at the specified point of delivery, with payment determined by the amount of output delivered.

In contrast, the take or pay methodology requires the off taker to either take and pay the PPA price or pay the PPA price even if the electricity is not taken during the applicable year. The intention behind this clause is to shift the annual risk to the off taker and incentivize the utility, and thus the government, to estimate their energy demand more accurately. This approach acknowledges that, given the bilateral relationship, there is no alternative offtake route, and thus implies that the government is better suited to bear the risk rather than the project company.

Currently, most lenders to utility size solar projects in Sub-Saharan Africa demand take or pay clauses because it is a better approach to shift dispatch risk to the government and give them a stronger incentive to anticipate their energy demand accurately.

8.6 Fixed Tariff

This section explores the crucial role of tariff predictability in PPA risk mitigation, focusing on stable electricity pricing throughout the contract.

A fixed tariff is a pricing mechanism in which a predetermined price for a specified duration is set for the purchase of electricity generated by a power plant. While the term “fixed tariff” is commonly used in the energy industry, a more accurate description would be ‘predictable’ or ‘set price’, as the price may not necessarily remain constant throughout the duration of the Power Purchase Agreement. For instance, the tariff may be set at a certain rate during the first ten years of the PPA, and then decrease during the subsequent ten years.

The reason why a fixed tariff is considered bankable and the preferred pricing mechanism by international lenders is because it offers investors predictability. While the fixed tariff may not necessarily be the most favorable price, investors can accurately predict the revenue stream and model their investment accordingly. The ability to mitigate variable risks around pricing is crucial to securing financing for energy projects.

A fixed tariff is a critical component of a PPA, as it ensures that the revenue generated from the sale of electricity is sufficient to cover the cost of operating the power plant, repay the debt, and provide reasonable return on equity to investors. According to the Overseas Private Investment Corporation (OPIC), it is essential for the revenue of any PPA, regardless of whether it is a take or pay or take and pay arrangement, to be a fixed amount per kWh generated. This fixed amount should sufficiently cover the operational costs of the facility, enable debt repayment, and offer a fair return on equity (OPIC).

8.7 **Foreign Exchange**

One of the biggest potential structural risks a developer or project company will face in emerging markets, Sub-Saharan Africa in particular, is currency or foreign exchange risk.[32] One of the most difficult issues during PPA negotiations will be regarding what currency the off-taker pays the project company. Who will bear the currency risk? Who is better capable of bearing the currency risk? Are the lenders lending in local currency or will the debt be in hard currencies? These are all important questions that each solar project developer must face during the development process.

There are two main specific risk to the project company when the PPA is in local currency; a) the local currency may not be freely convertible i.e., it cannot be exchanged for any major currency and b) the local currency may not have enough foreign currency reserves sufficient to meet the needs of the project company for the life of the project (Giroud, 2018).

Although there are international and local entities that are pushing for local currency PPAs, at the present time most lenders to all infrastructure projects in Africa are non-African financial institutions. In almost all circumstances they want the PPA to be either denominated in or linked to the currency in which they are lending. This presents diametrically opposed interest and risk. There will be zero sum currency risk if there are no foreign exchange mitigations and or are not tactical preparations for convertibility and remittance. How then is the PPA made bankable? What is a good balance of risk given that the project company has no control of either currency rate fluctuations or convertibility?

There are several ways to mitigate the short- and medium-term risks commonly associated with currency exposure:

1. A natural and partial way to hedge the asset-liability currency mismatch that occurs may be mitigated by selling a portion of the project to an investor with the same currency as the project's liability (Verdouw et.al., 2015).
2. Negotiate with the off-taker that all tariff fees are denominated in the funding currency.
3. Enter a local currency PPA and use derivatives to hedge currency mismatch.
4. Negotiate with the owner of the utility i.e., the government, that they will make up any losses to the project company due to any exchange rate fluctuations (Khanna, and Palepu, 2010).

Various methods have been proposed to mitigate currency risk in power purchase agreements (PPAs). While these methods are effective in reducing the impact of short-term fluctuations, they still present challenges for off takers and do not fully protect project companies against catastrophic devaluation risk (Khana & Palepu, 2010). Given the competing risks and the importance of a fully bankable PPA, the most effective approach is to quote the PPA tariff price in the funding currency e.g., U.S. dollars but pay in the local currency. To address convertibility risk and ensure bankability, the project company can contract with the central bank of the host country to set aside and guarantee the feed-in-tariff amount for a specified, short-term period. To further strengthen the PPA, the central bank chairperson can be included as a signatory to the agreement.

[32] Currency-related issues are initially addressed in the PPA Issues List contained in Portfolio § 11.6, p. 222, and are subsequently incorporated into the full Model Power Purchase Agreement in Portfolio § 11.9, p. 249.

8.8 **Assignment**

This section decodes collateral assignment and step in rights in PPA lending.

The lender to the PPA, in most circumstances, will demand the collateral assignment of the project company's assets in the project. In this respect, the collateral rights will act as additional security for the lender that will allow, without consent of the buyer of energy, to assign the PPA to the lender(s). The lender(s) will have the right to receive notice of any default, which will automatically allow them to take control of the project and have the right to cure such default (Andrew, 2012).

In addition, as a subset of collateral assignment, the bankable PPA will often include step-In rights that will allow that if there is a material breach of contract by the equity sponsor or developer the lender(s) have the right to 'step-in' to the place of the sponsor and take their place for the duration of the PPA. As a result, it is stated that in the case of non-performance, the party failing to fulfill its obligations is obligated to transfer any or all agreements with third parties pertaining to the development activities, encompassing all related agreements, to the party stepping in to assume responsibility.

8.9 **Step-in Rights**[33]

Step-in Rights are a vital component in the risk mitigation arsenal of lenders.

Project finance has a distinctive characteristic where funders or their representatives can 'step-in' and replace the independent power producers as a security and risk mitigation measure required by lending institutions. The rationale behind this feature stems from the extended duration of renewable energy projects, which typically lasts between 20 to 25 years. There is a reasonable likelihood of a developer or sponsor going bankrupt, winding up their business, mismanaging the project, or mishandling the project transition.

Therefore, lenders aim to mitigate their risk by including a step-in clause. While it is rare for banks and other financial institutions to take over a business in this way, the mere possibility of such an action is what makes these provisions effective, as stated by The Republic of Namibia (2014).

8.10 **Termination Clause(s)** [34]

This section exams the intricate dynamics between the termination for convenience, termination for cause, and the pivotal role of clear, definitive drafting in ensuring bankability.

A termination clause is a vital feature of a bankable Power Purchase Agreement (PPA) and typically comes in two forms: termination for convenience and termination for cause. Termination for convenience allows one or both parties to cancel the contract at any time for any reason. However,

[33] The issue of step-in rights is addressed in Section 11.3 of the Portfolio and further evidenced in the Model Concession Agreement, Schedule 4 (p. 185).
[34] Termination provisions are addressed in the "Termination and Default" clause contained in the Model Power Purchase Agreement in Portfolio § 11.9.

this type of termination clause is not considered a bankable clause in PPAs. One the other hand, termination for cause, also known as termination for default, allows one or both parties to terminate the contract when there is a breach of the agreement.

For a termination clause to be bankable, the drafter must clearly define the specific basis upon which either party may terminate the contract. This clause should outline the allowable termination events, such as the default of the utility or other mutually agreed-upon events. The terms should be specific as possible to ensure that both parties understand the circumstances under which termination is allowed (Adams, 2017).

In some cases, termination clauses may overlap with both termination for convenience and termination for cause. In such situations, the PPA should provide for a termination payment by the off-taker that is at least equal to the full amount of the power producer's outstanding bank debt if the PPA is terminated for any reason. This clause ensures that the equity sponsor is protected in the event of the off-taker's default.

The events that would or could trigger a termination should be mutually agreed upon by both parties. These events may include provisions of force majeure, acts of insolvency, failure to pay liquidated damages, failure to cure, abandonment beyond an agreed-upon period, failure to achieve commercial operation date, termination of connection, the plant not achieving capacity, and net electrical output violation for a particular period (Adams, 2017).

Lastly, clear, and definitive drafting is essential to segregate the terms of default by the buyer and seller and their corresponding results. The PPA should also include a cure period that specifies the type and nature of the default and the cure period, if any. The more specific the terms of the termination clause, the better for both parties, as it reduces the potential for disputes and increases the bankability of the PPA (Henderson, 2002).

8.11 Interconnection or Transmission Risk

This section examines PPA interconnection and transmission technicalities, highlighting key factors and risk allocation for grid integration.

`A critical technical issue that must be addressed in any power purchase agreement (PPA) is determining the party responsible for interconnecting the power plant to the utility's connection point and transmitting electricity. According to Tabermacki (2014), the PPA must clearly indicate which party bears the risk of connecting the facility to the grid and transmitting power to the nearest substation. Factors such as the distance of the connection point from the plant, proximity to major population areas, and terrain difficulty all affect the level of risk involved.

Given these physical factors, lenders require the PPA to outline transmission and interconnection services and assign responsibility between the project company and the utility. For instance, the project company/seller is usually not responsible for any electric transmission loss factors, which increase with distance. This risk is typically assumed by the utility. Additionally, the PPA should clarify who will provide ancillary services to both interconnection points and electricity transmission. Finally, the PPA must specify the proposed interconnection date and provide a clear interconnect point map as an attachment.

8.12 Conclusions and Recommendations

Introduction

This chapter brings together the principal findings of this doctoral research and situates them in relation to the research questions identified in the Introduction. The purpose of the chapter is to summarize the conclusions arising from the documentary analysis, comparative policy review, and practitioner based autoethnographic methodology adopted throughout the thesis, and to identify practical recommendations for improving renewable energy policy implementation in sub-Saharan Africa.

As stated at the outset of this research, the central objective of this thesis has been to examine whether standardized regulatory and contractual frameworks particularly standardized power purchase agreements and associated implementation instruments can function as practical institutional substitutes capable of improving, and therefore securing, bankability and accelerating utility scale solar PV deployment across sub-Saharan African electricity markets.

This concluding chapter therefore addresses:

1. the research questions identified in the Introduction;
2. the principal findings arising from the literature review and practitioner evidence;
3. the policy implications of those findings;
4. the recommendations arising from the research;
5. the limitations of the research; and
6. the contribution made by this doctoral study to renewable energy policy and project finance practice.

Taken together, these elements represent the final stage of the analytical structure established at the beginning of the thesis.

Restatement of the Research Questions and Objectives

The research undertaken in this thesis has been guided by two principal research questions:

1. whether sub-Saharan Africa would benefit from a standardized regulatory framework for utility-scale solar PV development; and
2. whether standardized power purchase agreements and associated project documentation would reduce risk, lower development cost, improve bankability, and increase implementation.

The objective of the thesis has therefore been to determine whether regulatory and contractual standardization can function as a practical implementation mechanism capable of reducing transaction costs and mitigating institutional risk within emerging and frontier sub-Saharan African electricity markets.

Summary of the Principal Findings

Institutional Voids as the Central Constraint on Implementation

The first and most significant finding of this research concerns the role of institutional voids in shaping renewable energy investment outcomes across sub-Saharan Africa.

As demonstrated in Chapter 4 and reinforced in the Findings chapter, the principal constraint affecting project implementation is not the absence of renewable energy policy ambition, but the uneven institutional capacity required to translate policy commitments into financeable project structures. Ministries often possess renewable energy targets, utilities possess basic technical operating capability, and regulators possess formal authority. However, coordination between these institutions remains inconsistent across jurisdictions.

This finding confirms the argument developed in the Literature Review that institutional voids represent one of the primary structural barriers affecting infrastructure investment in emerging markets. It also supports the conclusion that contractual mechanisms frequently operate as functional substitutes for incomplete regulatory systems.

Tariff Methodology Uncertainty as a Structural Policy Gap

A second important finding concerns the role of tariff determination uncertainty as a constraint affecting project development timelines.

Across multiple jurisdictions examined in this research, renewable energy procurement has shifted between feed in tariff programs, bilateral negotiations, and competitive auctions/tenders without clear sequencing between policy stages. From a developer, equity sponsor, and lender perspective, uncertainty regarding procurement pathways increases early-stage development risk and delays investment decisions.

This finding supports the conclusion that tariff predictability is not solely a pricing issue but a structural component of project bankability.

Payment Security Structures as Substitutes for Utility Credit Strength

A third finding concerns the central role played by sovereign guarantees and related payment security mechanisms in supporting renewable energy project financing across the region.

As demonstrated in both the Literature Review and the Professional Portfolio documents, long tenor project finance lending depends primarily on predictable revenue streams. Where state owned utilities lack sufficient balance sheet strength, governments frequently assume secondary payment obligations through sovereign guarantees, put call options, or liquidity support structures.

This confirms the conclusion that payment security mechanisms represent one of the most important components of a standardized renewable energy procurement environment.

The Central Role of the Power Purchase Agreement in Determining Bankability

A fourth finding concerns the role of the power purchase agreement as the principal legal instrument through which renewable energy policy objectives are translated into financeable infrastructure projects.

The research demonstrates that PPA negotiation across sub-Saharan Africa remains largely bespoke rather than standardized. As a result, transaction timelines increase and legal uncertainty persists across projects that otherwise share similar technical characteristics.

This finding supports the central hypothesis advanced throughout this thesis that standardized contractual frameworks can reduce negotiation complexity and improve implementation outcomes.

Constraints Affecting Smaller Electricity Markets

Further findings concern the distinct implementation challenges affecting smaller electricity markets within the region.

Utilities in smaller systems frequently operate with weaker balance sheets, smaller transmission networks, and less, and often no, institutional experience working with independent power producers. As a result, investment tends to concentrate within a relatively small number of larger electricity markets.

The research suggests that standardized procurement frameworks could play a particularly important role in supporting renewable energy deployment within smaller jurisdictions by improving predictability for investors and lenders.

Conclusions in Relation to the Research Questions

The findings of this thesis provide clear and evidence-based answers to both research questions identified in the Introduction. First, the research demonstrates that sub-Saharan African electricity markets would benefit from more predictable and standardized regulatory implementation frameworks governing utility-scale solar PV procurement. This conclusion is supported by the comparative policy analysis presented in Chapters 3 and 4 and by the documentary evidence contained in the Professional Portfolio, which together demonstrate that regulatory uncertainty increases transaction timelines, increases negotiation complexity, and reduces investor participation in smaller electricity markets.

Second, the research demonstrates that standardized power purchase agreements and associated implementation documentation materially improve project bankability by reducing negotiation risk, clarifying risk allocation, and supporting lender confidence in long-tenor infrastructure financing environments. Evidence supporting this conclusion is presented in the Findings chapter and reflected in the standardized documentation included in the Professional Portfolio, including the Implementation Agreement, Government Guarantee framework, PPA Key Terms structure, and Issues List.[35]

[35] As reflected in the Portfolio materials contained in §§ 11.1–11.9, beginning at p. 173.

Taken together, these findings confirm that contractual and regulatory standardization can function as practical institutional substitutes capable of improving implementation outcomes across emerging electricity markets.

The central hypothesis of this thesis has been that standardized regulatory and contractual implementation instruments can function as practical substitutes for incomplete institutional capacity within emerging electricity markets, thereby improving bankability and accelerating deployment of utility-scale solar PV infrastructure. The conclusions presented above confirm that this hypothesis is supported by both the comparative policy evidence and the practitioner documentation analyzed in this research.

Policy Recommendations

Recommendation 1: Development of Standardized Implementation Agreement Frameworks

Governments should adopt standardized Implementation Agreement templates capable of coordinating permitting obligations, land access sequencing, transmission interface obligations, and sovereign support undertakings within a single project-level implementation structure. As demonstrated in the Implementation Agreement included in the Professional Portfolio accompanying this thesis, such agreements can operate as coordinating instruments linking multiple regulatory authorities within a single contractual framework. This reduces institutional fragmentation and improves regulatory predictability during early-stage project development. Evidence supporting this conclusion is presented in Chapter 4 and in the Findings chapter, which identify coordination failures between ministries, regulators, and utilities as one of the principal sources of implementation delay across multiple jurisdictions.

Recommendation 2: Adoption of Standardized PPA Structures

Electricity regulators and ministries should adopt standardized power purchase agreement structures reflecting internationally recognized project-finance risk allocation principles. As demonstrated in the standardized PPA Key Terms document and the PPA Issues List included in the Professional Portfolio, negotiation timelines across sub-Saharan African electricity markets remain extended primarily because risk allocation is addressed on a project-by-project basis rather than through repeatable procurement templates. Standardized PPA structures reduce transaction costs by clarifying tariff adjustment mechanisms, curtailment provisions, force majeure treatment, change-in-law protection, termination compensation structures, and lender step in rights. These elements represent the core contractual mechanisms through which bankability is achieved in utility scale renewable energy transactions and therefore provide a practical foundation for repeatable procurement frameworks across multiple jurisdictions.

Recommendation 3: Establishment of Predictable Tariff Determination Pathways

Renewable energy procurement programs should follow clearly sequenced transitions between feed-in tariff programs, negotiated procurement structures, and competitive auction frameworks. Predictable sequencing can be achieved through the publication of medium-term renewable energy procurement roadmaps, adoption of transitional tariff regulations applicable during early stage

market development, and coordination between ministries and regulators regarding procurement authority. As demonstrated in Chapter 3, jurisdictions that transition prematurely to auction based procurement without first establishing bankable implementation frameworks frequently experience reduced investor participation. Structured sequencing therefore functions as a policy stabilization mechanism during electricity sector reform.

Recommendation 4: Expansion of Payment Security Frameworks

Governments should adopt structured payment security mechanisms capable of supporting renewable energy procurement programs where utility balance sheet strength remains limited. As demonstrated in both the Literature Review and the Government Guarantee framework included in the Professional Portfolio accompanying this thesis, sovereign guarantees, escrow arrangements, liquidity support facilities, and put and call option agreements represent essential credit enhancement mechanisms supporting long tenor infrastructure finance transactions across emerging electricity markets. [36]These instruments function as substitutes for investment grade utility creditworthiness and therefore represent a central component of standardized procurement environments.

Recommendation 5: Support for Smaller Electricity Markets Through Standardized Procurement Platforms

Regional development institutions and multilateral lenders should prioritize standardized procurement platforms designed specifically for smaller electricity systems. As demonstrated in the Findings chapter, renewable energy investment across sub-Saharan Africa remains concentrated within a relatively small number of larger electricity markets with established independent power producer procurement experience. Standardized regional procurement templates supported by development finance institutions could reduce early-stage development risk and expand investment participation across smaller jurisdictions lacking prior IPP implementation experience.

Areas for Further Research

This research has focused specifically on grid connected utility scale solar PV procurement frameworks and therefore does not address the implementation dynamics associated with off grid and mini grid renewable energy deployment structures. Future research could extend the institutional framework analysis developed in this thesis to decentralized electrification environments where regulatory coordination challenges differ significantly from grid connected procurement systems.

Similarly, while this thesis has examined regulatory and contractual determinants of project bankability, further research could investigate the interaction between macroeconomic variables,

[36] Guarantee provisions are addressed in the Model Government Guarantee contained in Portfolio § 11.8, p. 234.

currency risk mitigation structures, and sovereign credit environments affecting renewable energy financing across sub-Saharan Africa.

A further area for future research concerns the potential role of regional procurement platforms supported by multilateral development institutions in supporting standardized renewable energy implementation frameworks across smaller electricity markets.

Taken together, these areas represent natural extensions of the implementation focused analytical framework developed in this thesis.

Contribution of the Research

This doctoral thesis makes both a scholarly and professional contribution to the study of renewable energy policy implementation in sub-Saharan Africa.

First, the research contributes to the literature on institutional voids by demonstrating how contractual frameworks can function as operational substitutes for incomplete regulatory systems within infrastructure sectors.

Second, the research contributes to renewable energy policy scholarship by identifying tariff determination sequencing and payment security structures as central determinants of project bankability across emerging electricity markets.

Third, the research contributes to project finance practice through the development of standardized implementation instruments included in the Professional Portfolio accompanying this thesis.

Finally, the research contributes to policy design by proposing a structured regulatory pathway capable of supporting repeatable renewable energy procurement across multiple jurisdictions.

Taken together, these contributions respond directly to the research objectives established in the Introduction.

Final Conclusion

The central conclusion of this thesis is that standardized regulatory and contractual frameworks particularly standardized power purchase agreements and associated implementation instruments can function as practical institutional substitutes capable of improving bankability and accelerating utility scale solar PV deployment across sub-Saharan Africa.

While standardization cannot replace institutional capacity, it can materially reduce transaction costs, improve risk allocation, and support repeatable renewable energy procurement programmes across both large and small electricity markets.

For these reasons, regulatory and contractual standardization should be understood not as a technical drafting exercise but as a practical policy intervention capable of supporting the next phase of renewable-energy development across the region.

In this respect, the findings presented in this thesis provide both an analytical explanation of the constraints affecting renewable energy implementation and a structured framework through which those constraints may be addressed.

9. Introduction to Portfolio Documents: A Survey of my Professional Work

In the intricate and challenging landscape of solar energy development across sub-Saharan Africa, the creation of effective regulatory frameworks and standardized documentation is not just an academic exercise, but a practical necessity. The development of these documents is deeply rooted in the theoretical and practical insights explored throughout this thesis. They are not simply templates; they represent the culmination of a decade of rigorous interaction with energy, finance, and environmental ministries across multiple countries in the region. Each document is designed to address the unique challenges discussed in this thesis, including the pervasive institutional voids, the high costs associated with legal complexities, and the need for policies that attract a broad spectrum of developers.

The following portfolio of development documents is a direct manifestation of the strategies and solutions proposed in this thesis. For instance, the **Memorandum of Understanding (MOU),**[37] as referred to in section 7.5 above, reflects the need for initial, non-binding agreements that establish trust and set the groundwork for collaboration among multiple stakeholders—an approach emphasized in the thesis as crucial for overcoming the skepticism and inertia that often plague new projects in regions with underdeveloped regulatory frameworks. Similarly, the **Land Options Agreement**[38]**,** as referred to in section 7.5 above, exemplifies the thesis's argument for flexible legal instruments that allow developers to secure land without immediate commitment, thus aligning project timelines with market conditions and funding availability.

The **Concession Agreement**[39] is another critical document, embodying the thesis's emphasis on the importance of clear, legally binding contracts that outline the roles and responsibilities of all parties involved. This document mitigates risks by providing a transparent legal framework, which is essential for attracting investment and ensuring project viability—a core theme explored in the thesis.

Further, the **Project Information Memorandum (PIM)**[40] and the **Implementation Agreement**[41]**,** as referred to in section 5 above, serve as practical tools that translate the thesis's theoretical contributions into actionable steps. The PIM acts as a communication bridge between the developers and potential investors, encapsulating the project's scope, financial viability, and regulatory compliance, thus fostering transparency and trust—key factors discussed in the thesis as critical for successful solar energy projects in Sub-Saharan Africa.

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[37] See Portfolio § 11.1, Model Memorandum of Understanding page 173.

[38] See Portfolio § 11.2, Model Land Lease Options Agreement Page 176.

[39] See Portfolio § 11.3, Model Concessions Agreement Page 280.

[40] See Portfolio § 11.4, Model PIM page 190.

[41] See Portfolio § 11.5, Model Implementation Agreement page 213.

The **Power Purchase Agreement (PPA)**[42]**,** as referred to in sections 2.8 and 5 above, and its associated documents, including the **PPA Issues List**[43] and **PPA Key Terms List**[44], are central to the thesis's discussion on the necessity of well-structured, bankable contracts. These documents are informed by the thesis's exploration of how PPAs can be optimized to balance the needs of developers and off-takers, mitigate risks, and ensure long-term project sustainability.

Finally, the **Government Guarantee**[45]**,** as referred to in section 5 above, and **EPC Agreement,** as referred to in section 7.2 above, represent the thesis's broader vision of reducing financial and operational risks through strategic legal and contractual arrangements. By providing government backing and clearly defining the roles and responsibilities of all parties involved in the construction and operation of solar facilities, these documents contribute to the stability and attractiveness of the solar energy market in the region.

In summary, each document in this portfolio is a direct extension of the research and recommendations presented in this thesis. They are designed not only to guide the development process but also to serve as a blueprint for overcoming the systemic challenges identified in Sub-Saharan Africa's solar energy sector. Together, they form a cohesive framework that bridges theory and practice, offering practical solutions that can drive sustainable energy development across the continent.

Conclusion

This thesis explored the critical role of solar energy policy in addressing the severe electricity deficits in sub-Saharan Africa, a continent where approximately 650 million people lack continuous access to electricity. The introduction highlighted the direct correlation between economic growth, prosperity, and access to reliable energy, emphasizing the need for a sustainable and scalable solution. Solar energy, with its vast potential in Africa due to abundant sunlight, presents itself as a viable alternative to fossil fuels, offering not only environmental benefits but also economic opportunities for the region. Despite these advantages, the deployment of utility-scale solar projects in sub-Saharan Africa has been limited, necessitating a comprehensive examination of the underlying challenges and the development of effective policy frameworks.

The primary objective of this research was to identify and address the barriers to the development and financing of solar energy in Sub-Saharan Africa. This objective was approached through an in-depth analysis of the institutional voids, policy gaps, and financial challenges that hinder the growth of the solar energy sector in the region. The literature review provided a comprehensive analysis of these challenges, covering essential topics such as policy gaps, institutional voids, feed-in tariffs, renewable portfolio standards, auctions and tenders, power purchase agreements (PPAs), tax policy,

[42] See Portfolio § 11.8, Model PPA, page 234.

[43] See Portfolio § 11.6, Model Issues List, page 222.

[44] See Portfolio § 11.7, PPA Key Terms page 231.

[45] See Portfolio § 11.8, Model Government Guarantee Page 234.

bankability, and risk management. Each of these areas was critically examined to identify both the obstacles and the opportunities for advancing solar energy in Sub-Saharan Africa.

A significant contribution to this thesis lies in the development of a standardized approach to legal documentation for solar energy projects. By advocating for the use of relatively uniform legal documents across projects, this work addresses one of the most significant barriers to solar energy development: the high legal costs associated with financial close. This approach not only reduces costs but also accelerates the project development process, making it more accessible to a broader range of developers. Moreover, the use of standardized documents enhances the bankability of projects by providing clear, consistent, and predictable legal frameworks that investors can trust.

Another key contribution is the emphasis on policies that attract developers of all sizes, rather than favoring large, established entities. By recommending the initiation of solar energy projects with demonstration projects, this thesis highlights the importance of building confidence among stakeholders and proving the feasibility of solar energy in countries where such projects are still rare. This approach helps to create a track record of success, which is crucial for attracting both local and international investment.

This thesis also advocates for the adoption of policy uniformity and the strategic adaptation of successful policies from industrialized nations. This involves tailoring policies to the specific context of sub-Saharan Africa while leveraging the lessons learned from more developed markets. By doing so, this work provides a roadmap for policymakers to create environments that are conducive to solar energy development, thereby bridging the gap between energy supply and demand in the region.

The research has demonstrated that the challenges of developing solar energy in sub-Saharan Africa are multifaceted, encompassing technical, financial, and institutional dimensions. However, by addressing these challenges through targeted policies, standardized legal frameworks, and a focus on inclusivity, this thesis offers a blueprint for a sustainable energy future for the region. The suggested policies and frameworks presented here are not just theoretical constructs; they are practical solutions that can be implemented to drive real change in the energy landscape of sub-Saharan Africa.

In summation, each document and policy recommendation presented in this thesis is more than just a theoretical contribution; they represent actionable steps towards a more sustainable and equitable energy future for sub-Saharan Africa. Together, they form a comprehensive blueprint for reducing costs, lowering risks, and stabilizing the solar energy sector in the region. This thesis makes a significant and original contribution to the knowledge of solar energy policy in Sub-Saharan Africa, offering innovative solutions to long-standing challenges and providing a foundation for future research and policy development. The integration of global best practices with region-specific adaptations ensures that the recommendations are both practical and relevant, paving the way for the widespread adoption of solar energy across the continent.

As we reflect on the objectives set forth at the beginning of this research, it is clear that this thesis has addressed the critical questions surrounding the development and financing of solar energy in sub-Saharan Africa. By identifying the key barriers and proposing concrete solutions, this work not only contributes to academic discourse but also offers a valuable resource for policymakers, investors, and practitioners in the field. The original contributions made here are poised to make a lasting impact on the region's energy future, driving progress towards greater energy access, economic development, and environmental sustainability.

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W. Turner, cost figures are average payments that our company have been billed for project review and due diligence for the past 6 years in Sub-Saharan Africa. In addition, these figures correspond to other projects that I am personally aware of in the marketplace.

W. Turner At the time of the writing of this thesis I am working on building a 50mw solar project in northern Mozambique and therefore have traveled extensively in the country.

W. Turner, My company's first Sub-Saharan African project was in Rwanda. The state utility was funded properly for its capacity but didn't have the technical expertise to maintain the grid. Therefore, as one of our corporate social responsibility projects we funded their grid engineers to study grid management in Germany with SMA the largest inverter company.

W. Turner This 'payback period' estimate is based upon this researcher's current African project models using today's interest rates, pricing, and general finance cost.

W. Turner At the time of the writing of this thesis, the researcher has or is in the process of negotiating 7 bilateral agreements with 7 different Sub-Saharan African countries. These statements are taken from my experience thereof.

W. Turner. In 2018 I met the CEO of the energy regulator of Togo. I asked him why they don't have a solar program, and he said we have been working on one for the past seven years. I asked him why so long and he said no one knows what they are doing.

W. Turner These percentages are based upon the last three utility size projects developed by the writer; 7.5mw project in Burundi, 8.5MW project in Rwanda and a 22MW project in the state of Georgia, U.S.A., 2021

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11. Professional Portfolio Appendices

- Memorandum of Understanding
- Land Options Agreement
- Concessions Agreement
- Project Information Memorandum
- Implementation Agreement
- Power Purchase Agreement Issues List
- Power Purchase Agreement Key Terms
- Government Guarantee
- Power Purchase Agreement

11.1 MODEL MEMORANDUM OF UNDERSTANDING

Renewable Energy Project Development

This Memorandum of Understanding ("MOU") is entered into on **[Date]**

BETWEEN

Party A: [International Renewable Energy Developer]
Party B: [Local Partner / Developer]

Party A and Party B are collectively referred to as the **"Parties."**

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1. PURPOSE

The purpose of this MOU is to establish a framework for cooperation between the Parties to identify, develop, and evaluate renewable energy projects in **[Country/Region]**.

This MOU reflects the Parties' mutual intentions and provides the basis for negotiating future definitive agreements.

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2. SCOPE OF COOPERATION

The Parties intend to collaborate in relation to potential renewable energy projects, which may include:

- Solar photovoltaic projects
- Energy storage projects
- Related grid infrastructure

The Parties agree to work together in good faith to assess project feasibility and commercial viability.

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3. RESPONSIBILITIES OF PARTY B (LOCAL PARTNER)

Party B shall use reasonable efforts to:

1. Identify potential project opportunities.
2. Support engagement with governmental authorities.
3. Assist in securing land rights and site access.
4. Facilitate permits and approvals where applicable.
5. Assist with community and stakeholder engagement.
6. Provide relevant local market information.

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4. RESPONSIBILITIES OF PARTY A (DEVELOPER)

Party A shall use reasonable efforts to:

1. Evaluate project opportunities identified by Party B.
2. Provide technical, legal, and commercial expertise.
3. Lead project development and structuring.
4. Seek financing for viable projects.
5. Engage engineering, procurement and construction contractors where appropriate.

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5. PROJECT COMPANIES

The Parties anticipate that separate project companies may be established for specific projects. The structure and ownership of such entities shall be agreed in future definitive agreements, provided that Party A shall hold a majority ownership interest and operational control in any such project company unless otherwise agreed in writing by the Parties.

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6. EXCLUSIVITY

During the Term of this MOU, Party A agrees to work exclusively with Party B regarding renewable energy projects formally introduced in writing by Party B under this MOU ("Introduced Projects"), unless otherwise agreed in writing. For the avoidance of doubt, Party A retains the right to independently identify, evaluate, and develop renewable energy projects in the region that have not been introduced by Party B.

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7. CONFIDENTIALITY

The Parties agree to keep confidential all non-public information exchanged under this MOU, except to the extent that: (a) such information is or becomes publicly available through no fault of the receiving Party; (b) disclosure is required by law, regulation, court order, or the rules of any stock exchange; (c) disclosure is made to a Party's affiliates, directors, officers, employees, professional advisors, lenders, or investors who have a need to know and are bound by equivalent confidentiality obligations; or (d) the disclosing Party has given prior written consent to the disclosure.

This obligation shall survive termination of this MOU for **five (5) years**.

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8. TERM AND TERMINATION

This MOU shall remain in effect for **24 months**, unless terminated earlier.

Either Party may terminate this MOU with **30 days' written notice**. Termination shall not affect any rights or obligations accrued prior to the date of termination, and the Parties agree to negotiate

in good faith the continued development of any projects that are under active evaluation or development as of the date of termination notice.

Termination shall not affect confidentiality obligations.

---

9. NON-BINDING NATURE

Except for Clauses 6 (Exclusivity), 7 (Confidentiality), and 10 (Governing Law and Disputes), this MOU is **non-binding** and intended solely as a statement of cooperation.

Any binding commitments shall be set out in future definitive agreements.

---

10. GOVERNING LAW AND DISPUTES

This MOU shall be governed by the laws of **[**specify neutral jurisdiction, e.g., England and Wales / Singapore].

Any disputes arising from this MOU shall be finally resolved by arbitration under the Rules of the International Chamber of Commerce (ICC), by a panel of three (3) arbitrators appointed in accordance with those Rules. The seat of arbitration shall be [Neutral City]. The language of arbitration shall be English.

---

11. GENERAL PROVISIONS

- Amendments must be in writing and signed by both Parties.
- This MOU may be executed in counterparts.
- This MOU represents the entire understanding between the Parties.

SIGNATURES

Party A
Name:
Title:
Signature:

Party B
Name:
Title:
Signature:

11.2 MODEL LAND LEASE OPTION AGREEMENT

Utility-Scale Renewable Energy Projects (Africa)

This Land Lease Option Agreement ("Agreement") is made on **[Date]**

BETWEEN

The Landowner ("Lessor")
and
The Project Developer ("Developer")

The Lessor and Developer are collectively referred to as the **Parties**.

---

1. PURPOSE

The Lessor grants the Developer an **exclusive option** to lease land for the purpose of developing, financing, constructing and operating a renewable energy project (the **Project**).

---

2. OPTION PERIOD

The Developer shall have an exclusive option over the Land for [●] **years** (the **Option Period**) to:

- Assess feasibility
- Secure permits and approvals
- Negotiate financing and power purchase agreements

The Developer may extend the Option Period for up to [1-2 years] by written notice to the Lessor given no later than [30] days prior to the expiry of the then-current Option Period, with no additional option fee payable.

---

3. ACCESS RIGHTS

During the Option Period, the Lessor shall provide the Developer and its representatives access to the Land for:

- Surveys and site studies
- Environmental and social assessments
- Grid and technical studies
- Permit and licensing activities

All development activities are conducted at the Developer's cost and risk.

---

4. RIGHT OF FIRST REFUSAL

If the Lessor receives an offer to sell or lease the Land during the Option Period, the Lessor shall promptly notify the Developer in writing of the full terms of such offer within [5] Business Days of receipt.

- The Developer shall have a **right of first refusal**.
- The Developer shall have **six months** to match such offer.

---

5. CONDITIONS PRECEDENT TO LEASE

The Parties anticipate entering into a long-term Lease Agreement once the following are achieved:

1. Grid and technical studies confirm project feasibility.
2. Environmental and Social Impact Assessment completed.
3. Power Purchase Agreement secured.
4. Generation license and permits obtained.
5. Financing arrangements have been progressed to the Developer's reasonable satisfaction (including, without limitation, receipt of indicative term sheets or credit approvals from lenders).

---

6. LEASE AGREEMENT (FUTURE)

Upon satisfaction (or waiver by the Developer) of the Conditions Precedent, the Lessor shall be obliged to enter into a long-term lease with the Developer on the terms set out herein and on such further terms as are agreed between the Parties.

6.1 Lease Term

The Lease shall consist of:

- **Construction Phase:** up to 30 months
- **Operating Phase:** [●] years

6.2 Permitted Use

The Land shall be used for:

- Solar or wind generation facilities
- Energy storage
- Transmission infrastructure
- Access roads and ancillary facilities

---

7. RENT

Rent shall commence upon execution of the Lease Agreement and shall be:

- Payable annually at a rate of [●] per [hectare / acre]
- Indexed to inflation at a rate not exceeding [X]% per annum, based on the Consumer Price Index of [relevant country].

No rent is payable during the Option Period.

---

8. TAXES AND COSTS

During the Lease:

- Developer pays taxes related to the Project
- Lessor pays taxes related to land ownership

---

9. FARMING AND EXISTING USES

Existing land use may continue during the Option Period provided it does not, in the Developer's reasonable opinion, interfere with the Project, including the conduct of any surveys, studies, or assessments.

Developer may request cessation of activities prior to construction, subject to fair compensation consistent with international standards.

---

10. ENVIRONMENTAL AND SOCIAL COMPLIANCE

The Developer shall comply with:

- National environmental laws
- International environmental and social standards
- Community consultation requirements

---

11. TERMINATION

This Agreement may be terminated:

- By mutual written agreement; or
- By **the Developer for convenience on 30 days' written notice; or by the Lessor only in the event of a material breach by the Developer that remains uncured for [30] days following written notice of such breach.**

Termination shall not affect accrued rights.

---

12. ASSIGNMENT

The Developer may assign this Agreement to:

- Affiliates
- Project companies
- Financing parties

The Lessor may not assign without Developer consent.

---

13. GOVERNING LAW AND DISPUTES

This Agreement shall be governed by and construed in accordance with the laws of [England and Wales / the Republic of [Country]], without regard to its conflict of laws provisions.

Disputes shall be resolved by **international arbitration** under the [LCIA / ICC / ICSID Additional Facility] Rules, with the seat of arbitration in [London / Paris / Nairobi], conducted in the [English] language before [one / three] arbitrator(s).

---

14. GENERAL PROVISIONS

- Amendments must be in writing.
- Notices must be in writing.
- This Agreement represents the entire understanding of the Parties.

SIGNATURES

Lessor: _____
Developer: _____

11.3 MODEL CONCESSION AGREEMENT

Utility-Scale Solar Photovoltaic Project

CONCESSION AGREEMENT

This Concession Agreement ("Agreement") is made on [Date]

BETWEEN:

(1) The Government of [Country], acting through the Ministry of Energy (the **Government**)
AND
(2) [Project Company], a company incorporated in [Jurisdiction] (the **Company**)

The Government and the Company are collectively the **Parties**.

RECITALS

A. The Government seeks private investment to increase electricity generation capacity.
B. The Company intends to develop a utility-scale solar photovoltaic power plant (the **Project**).
C. The Parties wish to establish the legal and contractual framework enabling the Project.

NOW THEREFORE the Parties agree as follows:

ARTICLE 1 — DEFINITIONS AND INTERPRETATION

1.1 Key Definitions

Affiliate – an entity controlling or controlled by a Party.
Applicable Law – all laws of [Country].
Commercial Operation Date (COD) – date the plant begins commercial electricity delivery.
Consents – all permits and approvals required for the Project.
Force Majeure – events beyond reasonable control of a Party.
Off taker - the entity purchasing electricity from the Company under the PPA, as identified in the PPA.
PPA – Power Purchase Agreement between the Company and the Off taker.
Term – period defined in Article 2.

1.2 Interpretation

Headings do not affect interpretation. Singular includes plural. English language prevails.

ARTICLE 2 — EFFECTIVENESS AND TERM

2.1 Effective Date

This Agreement becomes effective upon signature.

2.2 Term

The Agreement remains in force for a minimum term of 25 years from the Commercial Operation Date, and shall thereafter continue until the earliest of:

- Expiry or termination of the PPA
- Termination under Article 14
- Mutual written agreement of the Parties

ARTICLE 3 — GRANT OF CONCESSION

The Government grants the Company the exclusive right to:

- Design, finance, construct, own, operate and maintain the Project
- Generate and sell electricity under the PPA

ARTICLE 4 — LAND RIGHTS

4.1 Site Access

Government shall:

- Provide exclusive possession of the Project Site
- Ensure land is free of occupants and encumbrances
- Guarantee peaceful use of the Site

4.2 Security Buffer

Government shall provide adjacent land necessary for Project security and operations.

4.3 Ownership of Assets

All Project assets remain property of the Company during and upon expiry or termination of the Term. Upon expiry or termination of the Term, the Company shall be entitled to remove, sell or otherwise dispose of all Project assets. To the extent any assets are transferred to the Government upon mutual agreement, the Government shall pay the Company fair market value for such assets.

ARTICLE 5 — GOVERNMENT SUPPORT

Government shall use best efforts to:

- Facilitate permits and licenses
- Assist with customs clearance of equipment
- Support infrastructure access (roads, telecoms, utilities)
- Assist community engagement and resettlement

ARTICLE 6 — NON-DISCRIMINATION & STABILIZATION

Government guarantees:

- No discriminatory treatment of the Project
- Treatment no less favorable than other IPPs
- No expropriation or nationalization
- Protection against adverse changes in law materially affecting the Project, and in such event the Government shall restore the economic equilibrium of the Project, including by adjusting the concession fee or making compensation payments, so as to place the Company in the same economic position as it would have been absent such adverse change in law.

ARTICLE 7 — COMPANY OBLIGATIONS

The Company shall:

- Arrange financing
- Construct and operate the Project
- Comply with Applicable Law
- Meet environmental and social standards
- Deliver electricity under the PPA

ARTICLE 8 — FINANCING AND LENDER RIGHTS

Government agrees to:

- Enter Direct Agreement with lenders if requested
- Permit assignment of Project rights as security
- Allow lenders step-in rights in case of default

ARTICLE 9 — PERMITS AND APPROVALS

Government shall support timely issuance of Consents in accordance with the timelines set out in Schedule 3. Failure to issue Consents within such timelines shall: (i) extend corresponding Project milestones on a day-for-day basis; and (ii) if any such delay exceeds 180 days in aggregate, constitute a Government Default under Article 14.1.

ARTICLE 10 — FORCE MAJEURE

10.1 Natural Events

Earthquake, flood, epidemic, extreme weather.

10.2 Political Events

War, terrorism, change in law, permit denial.

10.3 Effects

- Obligations suspended
- Deadlines extended
- Termination allowed after 12 months

ARTICLE 11 — FEES AND PAYMENTS

11.1 Concession Fee

Company shall pay Government a concession fee equal to:

[●]% of gross electricity revenues received under the PPA

Payable from COD.

11.2 Suspension

Fee payments suspended if Off taker fails to pay under the PPA.

ARTICLE 12 — TAXES

All Project taxes existing as of the Effective Date are deemed included in the concession fee. Any new taxes or increases in existing taxes imposed after the Effective Date as a result of a change in Applicable Law shall be for the Government's account and shall result in a corresponding reduction in the concession fee.

ARTICLE 13 — ENVIRONMENTAL & SOCIAL STANDARDS

Company shall comply with:

- National environmental laws
- IFC Performance Standards
- World Bank Environmental Guidelines

ARTICLE 14 — EVENTS OF DEFAULT

14.1 Government Default

Includes:

- Failure to provide land
- Discriminatory treatment
- Expropriation

14.2 Company Default

Includes:

- Failure to construct or operate Project
- Breach of material obligations

14.3 Cure Period

Defaulting Party has 60 days to remedy breach, provided that if the breach is not reasonably capable of being remedied within 60 days, the defaulting Party shall have such additional time as is reasonably necessary to remedy the breach (not to exceed 180 days in total) provided it commences remediation within the initial 60-day period and diligently pursues such remediation to completion.

ARTICLE 15 — TERMINATION

15.1 Termination Rights

Either Party may terminate for:

- Uncured default
- Prolonged Force Majeure
- Expiry of PPA

15.2 Effect of Termination

Termination does not affect accrued rights. Upon termination due to Government Default or Political Force Majeure, the Government shall pay the Company a termination compensation equal to the greater of: (i) all outstanding senior debt; (ii) the fair market value of the Project; and (iii) all equity invested by shareholders plus a return thereon, as determined by an independent expert in accordance with Schedule 6.

ARTICLE 16 — DISPUTE RESOLUTION

Step 1 — Negotiation

Step 2 — Expert determination (technical disputes)

Step 3 — Arbitration

Arbitration under **UNCITRAL Rules**
Seat: [City, Country]
Language: English

ARTICLE 17 — GOVERNING LAW

This Agreement is governed by the laws of [Country].

Government waives sovereign immunity for arbitration and enforcement.

ARTICLE 18 — CONFIDENTIALITY

Parties shall keep Project information confidential except where disclosure is: (i) required by law, regulation, or order of a competent authority; (ii) made to lenders, potential lenders, equity investors, financial advisors, or legal counsel on a need-to-know basis subject to confidentiality obligations; or (iii) approved in writing by the other Party.

ARTICLE 19 — ASSIGNMENT

Company may assign rights to lenders or affiliates.
Government consent required for other transfers.

ARTICLE 20 — NOTICES

All notices must be in writing and delivered to official addresses.

ARTICLE 21 — AMENDMENTS

This Agreement may only be amended in writing signed by both Parties.

ARTICLE 22 — ENTIRE AGREEMENT

This Agreement constitutes the entire agreement between the Parties.

SIGNATURES

For the Government: _____
For the Company: _____

SCHEDULE 1

PROJECT DESCRIPTION

1. Project Overview

The Project consists of the design, financing, construction, ownership, operation, and maintenance of a **utility-scale solar photovoltaic power plant**.

2. Installed Capacity

- Target Capacity: **[50–200 MWAC]**
- Technology: Ground-mounted solar photovoltaic (PV)
- Expected Capacity Factor: **18–25%**

3. Major Components

The Project shall include:

- Solar PV modules
- Mounting structures and trackers (if applicable)
- Inverters and transformers
- Substation and switchyard
- Transmission interconnection facilities
- Monitoring and control systems
- Security infrastructure and fencing
- Access roads and drainage

4. Interconnection

The Project will connect to the national transmission or distribution grid at:

Interconnection Point: [Location]

The Company will design and construct the interconnection facilities in coordination with the transmission operator.

5. Project Milestones

Milestone	**Target Timing**
Financial Close	Within 24 months of Effective Date
Start of Construction	Within 3 months after Financial Close
Commercial Operation Date (COD)	Within 24 months after construction start

6. Operating Life

Expected operating life: **25–30 years**

SCHEDULE 2

PROJECT SITE AND LAND RIGHTS

1. Site Description

The Government shall provide the Company with land suitable for the Project.

Approximate Area: 150–400 hectares
Location: [Region / District]

2. Land Rights Granted

The Government grants:

- Exclusive possession of the Site
- Right to construct, operate and maintain the Project
- Access roads and transmission corridor rights

3. Security Buffer Zone

The Government shall provide additional land surrounding the Site for:

- Security
- Maintenance access
- Future expansion (if required)

4. Resettlement (if applicable)

If resettlement is required:

- Government shall ensure compensation of affected communities
- Resettlement shall follow World Bank / IFC standards

5. Peaceful Possession

Government guarantees the Company uninterrupted use of the Site during the Term.

SCHEDULE 3

GOVERNMENT SUPPORT MEASURES

The Government shall use reasonable efforts to support the Project by facilitating:

1. Permits and Approvals

Including but not limited to:

- Environmental approvals
- Construction permits
- Grid connection approvals
- Import permits and customs clearance

2. Infrastructure Support

Where reasonably available:

- Road access
- Telecommunications connectivity
- Coordination with transmission operator

3. Security Support

Government shall assist with:

- Coordination with local authorities
- Community engagement support

SCHEDULE 4

DIRECT AGREEMENT – KEY TERMS

This Schedule summarizes the provisions to be included in the Direct Agreement between the Government, Company, and Lenders.

1. Recognition of Lenders

Government acknowledges lenders' security over:

- Concession Agreement
- PPA
- Project assets
- Land rights

2. Notice of Default

Government shall notify lenders of Company default before termination.

3. Cure Period

Lenders shall have **180 days** to cure Company defaults.

4. Step-In Rights

Lenders may:

- Replace the Company
- Assign the Project to a substitute operator

5. Continuity of Concession

Government shall continue the Concession following lender step-in.

SCHEDULE 5

ENVIRONMENTAL AND SOCIAL STANDARDS

The Project shall comply with:

- National Environmental Law
- IFC Performance Standards
- World Bank Environmental & Social Framework
- International Labour Standards

Key requirements include:

- Environmental Impact Assessment (EIA)
- Community consultation
- Health & safety plans
- Grievance mechanisms

SCHEDULE 6

DISPUTE RESOLUTION PROCEDURE

Step 1 — Negotiation

Senior representatives meet within 15 days.

Step 2 — Expert Determination

Technical disputes referred to independent expert.

Step 3 — Arbitration

UNCITRAL arbitration in neutral jurisdiction.

GIGAWATT GLOBAL

Gigawatt Global
Zambia 71 MW Hybrid Wind/Solar Project

Project Information Memorandum

DATE

IMPORTANT NOTICES

This document has been prepared by Gigawatt Global Cooperatief U.A. ("GWG") exclusively for use in providing certain information regarding the proposed 71-megawatt (MW) hybrid Wind/Solar project currently being developed by GWG, in Chibombo, Zambia (the "Project"). As a consequence thereof, this document may not be disclosed or published, nor used by any other person or entity, for any other reason without the express and prior written consent of GWG.

The information and any opinions, assumptions, estimates or statements made or included in this document have not been verified by independent third parties; therefore, no express or implied warranty or representation is made as to the impartiality, accuracy, completeness or correctness of the information or the opinions, assumptions, estimates or statements expressed herein.

GWG does not assume liability of any kind, whether for negligence or any other reason, for any damage or loss arising from any use of this document or its contents.

Neither this document nor any part of it constitutes a contract, nor may it be used for incorporation into or construction of any contract or any other type of agreement.

Investors must conduct their own due diligence and not rely on this Project Information Memorandum when making investment decisions in relation to the Project.

Weldon Turner
Managing Director
Gigawatt Global Zambia
Tel: +972 (0)54-484-4391 weldon@gigawattglobal.com

1) EXECUTIVE SUMMARY

Gigawatt Renewables Zambia Ltd., a Limited Company established in Zambia by Gigawatt Global (GWG), is seeking financing for a 71-megawatt (MW) Hybrid solar photovoltaic and wind power plant project to be built in Chibombo District, in Zambia (Project) per a MoU signed with ZESCO and Implementation Agreement signed with The Government of the Republic of Zambia I March 2021.

Site evaluation and access study

The site is currently a commercial farm, privately owned. A conversion of use to industrial activity is not expected to negatively impact the commercial farming area. Two staff buildings have been identified within the site and resettlement will have to be considered. This was indicated as being acceptable and understood by the landowner during the site visit. A private airstrip is located close to the farm, and the nearest governmental airstrip is located 50 km from the site. It is recommended that the Customer communicate with the Department of Civil Aviation to discuss the plans for the future Facility. The site is characterized by gentle slopes. Some site levelling and grading may be required during the construction phase, which is considered typical. No risks identified. The site is classified as “low” seismic terrain, with a 2% probability of a seismic event occurring in the next 50 years. The site is dominated by leached red-brown ferromagnesium- enriched silts and clays, demonstrating degrees of leaching with depth, overlying metamorphic basement complex granites, schists and amphibolite. Based on this assessment, no risks have been identified. During the rainy season (November to April), precipitation is often concentrated in storms, causing risk of flooding and soil erosion. Flooding and erosion could have an impact on site access and turbine and module foundations. It is recommended a hydrological study be performed to assess the level of risk for the construction and operation of the future Facility and define the mitigation strategy. No far shading effect is expected to impact the production of the PV component of the Facility. At present, the dense vegetation and existing measurement mast have not been considered in the solar Yield Assessment. Nevertheless, the wind turbines will remain the main shading factor to the PV plant. DNV GL has minimized these effects in the preliminary siting and therefore considers shading effects to be negligible risk to the success of the Facility. Water is available at the farm; however additional investigations should be performed to assess the quality and the accessibility for use during the construction and operation of the Facility. The mobile network coverage is poor at site. Fiber optic lines currently exist at site. No investigations were performed about any existing underground utilities (i.e., pipelines). The risk is expected to be low, due to the current use of the land. Mitigation measures should be defined during the construction phase. Site access is proposed to utilize the Port of Walvis Bay in Namibia, owing to the quay length, existing crane infrastructure at the port and road network condition from the port to the site. Travel distance from Walvis Bay to the site is marginally closer at 2,143km than the other considered alternative port of Durban in South Africa, which is 2,207km and possessed of less-favorable transport conditions. Due to the distance from the preferred port of entry and the conditions of the recommended route, some additional investigations are required, but the risk is considered minor at this stage.

Preliminary siting

The available area for the PV plant has been analyzed as per the site visit conducted. The PV plant has been positioned to not be affected by the shadow flicker of the wind turbines. The wind turbines on the other hand have been positioned to optimize power generation from the available wind based on the predominant wind direction. Combined these technologies have been positioned in consideration of the connecting reticulation system. There is sufficient space for the positioning of the required number of turbines to meet the nameplate capacity of at least 31MW and for the 40MW solar PV facility. It is noted that more turbines may be accommodated at the site should the Customer wish to expand generation at a later stage.

Electricity Evacuation Analysis

Grid Connection information has not been made available from ZESCO, as expected at this early stage. ZESCO will need to be approached to determine if the local substation, the 90 km single circuit connection to Fig Tree and the network beyond Fig Tree can accommodate the power exported from the Facility. It is deemed a medium risk that the ZESCO system may need an upgrade (equipment ratings or the single circuit requiring to be double circuit) to allow the full potential of export to occur without impacting the existing ZESCO customer base. DNV GL has produced a concept design of the wind and solar components of the Facility being connected as two distinct halves of the on-site substation. Depending on the full analysis of the design in the future, there is a risk there may be curtailment placed on either the wind half or the solar half if the export route is compromised (through faults or maintenance activity). DNV GL has generated a conceptual design of the wind collection system, from the turbines to the substation. This follows the typical arrangement installed at the majority of wind farms worldwide. There is a low risk to this design, as at least 4 or 5 turbines can continue to export if there is a fault in the opposite string. DNV GL has generated a conceptual design of the solar collection system, from the modules to the substation. This follows the typical arrangement installed at solar facilities worldwide. There is a low risk to this design, as at least half of the modules can continue to export if there is a fault in the opposite string. DNV GL has generated a conceptual design of the on-site substation, based on typical arrangements. The balancing level of maintaining export versus CAPEX is a requirement to be evaluated but is considered a low-risk item at this time.

Yield assessment

In the absence of ground measured irradiation data on site, DNV GL has analyzed a number of sources of satellite irradiation data for the site. On-site measurements are recommended in an early stage of development in order to reduce the uncertainty related to the solar resource. The analysis does not consider any grid requirements such as operation at non-unity power factor.

However, an export limitation of 40MWac is applied at the inverter output level. The risk rating given is “Medium” to reflect the need of an on-site correlation analysis with the solar measurements and the lack of information on the grid constraints that may affect the Yield estimates. The estimated P50 net energy production of the solar component of the Facility is 106.2 GWh/annum, which corresponds to a capacity factor of 25.1%. It is noted that the site measurements indicate high wind shear values. Based on knowledge of the region, DNV GL has reason to believe that the wind shear measured at the mast is high compared to what is anticipated to occur above mast height. As the mast measurements are less than the required turbine hub height, it is possible that the high shear values are resulting in an overestimation of the hub height wind speed, which would also result in an overestimation of the energy production. For this reason, DNV GL has classified the energy production risk for the wind component to be medium. The estimated P50 net energy production of

the solar component of the Facility is 125.7 GWh/annum, which corresponds to a capacity factor of 46.2%

Implementation plan

DNV GL anticipates approximately 18 to 24 months for the development phase, including site studies and financial close, and 18 months for the construction phase (from NTP to COD). The estimated period for the construction phase will be largely dependent on the delivery of the WTG components – which is considered the key critical path. No risk is considered at this stage of the project, as no time constraints have been defined for this review.

Initial environmental and social impact analysis

From a socio-cultural perspective, no "fatal flaws" were identified. The major socio-cultural risks arise from human health and safety impacts at the community level, particularly during the construction stage with transportation of turbines. Environmental screening has equally not highlighted any species of special concern that may be impacted upon. Moderate considerations for borehole and aquifer protection, HSE and Bio-diversity, as well as noise impact on nearby fauna and communities should be mitigated.

Project Overview

Gigawatt Global (GWG) is a multinational renewable energy company focused on the development and management of utility-scale solar power plants in emerging markets. We are the first company to have successfully developed a utility-scale solar field in East Africa with our success in Rwanda and have positioned our company to play a key role in the development of sustainable and reliable power generation infrastructure in Zambia.

2) **PROJECT SPONSORS & TEAM**

Gigawatt Renewables Zambia Ltd is a special purpose vehicle established by Gigawatt Global (GWG), a U.S. owned, Dutch developer of renewable energy projects worldwide.

Gigawatt Global Cooperatief U.A.

(www.gigawattglobal.com)

Gigawatt Global Cooperatief UA is a multinational renewable energy platform that develops, finances, builds, and operates utility-scale photovoltaic solar projects in emerging markets. Based on their experience as pioneers of the solar industry in Israel (in the Arava Power Company), the company's co-founders built the first grid-connected solar project in East Africa, an 8.5 MW solar PV plant in Rwanda. Gigawatt Global reached financial close on their 8.67MW PV project in Burundi in January 2020, with construction now under way.

Gigawatt Global is a founding partner of the U.S. Power Africa initiative and has excelled in attracting both political and financial support for early-stage development with USTDA, EEP, BIO, InfraCo, and others. GIGAWATT is presently developing projects in Liberia, Nigeria, Guinea-Conakry, South Sudan, Kenya, Zambia, Mozambique, Ethiopia and Burundi. While focusing on PV, we are actively pursuing wind and hydro technologies, developing our asset management and O&M capabilities, and engaging the C&I market.

Gigawatt Global is an efficient, experienced, and focused company bringing renewable energy projects to sub-Sahara Africa and other emerging/frontier markets. The company has exceptional financial partners, and has collaborated with institutions such as Norfund, FMO, AfDB, EAIF, DFC (OPIC), REPP, Inspired Evolution, and the World Bank Group, among others.

Arava Power – Associated Company

GWG was initiated by the American group that established and built the Israeli solar company Arava Power Company (APC). Arava Power Company was founded in 2006 and has first-mover advantage in Israel. Arava Power Company built the first grid-connected solar field in Israel. In May 2012, it closed on $204 million for the next eight solar fields in Israel. In April 2013, APC closed on another 40 MW project and has a further $1 billion worth of projects in the pipeline.

Gigawatt Global – Governance

Yosef Abramowitz – President & CEO

Yosef is the president, co-founder and CEO at Gigawatt Global. Yosef's expertise lies in strategy, government relations and development of solar PV projects. He is responsible for defining the overall project strategy. Yosef was named by CNN as one of the top six Green Pioneers worldwide. Yosef Abramowitz serves as president of the Arava Power Company. As an entrepreneur, environmentalist and human rights activist, Yosef established GWG to bring solar power on a commercial basis to developing nations.

Weldon Turner - Chief Operating Officer, Zambia Hybrid Wind/Solar Project Developer

Weldon is the Chief Operating Officer and Chief Compliance Officer of Gigawatt Global. From 2009 until 2011 Mr. Turner was the Product Manager for RCS Solar, a leading supplier of solar power plants in Europe, Africa and Israel. From 2005 until 2008 he was the C.E.O. of a boutique investment firm with offices in the U.S., South Africa and Israel. The firm oversaw private placements for real estate, commodities and farming projects. He was the co-manager of a long- short equity hedge fund that focused on market neutral investing. In addition, he was Chief Operating Officer and General Counsel at Goldnames, an internet domain name company. From 1994 to 1999 he was the Director of International Equity Sales/Trading at Credit Suisse in New

Gigawatt Global 8.5 MW Solar field in Rwanda.

York, and from 1985 to 1992 he was a V.P. of Equity Sales/Trading at Salomon Brother in New York. Mr. Turner has been on the Board of Directors of the Orthodox Union, the Board of Advisors of Thorium Power Company and Portofino Equity Advisors. He has a B.A. in History, a B.A. in Political Science, a J.D., an L.L.M (Master of Laws) and is a candidate for a PhD in Environmental Law with a concentration in developing renewable energy legal policies in sub-Saharan Africa.

Howie Rodenstein – Chairman of Advisory Board

Howie, based in Boston, served for the past 15 years as CFO of Adheris Inc. a pharmaceutical information services company that he grew from a start-up to its sale for $100 million to inVentiv Health. He earned an MBA with Distinction (Baker Scholar) from Harvard Business School and a BA in Economics from Brandeis University. Howie founded and still chairs an annual charity bike ride that has attracted over a thousand riders and raised over $2.5 million for environmental NGOs over the past nine years.

Gigawatt Global – Development Team

Michael Fichtenberg – Exec. VP Finance & Business Development

Mr. Fichtenberg handles finance for both corporate and project finance needs and supports business development and strategy. Michael started his professional career as an entrepreneur in the construction materials business in NYC, where he founded and operated his company in custom materials servicing high-rise buildings in Manhattan. Deciding to move into the clean technology sector, Michael worked at an insurance company at their renewable energy desk, where he dealt with private wealth management, clean technology start-ups, and acquisition/sale of operating solar fields. Joining the Arava Power Company in 2011, Michael worked as deputy CFO and assisted in raising the debt and equity for 100 MW of solar PV, and the construction and commissioning of Israel's first medium sized PV field. Michael holds a BS degree in Finance, a degree in Information Technology, and an Executive MBA from Northwestern's Kellogg School of Management.

Chana Abrams – General Counsel

Chana acts as General Counsel for Gigawatt Global. Chana is a project finance lawyer specializing in the renewable energy sector in Africa, with experience in Zambia, Tanzania, Rwanda, Benin, Burundi, Togo, Ghana, Egypt, Jordan, South Sudan and Nigeria. Previously employed at Slaughter and May, London and Herzog Fox, Tel Aviv. Visiting lawyer at leading Nigerian law firm Aluwko & Oyedobe, Lagos. Chana has published in the Renewable Energy Law & Policy journal and received her degree from King's College London.

Dr. Hanna H. Klein – Project management

Dr. Klein is director of research and grants at Gigawatt Global and overseeing the project management for the Burundi project. Hanna is an energy expert and seasoned project manager. She has developed gas turbines with ABB in Switzerland and worked with Nuclear Safety for Vattenfall power company in Sweden and designing concentrated solar systems with Aora Israel. She has developed her own patents in concentrated solar technologies (as EZKlein) and has been active as an evaluator for the European Commission for grants regarding energy and environmental Science. She built up her business experience working as a business consultant for Arthur Andersen out of Amsterdam. She holds a MSc in Energy Systems from the Royal Institute of Technology in Stockholm and a PhD in solar energy from the Weizmann Institute of Science.

Patrick Nzitunga – Local Project Coordinator

Patrick is the local project coordinator of the 7.5MW solar power plant and regional business associate. He manages local logistics, relationships with local authorities, government license procurement, local banking, identification and vetting of local contractors, CSR and off grid development, and development support in regional markets. He is fluent in English, French, Swahili, and Kirundi. Patrick studied law and project management at the University of Bujumbura, Burundi. He worked as a consultant for various companies (TUTTNAUER), Canada (Anyway Solution), France (Egis BCEOM International), and various international NGOs including Christian Aid, CordAid, and Tevel B'tzedek.

Akiva Turner – Project Development

Akiva serves as a project developer and financial analyst for Gigawatt Global where he worked on several PV solar projects in countries such as Nigeria, Rwanda, Turkey and South Sudan. Prior to joining the renewable energy industry, Akiva worked as a financial analyst at a boutique consulting firm in Los Angeles which provides financial and strategic advisory services to large independent film and TV companies in Hollywood. Akiva has a BA in business administration and finance from IDC Herzliya.

Legal Advisors

GWG prides itself in consulting the best international and local legal advice for each project. Our legal team includes, but is not limited to:

- Norton Rose Fulbright, a global law firm based in London.
- Trinity International LLP, a global law firm based in London.
- Kaplan & Stratton Advocates, a premier law firm in Kenya.
- Van Campen Liem, a boutique law firm in Holland that specializes in international and European tax law.
- Pearl Cohen, an international law firm based in Tel Aviv that specializes in international business transactions and tax law.

3) PROJECT BACKGROUND & DESCRIPTION

Project history

The hybrid solar/wind project officially started Q2-2018, when Gigawatt Global met with the Zambian Government Officials, during their visit to Jerusalem, Israel. Gigawatt thereafter proposed to develop a 71 MW project with an approximate 50/50 split between wind and solar, which was agreed to in principle with the Government officials. Gigawatt Global had at that time, been active in Zambia for several years, but had lowered its intensity when most of the management of ZESCO (the utility) were relieved of their duties in the beginning of 2017. Though Gigawatt had signed an MoU with the Ministry of Energy in 2017 and secured land suitable for only a solar power plant, when it was decided instead to pursue a hybrid solar/wind project, a new land site was secured. This land had a wind mast installed by the World Bank on the site, enabling the project to expedite the collection process of bankable wind data. The MoU was amended to include the new land site, and

an MoU was also signed with ZESCO for accessing grid data. A feasibility study was conducted on the land site that was completed in May 2019, with no red flags identified. In the January 2020, Gigawatt executives and project managers met with representatives of the

Ministry of Finance, Ministry of Energy to discuss the next steps for the project. On 6 February 2020, Gigawatt received a clear outline for how to move the project forward, including a request for Gigawatt to provide a draft Implementation Agreement, which has since been signed by the Government of the Republic of Zambia. Gigawatt Global has acquired an Investment License from the Zambia Development Agency for the hybrid project in Zambia during 2020.

The country and region

Zambia is a landlocked nation in southern Africa, bordering Angola, Namibia, Mozambique, Malawi, Zimbabwe, Tanzania and DRC. Its 16 million inhabitants are mostly Protestant Christians, and the country is an area slightly larger than France. The country has been politically stable over the last decade with its main source of income coming from mining.

Energy situation in Zambia

Zambia is heavily dependent on hydro power (96%) to power its economy, which is primarily focused on copper and other mining related industries. The country has a relatively large installed capacity of 2350 MW, considering its low population density, though only 26% of the population has access to the grid. During the last number of years of drought in Eastern and Southern Africa, the hydro capacity has been reduced to about 50% of full capacity, requiring an import of electricity or use diesel generators to address the gap in electricity supply, which has severely strained the country financially. Recently, ZESCO received the government's permission to raise the tariff to consumers by around 75%, though even this increase is not projected to fully cover the costs considering times of drought and needed diesel generated power to compensate for the lack of hydro production.

Local company

Gigawatt Renewables Zambia Limited, company number 120180004495, was incorporated on 30 May 2018, to be the special project company for the hybrid plant project.

Gigawatt Renewables Zambia Ltd is owned 100% by Gigawatt Global Cooperatief U.A., registered in the Netherlands under 51503700 with a business address on Kingsfordweg 151 1043 GR Amsterdam, The Netherlands.

Project Land

Gigawatt Global signed a land lease option agreement with Kabwese Farm, a commercial farm currently cultivating wheat and soya crops and cattle ranching. A wind mast was installed on the land in 2017 by the Renewable Energy Resource Mapping (ESMAP) program, led by World Bank Group and its partners. This is the best performing mast in Zambia, with data collected at 80m, and the site, essentially flat and situated at high elevation (1180m), is suitable for solar PV and wind.

Topography

The land is characterized by gentle slopes to flat areas with natural slopes that vary from 1% to 2.5% in average both on the west-east and the north-south directions. Some site levelling or grading may

be required during the construction phase, but this is considered typical for a project of this size. No risks are identified for the project due to the topography of the site.

Seismology of the site

	Latitude	Longitude
WT1	-14.788°	28.038°
WT2	-14.792°	28.036°
WT3	-14.796°	28.034°
WT4	-14.800°	28.032°
WT5	-14.805°	28.030°
WT6	-14.810°	28.028°
WT7	-14.814°	28.026°
WT8	-14.818°	28.025°
WT9	-14.823°	28.023°
SOL1	-14.792°	28.053°
SOL2	-14.812°	28.053°
SOL3	-14.812°	28.050°
SOL4	-14.792°	28.049°

The Seismic risk factor for large parts of Zambia is described as “medium” as a result of the proximity to the East African Rift Valley. The Project site, however, is located in the low seismic risk region of Chibombo, see Figure 3-3. This implies that there is a 2% chance of a potentially damaging seismic event occurring within the next 50 years. With the Project being located in a low-risk area, DNV GL does not expect to see any major impact on the structural requirements due to the seismic factor.

Geotechnical characteristics

The geological environment prevailing at the site comprises leached, red-brown argillaceous soils. The silty clay and clayey sands have been subject to secondary enrichment of ferric and magnesium ions, possibly sourced from the chemical and mechanical erosion of the underlying strata. The hard rock geology is depicted as pre-Cambrian basement complex, which has undergone extensive local alteration and as well as regional metamorphism. Schists, gneiss, amphibolite and phyllites all persist in the basement complex, as well as secondary igneous intrusions by other granites, dolerite, gabbro, syenite and andesite. The Katanga Supergroup unconformably overlies the basement complex, and is dominated by Neoproterozoic sedimentary mudstones, conglomerates, shales, arkose and aeolian sandstones. No sloughing of the soil mantle, large-scale slippage or ground subsistence was noted during the site visit. There is no available record of previous artisanal or commercial mining having taken place on the site. No geological red flags are thus raised from a geotechnical and seismic risk point of view for this development, based upon available information.

Crucial for the next phase of this development will now be the commencement of a phased Geotechnical Investigation on the site. This may commence with a Desktop Geotechnical Assessment with site walkover, followed by a Detailed Geotechnical Investigation for the site.

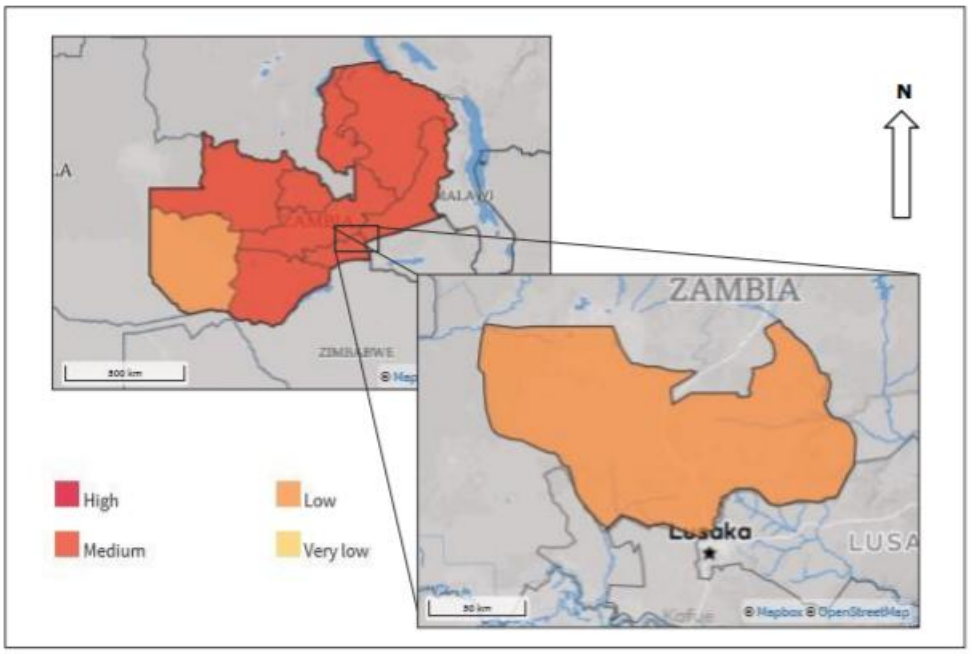


Figure 3-3 Seismic map of Zambia (source: ThinkHazard.org)

Broadly speaking, the latter must include as a minimum, aspects of coverage for both wind and solar foundation design:

- This will entail bulk sampling through the excavation of trial pits at prior-approved positions across the site;
- Rotary core drilling at each turbine position to depths equivalent to 1.5xB, where B = minimum turbine foundation diameter. Rotary coring to a shallower depth must also be conducted at select positions across the solar array footprint.
- Selected sampling of bulk, core and groundwater samples for laboratory analysis at an accredited testing facility;
- In-situ field testing, including Dynamic-Cone-Penetrometer (DCPs), Standard Penetrometer Tests (SPTs) in boreholes, electrical resistivity, and thermal resistivity for the excavation of cable trenches. Consideration may be given to use of seismic or Continuous Surface Wave (CSW) geophysics as well, depending upon the suitability of ground conditions for such testing;
- Installation of standpipes for subsequent groundwater monitoring over a 12-month period;
- Construction materials availability on or near the site; and
- Reporting.

It is further recommended that a Geohydrological Assessment of the site be conducted, considering the local reliance upon boreholes and groundwater sources. This may include a hydro census of existing available water sources on the site, as well as pump yield testing of installed abstraction boreholes. This will inform us upon the potential availability of water for construction and operational demands.

Climatic conditions

Zambia is characterized by a tropical climate, with a dry season from May to October and a rainy season from November to April. The Project is located in Central Zambia and its subject to the tropical climate conditions. The precipitation is often concentrated in rainstorms during the rainy season. Based on the exchanges during the site visit with local farmers, flooding is recorded in the area. Considering the dense vegetation at the site, DNV GL recommends performing a hydrological study taking into consideration the future facility and the impact to the natural drainage system. The hydrological study is expected to assess the flooding and soil erosion risks at site and identify any mitigation actions (i.e., water drainage system) where needed.

The average yearly temperature at site is 20.8 degrees Celsius, with the hottest months being October and November. DNV GL reviewed the temperatures registered at site based on the 24 years satellite dataset acquired for the Project. The minimum and maximum ambient temperatures recorded at site are respectively 5°C and 44°C.

Horizon

The site is covered with dense vegetation, including trees about 10m high. A wind measurement mast is located in the middle of the site (see Figure 3-5). This was installed approximately two years ago on behalf of the Renewable Energy Resource Mapping (ESMAP) program, led by World Bank Group and its partners. While the future ownership of the mast is unclear, DNV GL recommends considering maintaining the existing mast in order to collect data that could serve the future wind farm. Please note that for the purpose of the Energy Yield Assessment of the future solar PV plant, DNV GL has not considered this measurement mast in its simulation. The horizon line is flat. The expected shading impacts to the future PV plants are related mainly to the future wind turbine generators. DNV GL has assessed and selected a suitable location for the future PV plant that allows to minimize the shading effect,

Site access and route selection for transportation of the wind turbines

The site is easily accessible by road via the T2 transnational road that borders the site on the east side.

Following a site access study, it was concluded that the port of entry should be Walvis Bay in Namibia. The route to the site is 2,200km long, following the road from Walvis Bay to Katima Mulilo on the Zambian border. From there, it follows M10 north to Mungu, M9 East to Mumbwa, and M20 East until it meets T2 close to the project site. This route is not the shortest option, but it avoids the Lusaka area where traffic congestion is greatest. A more detailed road assessment study will be conducted closer to construction to specify any potential road works/adjustments that will be required for the successful transportation of the turbines. Each wind turbine is expected to be transported in 10 sections to site on a specialized vehicle.

Site design

The wind direction is prevailing east-ward and the layout of the wind farm, and therefore the design includes a single row of wind turbines (see pink pins in the image below on the right), to enable small distances between the turbines but avoiding wakes, with 3.5 rotor diameters between turbines. The software used for the sitting was WAsP 10.2.

The solar farm is located at the western edge of the site, alongside the T2 road. An elongated solar field design (see blue rectangle in the picture below on the right) was selected to avoid shading and shadow flickering from the wind turbines. The solar field will cover 90 ha.

Transmission and grid study

The Chibombo substation is located 5 km south of the project site (see picture above to the left). It is connected to the Fig Tree substation at a distance of 90 km on a 132 kV line, now operating at 88 kV. A number of questions regarding the grid were posed to ZESCO in Q1 2019 with ZESCO's transmission director replying that RES4AFRICA has partnered with the Ministry of Energy to conduct an in-depth analysis of issues related to the grid, transmission, and related integration of variable renewable resources in Zambia. The study is expected to be completed in Q2 2020, and ZESCO is not expected to engage with other private developers until the study is completed. The full grid study can therefore only be conducted following the delivery of the ZESCO analysis.

PPA and Implementation Agreement (IA)

Gigawatt Global received an official letter from the Minister of Energy on 6 Feb 2020, delineating the requirements to start PPA negotiations. As part of the process of approving the feasibility study and in framing the tariff discussions, during Q 1 2021 we signed an Implementation Agreement with the Ministry of Energy. We are aiming to start negotiations for a PPA with ZESCO in Q4-2021, with the goal to have one PPA for the solar/wind hybrid project.

The off-taker for the electricity is the government-owned power utility, ZESCO, which is responsible for electricity distribution, and produces 80% of the electricity in Zambia. However, given the financial challenges ZESCO is facing, an alternative off-taker is being considered, Africa GreenCo, though this new entity is currently in the process of formation, with further concrete discussions to take place after the formation is completed in mid-2020 to 2021.

Environmental and Social Impact Assessment (ESIA)

DNV GL performed a preliminary ESIA assessment, which verified that there are no “red flags” regarding Environmental and Social elements which could be a challenge for the implementation of the project. An ESIA in accordance with Zambian regulation will be pursued and submitted to ZEMA for the awarding of an environmental license.

The project area is located on a commercial farm, whose natural habitat changed many years ago and the entire site is considered a highly modified habitat from a bio-diversity point of view. As wind turbines can impact bird and bat populations, while no red flags were found in the preliminary investigation at our site concerning this issue, it must be investigated in more depth in the next E&S study stage. Two houses for cattle herders are within the planned area of the hybrid farm, and the landowner will relocate his workers to another part of his farm that will not be directly impacted by the project.

While there are no civil aviation airstrips within 50 km of the site, there is a private airstrip on another commercial farm 2.5 km from the planned wind turbines that can be utilized.

Solar resource and expected productivity

A solar yield assessment has been performed by DNV GL for the site design. Satellite solar resource data was used with an estimated yearly GHI of 2,184 kWh/m^2, and the average yearly temperature on site is 20.8 °C. The solar field will have a capacity of 40 MWp AC, with 48.2 MWp DC installed on east-west orienting trackers. The net output for this design was estimated at 106,187 MWh/year (at P50) with an average PR of 78.3%.

Wind resource and expected productivity

A wind resource study was performed by DNV GL, an engineering company with extensive experience in wind and solar and conducted the mapping and installation of the wind masts in Zambia, therefore having extensive local knowledge. The choice of turbines and the site layout of the wind farm was an integral part of the study, and the wind data from the on-site wind mast was used as the primary inputs. For turbine selection, the study used Vesta V136 with a rating of 3.45 MW, a hub height of 132m, rotor diameter of 136m, and 9 turbines, bringing the total capacity of the wind farm to 31.05 MW.

[years] [years] [m/s] [m/s] [m/s]

1.1 16 6.2 6.5 0.34 8.0

Design assumption	Specification
Plant Arrangement	Single axis solar tracker
Tracker rotation [°]	±60
PV Module Technology	p-Si
Pitch E/W [m]	11.5
PV module rated power [Wp]	330
Ratio modules/string	29
Ratio strings/inverter	252
Number of inverters	20
Inverter rated AC power [kW]	2,000
Total rated power P_{DC} [MWp]	48.2328
Total rated power P_{AC} [MW]	40.0
Ratio P_{DC}/P_{AC}	1.2
Plant available area [ha]	89.3
Plant area ratio [ha/MWp]	1.85

Measurement period	Period defining the long- term wind speed	Measured wind speed at 80 m	Long-term wind speed at 80 m	Wind shear exponent	Long-term wind speed at 132 m

The seasonal wind profile peaks in September/October, with higher wind months occurring from May to October and low wind months occurring from November to April. A normalized seasonal profile of the wind is provided below, which indicates when months are above (>1) or below (<1) average.

The Wind resource simulation program WindFarmer, based on the Monte Carlo method, was used to calculate the energy production of each turbine at the specified location, using the power curve for the specified turbine. The gross energy output was estimated at 139.9 GWh/year. When considering losses such as turbine interaction effects, availability, transmission efficiency and turbine performance, the net output was estimated at 125.7 GWh/year.

Hybrid generation match

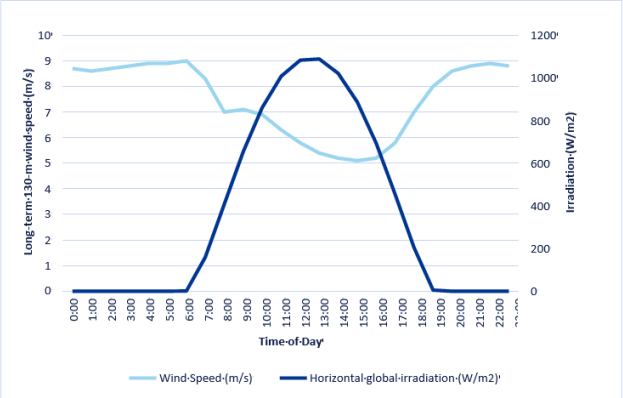
The daily diurnal profile of the wind and solar resources available show the solar resource peaking midday, just as the wind resource typically drops down below average. As such, the wind and solar resource profiles are extremely complimentary.

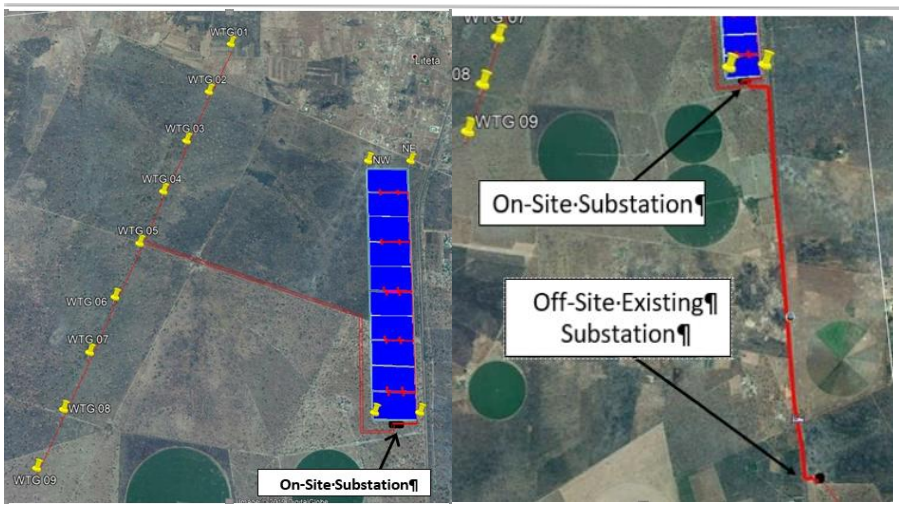
Hybrid Park collection system

There will be two 33 kV circuits for the wind farm and two for the solar farm. The two wind circuits and the two solar circuits will connect to a 45 MVA transformer each, to step up the voltage from 33 kV to 132 kV at the on-site substation at the south-east corner of the project site.

1.50 1.40 1.30 1.20 1.10 1.00 0.90 0.80 0.70 0.60

Normalized Wind Speeds





Cost estimates

The CAPEX costs for the project are estimated in the table below.

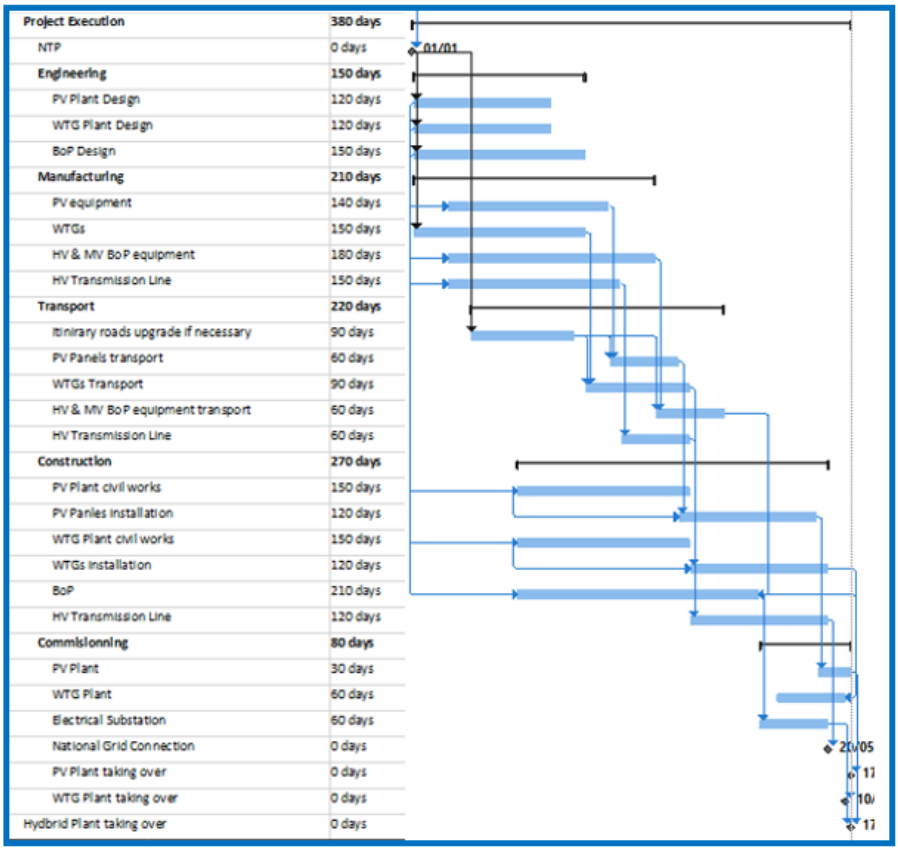
Project construction and operation

The time from financial close (FC) to Commercial Operation Date (COD) for the hybrid plant is expected to be 18 months, including both the wind and solar components together with the grid interconnection.

The construction phase will have an estimated 600 workers on site at the height of the construction, with an average of 250 workers throughout the construction period. During the 20-year operational period, 35 full-time skilled and semi-skilled workers drawn from the local population for the operations, maintenance, and security needs of the project. The project is focused on giving preference for employment to the communities surrounding the site if the required skill level is available, and there is a target of a minimum participation of at least 30% of women to be employed during construction and operational periods.

Item	Cost	Unit
Equipment		
Turbine	1.08	MUSD/MW
Module	0.29	USD/Wp
Inverter	0.07	USD/Wp
Tracker	0.14	USD/Wp
Civil works		
Crane pad and roads	2,442 to 4,152	kUSD
Foundations	2,000 to 3,480	kUSD
Substation & building	1,584 to 2,534	kUSD
Electrical works		
Cabling (wind + solar)	1,484	kUSD
Earthing (wind + solar)	426	kUSD
Trenching (wind + solar)	2,128	kUSD
Substation	3,059	kUSD
Grid Connection	924*	kUSD
Contingency	10%	

*It is noted that there is increased uncertainty related to the cost for the grid connection due to lack of available information from ZESCO. The cost presented includes only considerations for switchgear and circuit upgrades.



Main challenges

Zambia has been interested in solar and wind development for many years, and a number of companies have pursued projects in the country with little success. There is the exception of the Scaling Solar Program from the World Bank, along with the KfW supported Get FiT program which offered non-replicable concessions and commercial terms that have distorted perceptions of what IPPs can do without concessional financing. Intense pressure for very low tariffs and program perfection has paralyzed the IPP industry, and Zambia with its large mining sector, continues to largely depend on hydro plants and expensive diesel generators when routinely occurring droughts hit East Africa. Buying electricity produced by fossil fuel at a much higher price than the sale price to its customers has brought ZESCO to the brink of bankruptcy, with the Chinese looming to possibly

take over the company. Painful increases in consumer electricity prices have been implemented, which has led to unhappiness by the customers.

A newly passed environmental license fee structure is also a challenge, as the fee to the ministry of environment for our project's size is between US $ 50,000 US $100,000 due to currency volatility.

Our inability to conduct the definitive grid and ESIA studies until the donor-funded study has been completed also presents a timing and logistical challenge.

Strategic and tactical approach to reach implementation

Gigawatt Global successfully directly engaged with the Minister of Energy and the President's office in January 2020 to move things forward, with a focus on moving ahead with negotiations on the project documents. Though ZESCO is not a financially stable off-taker, we continue to pursue this approach along with mitigation measures that can reduce the risk profile to be in line with standard project finance expectations. In parallel, we are in discussions with Africa GreenCo as a possible alternative off taker, though this will take time to progress due to their formation process not having been concluded.

For the US $ 50,000 to US $100,000 fee for the environmental license process, we are engaging with the Ministry of Energy to postpone the necessity of paying the entirety of the fee which is currently required to start the official environmental study needed for obtaining the license until there is either material progress, or possibly after the execution of the project documentation (PPA/IA).

4) CORPORATE SOCIAL RESPONSIBILITY PROGRAM

Corporate Social Responsibility (CSR) Program

As in all of our projects, Gigawatt Global is committed to provide clear benefits to the project sites' surrounding communities. A comprehensive program will be initiated to address the local community's most pressing needs, with funds set aside from project revenues to finance the CSR program though the life of the PPA. Gigawatt Global takes a bottom-up approach, working closely with the local community and relevant NGOs to evaluate the most valuable actions to improve their daily lives and long-term standard of living.

Economic and social outlook

Zambian Economy Outlook -Zambia's economy is primarily driven by Mining, Agriculture, Construction, Transport and Communication sectors. In 2010 the real Gross Domestic Product (GDP) growth was 7.6 percent, the highest level recorded since 1972. Between 2000 and 2010 the annual end year inflation rate declined from 30.1 percent to 6.5 percent. Real GDP growth slowed to an estimated 2% in 2019, down from 4.0% in 2018. Zambia's economy was hit by drought in the south and west that lowered 2018/19 agricultural production and hydropower electricity generation considerably. Severe electricity rationing followed, and long periods of electricity load shedding dampened activity in almost all economic sectors. Zambia also faces slower mining, with reduced output and lower copper prices. However, this has now changed has the copper prices has now risen to record high. Inflation rose from 7.5% in 2018 to 9.2% in 2019 pushed by large exchange rate depreciations and food price increases.

Poverty Levels

General Outlook -In 2015, incidence of poverty in Zambia was estimated to be 54.4 percent at the national poverty line of approximately US$1 per day. In urban areas, the incidence of poverty remained much lower than in rural areas and fell from 25.7 percent to 23.4 percent. While poverty was already much higher in rural areas, it rose significantly from 73.6 percent in 2010 to 76.7 25 percent in 2015, and the widening the urban-rural poverty divide had continued to increase in the recent years. Another welfare indicator that has gained prominence in contemporary poverty analysis is the Per Capita Aggregate Poverty Gap Ratio (PCAPG) which was estimated at 26.4 percent nationally in 2015. The poverty gap ratio is the mean shortfall of the total population from the poverty line, expressed as a percentage of the poverty line is especially appealing in Zambia due to high rates of poverty. In considering the high poverty levels in Zambia it is increasing difficulty to sell electricity to the domestic customers at cost recovery tariff without government subsides.

Poverty Levels Relative to Sub-Sahara African Countries- The poverty incidence measured by the population living below US$1.90 per day of purchasing power parity (PPP) in Zambia was 57.5 percent in 2015, dropping from 60.4 percent in 2010. When making international comparisons based on PPP rates, this percentage puts Zambia well above the average population under poverty in Sub-Saharan Africa, which stood at 41 percent in 2013. In contrast with Zambia, countries with higher poverty rates, such as Niger and the Democratic Republic of Congo (72 percent and 91 percent, respectively), exhibited much larger reductions in poverty.

Policy and legislative framework

- The Energy Regulation Act (ERA), 2003 -The Energy Regulation Act (ERA), 2003: - provides for the control in the pricing of energy products in the country as well as the licensing of undertakings to produce energy
- The Electricity Amendment Act, 2003- The Electricity Amendment Act (EMA), 2003: - regulates the transmission, distribution, and supply of electricity
- The National Energy Policy (NEP), 2019 -The National Energy Policy (NEP), 2019: -supports optimal supply and utilization of electricity
- The Lands Act No 29 of 1995 -The Lands Act (LA) No 29 of 1995: - recognizes two land tenure classifications in Zambia: state lands and customary lands. The period for which the title is given for state land is normally 99 years
- The Urban and Regional Planning Act (URPA) No. 3 of 2015 -The Urban and Regional Planning Act (URPA) No 3 of 2015: - provides for development, planning and administration principles, standards and requirements for urban and regional planning processes and systems
- The Forests Act, 2015 (Act No. 4 of 2015) -The Forests Act (FA), 2015 (Act No. 4 of 2015): - provides for the conservation and use of forests and trees for the sustainable management of forests ecosystems and biological diversity
- The National Heritage Conservation Commission Act (NHCCA), 1999 (Cap.173) -The National Heritage Conservation Commission Act (NHCCA), 1989 (Cap.173): - provides for the conservation of ancient, cultural, and natural heritage, relics, and other objects of aesthetic, historical, prehistorical, archaeological, or scientific interest
- The Occupation Health and Safety Act (OHSA) No. 36 of 2010 -The Occupation Health and Safety Act (OHSA) No 36 of 2010: - is Zambia's principal legislation concerning the health and safety of employees
- The Constitution of the Republic of Zambia (CRZ) (Act of 2015) -The Constitution of the Republic of Zambia Act (CRZA) (Act 0f 2015): - stipulates that every person has the right to the protection of the environment for present and future generations

- The Environmental Management Act (EMA) No. 12 of 2011- The Environmental Management Act (EMA) (No 12 of 2011): - provides for the integrated environmental management and the protection and conservation of the environment and the sustainable management and use of natural resources
- Zambia Electricity Grid Code (ZEGC)-SI No. 79 of 2013 -Zambia Electricity Grid Code (ZEGC) - SI No. 79 of 2013: - The Grid Code legally establishes technical requirements for the connection to and use of the electrical transmission system by parties other than the owning electricity utility, in a manner that will ensure reliable, efficient, economic, secure, and safe operation

Institutional framework

The following institutions are key to the success of the project:

- The Ministry of Energy (MoE): - is responsible for the management of energy in Zambia. Through its unit, the Office for Promoting Private Power Investment (OPPPI), promotes private sector investment in the power generation industry.
- The Energy Regulation Board (ERB): - regulates the energy sector in line with the provisions of the Energy Regulation Act (No. 12 of 2019).
- Zambia Environmental Management Agency (ZEMA): - is empowered by the Environmental Management Act (No. 12 of 2011) (EMA) to identify projects, plans and policies for which an Environmental and Social Impact Assessment (ESIA) is necessary.
- ZESCO Limited:- a vertically integrated electricity utility, which generates, transmits, distributes, and supplies electricity in Zambia. It is a public utility, with the GRZ being the sole shareholder.
- Copperbelt Energy Corporation Limited:- is responsible for High-voltage transmission and distribution systems that supply electricity to Zambia's mining companies in the Copperbelt province.
- Chibombo District Council:- the local governing body of the Chibombo District where the project site is located.

5) ENERGY SECTOR REGULATORY FRAMEWORK ZAMBIA ENERGY SECTOR OVERVIEW

Zambia's electricity sector operates under the single buyer model, with several large Independent Power Producers (IPP) and transmission and distribution operators.

National electricity energy demand

The Government of Zambia (GRZ)'s 7th National Development Plan (NDP) indicate that demand in energy will increase between 150 MW and 200 MW per annum. Further, the peak demand for electricity in the country is expected to increase to over 3,525 MW in 2030, higher than the total installed capacity of the existing plants. As of December 2012, total energy demand exceeded internal generation capacity. This was as a result of the expansions in the mining sector, manufacturing sector and overall expansions in the economy and population. In 2019, the mining sector accounted for the highest consumption of national electricity of 51% followed by the domestic sector which consumed 33% of electricity. The other sectors accounted for 16 percent of the total national electricity consumption

Zambia's installed electricity generation capacity

Zambia with 40% of the water resources in the Southern African Development Community (SADC), Zambia has about 6,000 MW of unexploited hydropower potential, while only about 2,398.55 MW has been developed. In 2019, Zambia's total installed capacity was 2,981.33MW consisting of hydro 2,398.55MW (mainly large scale), thermal 300MW, diesel 88.60MW, heavy fuel oil 110MW, and solar 89.13MWp

Existing transmission lines

The Zambia National Grid (ZNG) is composed of the 330 kilovolts (kV) main line that spans a total of 2241 km across the country. The rest of the transmission network consists of 571km of 220 kV lines serving as interconnectors with neighboring Democratic Republic of Congo (DRC), Namibia, and Zimbabwe, 202 km of 132kV lines and 734 km of 88 kV mainly in the Lusaka area, and 1037 of 66 kV transmission lines.

Potential off-takers

ZESCO Limited, Mines, Copperbelt Energy Corporation Limited, Northwestern Power Company, Commercial and industrial installations and other countries in SAPP

Rationale for electricity infrastructure development

The following are some of factors that would encourage IPPs to participate in the electricity energy sector development

- Declaration of Electricity Energy as Priority Sector; In recognition of the need to reduce the cost of developing power plants and attract IPPs to increase generation capacity in Zambia, the Government amended the second schedule of the Zambia Development Agency Act (ZDAA). Following the amendment to the second schedule of the ZDA Act, power generation has now been declared a priority sector. It is expected that this development will motivate more IPPs to participate in the electricity energy sector development.
- Tax Concessions of Power Generation Projects; Building of power plants to generate power from various sources of energy including solar qualify for tax concessions. It is noted that importation of photovoltaic panels, inverters and solar batteries are tax free. However, cables and other accessories may only benefit from the tax waiver if they are imported from within the Common Market for Eastern and Southern Africa (COMESA) and Southern Africa Development Community (SADC) regions.
- Call for Increased Investment in Energy Infrastructure Development; **The 2019 National Energy Policy (NEP)** recognizes the need to attract more investment for improved energy infrastructure development and management of the resource in order to enhance economic growth and make the resource available to all. The Seventh National Development Plan (7NDP) further asserts the role of the private sector and the need to harness its financing potential to ensure positive contribution to the national development and ease pressure on the national treasury.
- Effect of Climate Change on Energy Security; Zambia's over reliance on hydropower electricity generation is threatened by effects of climate change such as drought. Low water-levels at the main reservoirs for hydroelectric generation have triggered a power deficit of over 34% of demanded electricity. With the country's historically abundant power supply, the sudden crisis has caught households and businesses unprepared and without back-up sources of energy.

- Low Electricity Access; Access to electricity in Zambia remains extremely low attributed to growth in the population and industrial activities that have not been matched with the rate of electricity connections. As a result, the need to expand the renewable energy resources has become an urgent requirement.
- Electricity Cost of Service Study; The Energy Regulation Board (ERB) successfully re- launched the Electricity Cost of Service Study (COSS) on 3rd December 2019 with financing from the African Development Bank (AfDB). The main aim of the study is to determine the economic cost of supply of electricity for generation, transmission, distribution, and supply. This in turn would encourage IPPs' participation in the Energy Sector.
- Cost Recovery Renewable Energy Feed In Tariffs; The MoE in collaboration with KfW Development Bank of Germany (DBG), jointly developed and are implementing the Global Energy Transfer Feed-In-Tariffs (GETFiT) programme under the framework of the Renewable Energy Feed in Tariff Strategy (REFiTS). In addition, the program would facilitate private sector investment in small and medium scale renewable energy IPPs in Zambia.

The following are the main players in the electricity energy sector

ZESCO Limited ZESCO is a parastatal company and produces approximately 80%ofthe electricity consumed in the country and has historically been the main player in the generation, transmission and distribution of electricity in Zambia.

Ngonye Power Company- Ngonye Power Company (NPC) is also an entity owned by IDC and Enel Green Power S.P.A of Italy and owns a 34 MW solar energy power plant located in the LSMFEZ and signed a 25- year PPA with ZESCO in 2018

Bangweulu Power Company- Bangweulu Power Company (BPC) is a jointly owned entity by the Industrial Development Corporation (IDC) and Neon S.A.S of France which owns and operates a 54.3 MW grid connected solar power plant in the Lusaka South Multi-Facility Economic Zone (LSMFEZ) and signed a 25-year PPA with ZESCO

Kariba North Bank Extension Power Corporation Kariba North Bank Extension Power Corporation (KNBEPC) is wholly owned by ZESCO and has an Operations and Maintenance Agreement with ZESCO. The Company owns the 360 MW Kariba North Bank Extension Power Station. ZESCO is the off-taker of power generated from the plant under a long term PPA

Maamba Collieries Limited- Maamba Collieries Limited (MCL) is the largest IPP in the country and operates the only coal-fired 300MW Thermal Power Plant (TPP) in Zambia, adopting modern, ecofriendly mining and processing methods.

Lunsemfwa Hydro Power Company Lunsemfwa Hydro Power Company (LHPC) owns and operates the 32MW Mulungushi and 24MW Lunsemfwa Power Plants located 65km and 110km from Kabwe Town, respectively. The LHPC also owns 180km of 66KV transmission lines that connect the two power plants to ZESCO substations and have signed a 15-year power purchase agreement with ZESCO

Ndola Energy Company Limited Ndola Energy Company Limited (NECL) generates and supplies power to ZESCO under a long-term Power Purchase Agreement (PPA). The Company is based in Ndola Town of Zambia and operates an 110MW capacity Heavy Fuel Oil (HFO) power plant

Zengamina Power Limited -Zengamina Power Limited (ZPL) is based in Kalene, North- western Province of Zambia and is owned by North West Zambia Development Trust (NWZDT). The

company generates and supplies 0.75MW of power to Kalene Mission Hospital (KMH), Ikelenge central business district and surrounding areas

Itezhi Tezhi Power Corporation Limited Itezhi Tezhi Power Corporation Limited (ITPC) owns and operates the Itezhi Tezhi hydropower plant with an installed generation capacity of 120MW. The company is jointly owned by Tata Africa Holdings (SA) Pty Limited and ZESCO. The company has a long term PPA with ZESCO

Copperbelt Energy Corporation Limited- The Copperbelt Energy Corporation (CEC) Limited is responsible for High-voltage transmission and distribution systems that supply electricity to Zambia's mining companies in the Copperbelt province. It also operates 80 MW of standby gas turbine generation facilities and exports electricity to a mine in the Democratic Republic of Congo (DRC), and trades in its own right through the SAPP

North West Energy Corporation -The North West Energy Corporation (NWEC) owns and operates power distribution, and supply infrastructure has a 15-year distribution and supply license issued in 2008 to distribute 20MW of electricity to mining townships in North Western Province of Zambia

Rural Electrification Authority- The Rural Electrification Authority (REA) is a statutory body created by an Act of Parliament No. 20 of 2003to provide electricity infrastructure to all rural areas using appropriate technologies to increase access, productivity and contribute to improved quality of life. REAs goal is to increase the electrification rate from 3% to 51% by 2030.

Potential off-takers

ZESCO Limited, Mines and - Copperbelt Energy Corporation Limited, Northwestern Power Company, Commercial and industrial installations.

6) KEY RISKS & ISSUES Risks and Constraints

License Approvals

There are approvals from government bodies and organizations. The risk of having the license denied means a financial loss associated with capital invested in legal firms and pre-engineering and feasibility studies. Therefore, as the most appropriate mitigating action Gigawatt should pay special attention to the local legal requirements, and industry technical standards and local requirements.

Electricity Generation Predictions

It is simply impossible to predict exactly when the sun will shine on a solar plant, however site solar resource measurements conducted in the prefeasibility document and weather data is expected to be used as a reliable source for predicting the site generation potential.

Energy Prices

In most deregulated power markets, the electricity selling price is volatile. This is not the case for Zambia. When the PPA is signed it's an assurance that all electricity generated will be sold at a given price and for a period of the PPA and the PPA price is attached to the US Dollar.

Inflation and Currency Depreciation

In Zambia, the main driver for inflation is the increase in domestic commodities and utility prices as a consequence of depreciation of local currency. The mitigation steps will include setting the PPA's electricity sales tariff on hard currency such as the US dollar.

Political Risk

The interpretation of political and financial climate varies from one investor to another; therefore, the current status of Zambia (set as stable) does not diminish the risk level. However, Zambia is a peaceful nation with friendly people which got Independence from colonial master Britain in 1964 to a democratic state and the Country has successfully changed Governments democratically for 7 times with 7 Presidents. Most importantly, the investments, in Zambia, are protected by local legislation. The other strategy that Gigawatt should consider is to be able to secure a comprehensive insurance policy which, protects the investment fully.

Natural Hazard

Probably the most unforeseeable risk, acts of nature can result in the complete loss of an investment. There has been no extreme weather conditions or natural disasters experienced in Zambia. In this case the insurance s policy may not have a clause covering the investment from these events. This clause is usually addressed to as 'Force Majeure'. However, adopting climate resilience approaches in the design of the infrastructure can mitigate the potential climate induced adverse effects.

Delayed Power Purchase Agreement

Delays in signing the PPA may lead to loss of income. The mitigation measure is to engage the off-taker early enough during the project development.

Water Availability

Clean, low mineral water is preferred for cleaning modules. Additional budget would be required to sink boles and use solar powered submersible pumps.

Module Soiling

The areas around the project are covered in green vegetation with small patches of open ground. Therefore, emission of dust during the life of the project is expected to be significantly low. The efficiency of solar plant could be significantly reduced if the modules are soiled by particulates/dust. Therefore, module cleaning facilities should be considered in the design.

ZESCO Monopoly

On Transmission Infrastructure ZESCO owns and operates the bulk of Zambia electricity transmission infrastructure. Any off-take arrangement away from ZESCO might require using ZESCO's transmission lines at additional cost.

Economic Impact

The installation and operation of the solar & wind plant will promote local job creation in Chibombo hence contributing to the growth of the local economy and social upliftment in the area. The project will significantly contribute to the energy deficit and mix in Zambia.

11.5 MODEL IMPLEMENTATION AGREEMENT

Utility-Scale Solar Photovoltaic Project

IMPLEMENTATION AGREEMENT

This Implementation Agreement ("Agreement") is made on this [___] day of [_____] 20[__]

BETWEEN

The Government of [Country], acting through the Ministry responsible for Energy (the "Government")

AND

[Project Company Name], a company duly incorporated under the laws of [Jurisdiction] (the "Company").

The Government and the Company are referred to individually as a "Party" and collectively as the "Parties."

RECITALS

A. The Government seeks to promote private sector participation in the development of renewable energy infrastructure.

B. The Company intends to develop, finance, construct, own, operate and maintain a utility-scale solar photovoltaic power generation facility (the "Project").

C. The Parties wish to establish the legal and regulatory framework governing implementation of the Project.

NOW THEREFORE, the Parties agree as follows:

ARTICLE 1

DEFINITIONS AND INTERPRETATION

1.1 Definitions

"Change in Law" means any enactment, repeal, or modification of any applicable law, regulation, rule, order, judgment, or decree, or any change in the interpretation or enforcement thereof by any governmental authority, occurring after the date of this Agreement, that materially affects the cost, revenue, or ability of the Company to perform its obligations under this Agreement.

- **"Commercial Operation Date" (COD)** means the date on which the Project is certified as commercially operational in accordance with the Power Purchase Agreement.
- **"Financial Close"** means satisfaction of all conditions precedent to first drawdown under the Financing Agreements.
- **"Force Majeure Event"** has the meaning set forth in Article 11.1.
- **"Permits"** means all governmental approvals required for the Project.
- **"Power Purchase Agreement" or "PPA"** means the agreement between the Company and the power off-taker for the sale of electricity.
- **"Project Documents"** means this Agreement, the PPA, land agreements, financing agreements, EPC contracts and related documents.
- **"Term"** has the meaning set forth in Article 3.

1.2 Interpretation

- Headings are for convenience only.
- References to laws include amendments and replacements.
- Schedules form part of this Agreement.

ARTICLE 2

PURPOSE AND SCOPE

This Agreement establishes:

1. The rights granted by the Government to the Company.
2. The obligations of each Party.
3. The risk allocation framework governing the Project.
4. The legal protections required for international project financing.

ARTICLE 3

EFFECTIVE DATE AND TERM

3.1 Effective Date

This Agreement shall become effective upon execution by both Parties.

3.2 Term

This Agreement shall remain in effect until the earlier of:

- Expiry of the PPA;
- Termination under Article 14; or
- Mutual written agreement of the Parties.

Certain provisions shall survive termination as expressly stated herein.

ARTICLE 4

GRANT OF RIGHTS

Subject to compliance with this Agreement, the Government grants to the Company:

1. The exclusive right to develop, finance, construct, own, operate and maintain the Project.
2. The exclusive right to generate and sell electricity under the PPA.
3. The right to enter into financing arrangements.
4. The right to appoint contractors and subcontractors.
5. The right to import equipment and materials necessary for the Project.

ARTICLE 5

GOVERNMENT SUPPORT OBLIGATIONS

The Government shall:

1. Use its best efforts to procure the timely issuance of required Permits and, where within its direct authority, issue or cause to be issued such Permits within [___] days of a complete application.
2. Support grid interconnection approvals.
3. Facilitate access to available investment incentives.
4. Assist with work permits and visas for necessary personnel.
5. Permit the opening and operation of foreign currency accounts.
6. Permit repatriation of dividends and debt service payments.
7. Refrain from discriminatory or arbitrary actions affecting the Project.

Nothing herein shall obligate the Government to provide financial guarantees unless separately agreed.

ARTICLE 6

COMPANY OBLIGATIONS

The Company shall:

1. Undertake all feasibility and development studies.
2. Secure financing for the Project.
3. Obtain all Permits and regulatory approvals.
4. Construct the Project in accordance with international industry standards.
5. Achieve COD within the agreed timeframe.
6. Operate and maintain the Project safely and efficiently.
7. Maintain adequate insurance coverage.
8. Provide periodic progress and operational reports.

Subject to the express provisions of this Agreement (including Articles 10, 11, 13 and 14), the Company bears the construction, financing and operational risks of the Project.

ARTICLE 7

FINANCING AND LENDER PROTECTIONS

7.1 Assignment

The Company may assign its rights to lenders or security agents for financing purposes.

7.2 Direct Agreements

The Government shall enter into customary Direct Agreements with lenders upon request.

7.3 Step-In Rights

In case of a Company Event of Default, the Government shall give simultaneous written notice to the lenders and shall not terminate this Agreement until at least [90] days after delivery of such notice (or such longer period as may be agreed in a Direct Agreement), during which period lenders or their nominee may step in and exercise cure rights on behalf of the Company.

ARTICLE 8

ENVIRONMENTAL AND SOCIAL COMPLIANCE

The Company shall:

1. Conduct Environmental and Social Impact Assessments.
2. Comply with national environmental laws.

3. Implement mitigation measures.
4. Adhere to recognized international environmental standards.
5. Maintain health and safety protocols.

ARTICLE 9

LOCAL CONTENT AND CAPACITY BUILDING

The Company shall:

- Employ local personnel where practicable.
- Implement training programs.
- Promote knowledge transfer.
- Support development of local supply chains where feasible.

ARTICLE 10

CHANGE IN LAW

If a Change in Law materially affects the Project's economics or performance:

- The Parties shall consult in good faith.
- Adjustments shall be made to restore the economic balance of the Project as it existed prior to the Change in Law, including through tariff adjustments, compensation payments, or extension of the Term.
- If restoration is not possible, termination rights may apply.

ARTICLE 11

FORCE MAJEURE

11.1 Definition

Force Majeure includes natural disasters, war, civil unrest, or actions of third-party governmental authorities beyond the control of the affected Party; provided that Force Majeure shall not include any act, omission, decision, or failure of the Party claiming Force Majeure or any of its affiliates or instrumentalities.

11.2 Consequences

- Obligations are suspended to the extent affected.
- Deadlines extended.
- Prolonged Force Majeure may give rise to termination rights.

ARTICLE 12

REPRESENTATIONS AND WARRANTIES

12.1 Company

The Company represents that it:

- Is duly incorporated.
- Has authority to enter into this Agreement.
- Is solvent and capable of performing obligations.

12.2 Government

The Government represents that it:

- Has authority to enter into this Agreement.
- Has taken all required legal actions.
- Will not take actions inconsistent with this Agreement.

ARTICLE 13

DEFAULT

13.1 Company Events of Default

- Failure to achieve Financial Close.
- Failure to achieve COD.
- Insolvency.
- Material breach that remains uncured for thirty (30) days after written notice (or such longer period, not to exceed ninety (90) days, as may be reasonably required to cure if the Company has commenced cure within such thirty (30)-day period and is diligently pursuing such cure).

13.2 Government Events of Default

- Failure to provide agreed support.
- Expropriation or discriminatory treatment.
- Material breach not cured.

ARTICLE 14

TERMINATION

This Agreement may be terminated for:

1. Uncured default.
2. Failure to achieve Financial Close.
3. Prolonged Force Majeure.
4. Mutual agreement.

Termination shall not affect accrued rights or lender protections. Upon termination due to a Government Event of Default, the Government shall pay the Company termination compensation equal to [the outstanding debt, return of equity invested, and loss of anticipated profits, as further specified in Schedule [___]]. Upon termination due to a Company Event of Default, compensation shall be as specified in Schedule [___].

ARTICLE 15

INDEMNIFICATION AND LIABILITY

Each Party shall indemnify the other for losses arising from its negligence or breach.

Neither Party shall be liable to the other for indirect or consequential damages; provided, however, that this limitation shall not apply to: (i) losses arising from a Government Event of Default, expropriation, or discriminatory or arbitrary action by the Government; or (ii) obligations to pay termination compensation under this Agreement.

ARTICLE 16

SOVEREIGN IMMUNITY

The Government agrees that:

- This Agreement constitutes a commercial transaction.
- It irrevocably and unconditionally waives any right of sovereign immunity from jurisdiction, suit, execution, attachment, or other legal process in relation to any dispute arising under this Agreement or enforcement of any arbitral award and agrees that such waiver shall not be limited by any provision of domestic law.

ARTICLE 17

CONFIDENTIALITY

Each Party shall keep non-public information confidential except as required by law or financing arrangements. This obligation shall survive termination of this Agreement for a period of [three (3)/five (5)] years.

ARTICLE 18

GOVERNING LAW AND DISPUTE RESOLUTION

18.1 Governing Law

This Agreement shall be governed by and construed in accordance with the laws of [Jurisdiction], as they exist on the date of this Agreement, without giving effect to any subsequent Change in Law that would materially prejudice the rights of the Company hereunder.

18.2 Dispute Resolution

1. Good faith negotiation (60 days).
2. International arbitration administered under the [ICC/LCIA/UNCITRAL] Rules, before a tribunal of [one/three] arbitrator(s) appointed in accordance with such Rules.
3. Seat of arbitration: [City, Country].
4. Language: English.

Arbitral awards shall be final and binding.

ARTICLE 19

MISCELLANEOUS

- Amendments must be in writing.
- This Agreement constitutes the entire agreement.
- No partnership is created.
- Notices must be in writing.
- Severability applies.

SCHEDULE 1

CONDITIONS PRECEDENT

The following Conditions Precedent must be satisfied (or waived in writing by the relevant Party) prior to Financial Close:

- Feasibility study completion.
- Environmental approval.
- Land rights secured.
- PPA executed.
- Financing plan submitted.
- Required governmental approvals obtained.

SCHEDULE 2

INITIAL PERMITS

- Generation license.
- Environmental approval.
- Construction permits.
- Grid interconnection approval.
- Work permits and visas.

SCHEDULE 3

PROJECT DESCRIPTION (ILLUSTRATIVE)

- Technology: Solar PV
- Capacity: [___] MW
- Interconnection: [Transmission Voltage]
- Site: [General Location]

EXECUTION

IN WITNESS WHEREOF, the Parties have executed this Agreement.

For the Government:

For the Company:

11.6 POWER PURCHASE AGREEMENT ISSUES LIST

No	Issue	Action	Issues relating to draft PPA dated December 18
1.	**Expansion of _____**, as agreed to be incorporated into Schedule 1	The following amendment is to be included in Schedule 1 "The Parties hereby agree that the following Clause _____ is added at the end of Clause _____: (j) the occurrence of an event or act, or threat to the Contractors, personnel or Plant which, in the reasonable opinion of the Seller's security consultant makes it necessary for the Seller or its Contractors to voluntarily suspend, or Abandon, activities at the Site;"	_____ position is that this requested addition is already provided for in the existing LPFME definition _____ position is that this is not the case, as the requested expansion is designed to include "pre-emptive" active, which would still enable NSCP to receive the benefit of Availability Event Energy Payments i.e. not being required to wait until the "act" of terrorism etc. occurs.
2.	**Grid Code** – Given that Seller would like to be in a position to sign the PPA as soon as possible, Seller would strongly prefer that the current Grid Code would apply to the Seller's PPA. (Given that the timeframe for implementing the Renewable provisions of the Grid Code is unknown).	Seller requests an express provision in Schedule 1 to expressly state that the current Grid Code applies to the Project and the parties agree that renewable provisions will be incorporated into the Connection Agreement, which will supersede any obligations relating to the Grid Code pursuant the PPA.	Not resolved. An additional issue in the current draft is that the PPA contains an express provision that changes to the Grid Code will not be covered by Change of Law Protection.
3.	**Definition of expropriation** – A relevant authority acting in a commercially reasonable manner should not excuse expropriation, the inclusion of "unless having a confiscatory effect" is too subjective for this limb to be acceptable.	Proposed amendment: "**Expropriation**" means the act(s) of expropriation, requisition or nationalization of the Plant or any material portion of the Plant by a Relevant Authority; provided that, the following shall in no event constitute an Expropriation: (a) any measure that constitutes a bona fide, non-discriminatory measure of general application that	Not resolved

No	Issue	Action	Issues relating to draft PPA dated December 18
		governments normally take for the purpose of regulating economic activity, ensuring public safety, raising revenues, or protecting the environment, unless the measure is designed by the Relevant Authority to have a confiscatory effect; and (c) any Change in Law or Change in Tax.	
4.	**Extraordinary L/C Event** – An Extraordinary L/C Event should only be triggered following the action or inaction of the Seller or its Affiliates when the 'breaching' entity is in breach of the PPA or the Buyer Payment Security. An LPFME should not be excluded from an Extraordinary L/C Event.	Amend the definition as follows: "Extraordinary L/C Event" means the suspension or termination of the Buyer Payment Security as a result of any action or inaction of Seller or its Affiliates in relation to the PPA or the Buyer Payment Security, provided, however, that no such action or inaction shall constitute an Extraordinary L/C Event if it results from (i) a breach by Buyer of this Agreement, or (ii) a Buyer Default,	**Not Resolved:** Extraordinary L/C Event – An Extraordinary L/C Event should only be triggered following the action or inaction of the Seller or its Affiliates when the 'breaching' entity is in breach of the PPA or the Buyer Payment Security. **Resolved**: An _____ should not be excluded from an Extraordinary L/C Event.
5.	**Availability Events Prior to COD –** Seller's position is that if an Availability Event occurs prior to COD, Seller should be made whole on a monthly basis (not at COD).	Drafting to be amended.	In the event that an AE occurs prior to COD, Seller should be made whole, as this is not a risk that should remain with Seller. (consider potentially accepting from a commercial perspective).
6.	**Definition of Contract Year –** As currently drafted, if the Project reaches COD on any day of the Month following COD (other than the first day of that month), the Seller will lose its rights to full energy payments for that Contract Month (as COD will not be deemed to occur until the first day of the following Month). We	Drafting to be amended: 3. Definition of 'Contract Year': "Contract Year" means each period of twelve (12) consecutive months commencing on the Commercial Operations Date i, and on each anniversary thereof and ending at the end of the Day immediately prior to each immediately following anniversary of the first Day of the	Not resolved

No	Issue	Action	Issues relating to draft PPA dated December 18
	do not believe this to be the Buyer's intention.	Contract Year and the final Contract Year shall end on the termination of this Agreement. The old Clause _____ wording (in the previous PPA draft) will then need to be added back in as follows: "in the event the Commercial Operations Date occurs on a Day other than the first or the last Day of a Billing Period, then the Billing Period shall be split into two Billing Periods, with the first of such Billing Periods commencing on the Day on which the single Billing Period commenced and expiring on the Day prior to the Commercial Operations Date and the second of such Billing Periods commencing on the Commercial Operations Date and expiring on the Day on which the single Billing Period would have expired."	
7.	**Delayed Commissioning Payments** – Delayed Commissioning Payments must be payable from the later of (i) the date on which the Seller would have been able to commission the plant and (ii) the Target COD. The debt repayment and O&M payment obligations of the Seller will not be suspended during a Delayed Commissioning period, as such, the Seller needs to be kept 'economically whole' during this period. In addition, the Seller	Clause 7.8.3 Delayed Commissioning Payments to be amended as follows: In the event that the Commercial Operations Date is delayed as a result of a Delayed Commissioning Event, then, provided that Seller shall have made all Reasonable Endeavours to prevent and/or mitigate the effect of such Delayed Commissioning Event, on and from the date on which Seller would have been able to achieve the Commercial Operations Date, but for such Delayed Commissioning Event (provided such date is on or after the Target Commercial Operations Date), until the date that	_____position is that it is reasonable for DCP to be payable from Target COD. Indeed the Seller has no control over the Delayed Commissioning Events and therefore should not be economically affected and penalised by them via delayed payments from the Buyer

No	Issue	Action	Issues relating to draft PPA dated December 18
	will always aim to construct the Plant prior to the Target COD date- if it is not able to commission on this date, the Seller agrees to 'share the pain' up to the Target COD Date but not beyond that date.	the Commercial Operations Date is actually achieved:	
8.	**Conditions Precedent** – A number of new conditions precedent have been helpfully incorporated. However, the parties need to agree upon the primary responsibility for these new CPs in order for the Closing Date mechanics to work. This is an important omission but should not be a controversial commercial issue.	The parties need to agree upon the primary responsibility for these new CPs in order for the Closing Date mechanics to work.	_____ and (i) still not allocated to Buyer under _____. Not clear whose responsibility those are now. This is important (i) to ensure that the Closing mechanisms work correctly; and (ii) given that a termination right is included for failure to perform CPSs, a clear and correct allocation of responsibilities are critical.
9.	**Buyer Payment Security** – As currently drafted Acceptable Confirming Bank would also have to issue the Buyer Payment Security. Seller has a minor drafting suggestion which will ensure the L/C mechanics work in all scenarios.	Amend the definition as follows: "Acceptable Commercial Bank" means the bank (or branch thereof) meeting the criteria set out in Clause 3 of Schedule 1.	"Acceptable Commercial Bank" means the bank (or branch thereof) meeting the criteria set out in Clause _____ of Schedule ____ that will provide the Buyer Payment Security required under Clause 3 of Schedule ____. Not resolved as the highlighted yellow section defeats the purpose of our suggested amendment.
10.	**Restoration** – The PPA must not be terminated during a restoration that follows a Natural FM or Foreign Political FM Event (as currently drafted only Local Political Force Majeure Events and	Clause_____ to include Natural Force Majeure Events and Foreign Political Force Majeure Events.	Not resolved

No	Issue	Action	Issues relating to draft PPA dated December 18
	Change in Law related restorations are covered by Clause _____).		
11.	**Buyer Events of Default** – Buyer cannot be excused from a breach caused by a Local Political Force Majeure Event	Drafting to be amended	Not resolved
12.	**Termination** – In Clause _____ the termination right contained in Clause _____has been omitted- for the termination mechanics to function correctly across the PPA, this termination right must be included. We believe this to be a simple 'mechanical' omission.	Clause _____ to be amended as follows to include limb: (g) The delivery of a Termination Notice by either party pursuant to Clause 21.9 following the occurrence of a Following a Local Political Force Majeure Event or Change in Law	Resolved
13.	**Termination for Poor Performance** – Buyer's right to terminate for poor performance is not accepted by Seller.		Not resolved. This is onerous, given the extensive LD scenarios.
Schedule One – TERMS SPECIFIC TO THE AGREEMENT			
14.	Annual Electrical Output / Minimum Annual Electrical Output / Expected Annual Electrical Output		Expected Annual EO = 85% of planned AEO Minimum Achieved Capacity – per cent of Contract Capacity Minimum Annual EO = 65% of planned AEO (only feeds into termination if NEO < Minimum Annual EO for 3 consecutive year) Actual workings of the model still not clear.
15.	Tax & Law Threshold Amount		USD 100,000

No	Issue	Action	Issues relating to draft PPA dated December 18
16.	Minimum Indemnification Amount		USD 200,000 per annum.
17.	Liquidated damages payable if Achieved Capacity is less than Contract Capacity		US$100,000 (or local currency equivalent) per MW
18.	Liquidated damages payable if Seller fails to achieve Commercial Operations Date on or prior to the Long Stop Commercial Operations Date.		US$27,400 (or local currency equivalent) per day.
19.	Liquidated Damages Limit		US$ ____ million in the aggregate for liquidated damages for failure to achieve Commercial Operations Date by Long Stop Commercial Operations Date and for Achieved Capacity less than Contract Capacity.
20.	Liquidated Damages for Failure to Achieve Expected Annual Electrical Output		An amount per MWh of shortfall equal to 10% of the Energy Charge Rate, if Seller makes an election to pay liquidated damages pursuant to Clause 8.2(ii)
21.	Annualized percentage Rate Reduction if COD is after required COD	• Seller considers this penalty unusual as this would be a reduction in the Charge Rate for the duration of the PPA. • Seller proposes to pay LDs per day for every day of delay. • Seller proposes that this line item is removed.	Reduction rates given: - Daily Percentage Reduction: 0.0159% = 0.02735 USD/MWh - Maximum reduction: 2.9070% (i.e. 183 days) = 5 USD/MWh An express provision should be included that the Annualized rate reduction would not be applicable in the event of an Availability Event. Delayed Commissioning Event, or Force Majeure Event.

No	Issue	Action	Issues relating to draft PPA dated December 18
22.	Loss Factor		- New figure to be specified. Express provision should be included that the Loss Factor is grossed-up so that _____ is kept economically whole.
23.	Letter of Credit		Amendments need to be made to the Buyer Payment Security provisions at Schedule 1 clause ____ to ensure that the PPA is bankable. In particular: • the amount of security should be specified; • the security needs to be drawable in the event Buyer fails to pay any Delayed Commissioning Payments; • the criteria of the issuing or confirming bank need to be specified; and the laws governing the security (L/C or demand guarantee) need to be those of England & Wales, or NYC
24.	Schedule Two – Description of Plant and Facilities		PV Panels and inverter details requested including: manufacturer, model, rating, numbers and so forth. Consider whether we can provide this information.
SCHEDULE 6 – TARIFF SCHEDULE			
25.	Payment for Early Net Electrical Output	Seller notes that Buyer is expecting to pay for only per cent of the Charge Rate for ENEO. Seller's position is that if Buyer receives energy the full Charge Rate should be paid	per cent payment

No	Issue	Action	Issues relating to draft PPA dated December 18
26.	Availability Event Energy Payments	If an Availability Event occurs prior to COD, Seller should be made economically "whole". An Availability Event should also not be restricted to a Settlement Period where an Availability Event continues for more than 50% of the Settlement Period –drafting to be amended	**Not Resolved:** If an Availability Event occurs prior to COD, Seller should be made economically "whole". **Resolved:** An Availability Event should also not be restricted to a Settlement Period where an Availability Event continues for more than 50% of the Settlement Period.
27.	**FX Provision** – requirement for "Reasonable Endeavours" and "detailed explanation of conversion method" to be clarified in the drafting.	Drafting to be amended: so that "Reasonable Endeavours" and "detailed explanation of conversion method" are either removed or amended	Parties to agree on a FX protocol prior to signing.
28.	**Delayed COD Rate Reduction** – Buyer and Seller to discuss the insertion of any reduction to the Energy Charge. Seller will be paying LDs which is sufficient deterrence.	Reduction to the Energy Charge to be deleted if the delay to COD is caused by any action of any Nigerian Federal or State entity (including Port or Highway issues)	Drafting of Force Majeure to be strengthened. NSCP provided a proposal which was not accepted. No changes made to Force Majeure provisions.
29.	Make Up and FM Shortfall mechanics/payments		Not resolved – the new clauses are still strange and limit any upside (and oblige the Seller to provide power for free in catch-up of Availability Event Payments made, which are not the fault of the Seller in the first place).
Schedule 10 – Development Security and Performance Guarantees			
30.	Seller has completed all development milestones and is highly incentivised to achieve COD in the shortest timeframe possible.	Seller requests the removal of the requirement for Development Security – drafting to be amended.	The **Performance guarantee** now includes a trigger if the Achieved Capacity is less than the Contract Capacity – this is unreasonable considering the extensive LD scenarios. No amount specified

No	Issue	Action	Issues relating to draft PPA dated December 18
			Development Security to be provided prior to execution. Development security to be triggered at Target Closing Date, not Required Closing Date. No amounts of development security specified.
Schedule 15 – EMISSION REDUCTION RIGHTS			
31.	Drafting to be clarified that the decision to obtain Emission Reduction Rights is at the Seller's sole election. The ___ per cent. Sharing mechanism is of the amounts actually received, rather than predicted.	Drafting to be amended as follows: 1.1. To the extent, in the Seller's reasonable opinion it is economically feasible and profitable from time-to-time, Seller shall use Reasonable Endeavours to develop and market Emission Reduction Rights. Clause _____ of the Schedule to further track that the profit share is of profit actually received, rather than estimated.	Resolved – this is now at the Seller's discretion.

11.7 POWER PURCHASE AGREEMENT KEY TERMS

Utility-Scale Solar PV PPA Key Terms (Grid-Connected Projects – Sub-Saharan Africa)

THE FOLLOWING PROVIDES A HIGH-LEVEL OUTLINE OF KEY TERMS AND TOPICS THAT BOTH THE BUYERS AND SELLERS OF ENERGY SHOULD CONSIDER WHEN STRUCTURING A POWER PURCHASE AGREEMENT (PPA). THE DRAFTER USUALLY WILL GET THIS INFORMATION FROM WHOMEVER HE OR SHE IS REPRESENTING.

Transaction Structure

Physical delivery PPA with a single utility off taker, typically structured as take-or-pay. Often supported by Government Support Agreement, Implementation Agreement, Put-Call Option Agreement, sovereign guarantees, letters of credit, or multilateral guarantees.

Term

Typically, 20–25 years from Commercial Operations Date (COD) to support long-tenor DFI debt and tariff stability.

Contract Capacity

Defined AC export capacity at the delivery point. Must align with grid connection agreement and transmission approvals.

Tariff Structure

Usually USD-denominated tariff expressed as USD/MWh, sometimes structured as availability-based capacity plus energy payment.

Currency and FX Protection

Tariff typically denominated in USD and payable in local-currency equivalent with convertibility and transfer protections.

Take-or-Pay Obligation

Buyer obligated to pay for available capacity regardless of dispatch. Often supported by deemed energy provisions.

Conditions Precedent

Seller CPs include financing, land rights, permits, EPC execution, and grid connection. Buyer CPs include payment security delivery and sovereign support documentation.

Commercial Operations Date (COD)

Defined technical completion threshold, testing requirements, Target COD and Longstop COD with delay liquidated damages regime.

Delay Liquidated Damages

Seller pays capped LDs if COD occurs after Target COD.

Delivery Point

Typically, the high-voltage interconnection substation or transmission node.

Curtailment Risk Allocation

Economic and transmission curtailment generally compensated via deemed energy payments.

Payment Security Package

May include Letter of Credit, escrow account, sovereign guarantee, Put-Call Option Agreement, or multilateral guarantees.

Change in Law Protection

Covers tax, regulatory, environmental, import duty, and grid-code changes affecting project economics.

Force Majeure

Includes Natural, Local Political, and Foreign Political Force Majeure with corresponding relief and termination protections.

Environmental Attributes

Defines allocation of carbon credits and emission reduction rights, typically retained by Seller.

Insurance Requirements

Construction all-risk, operational insurance, political risk insurance, terrorism insurance, and business interruption coverage.

Performance Guarantees

Minimum availability thresholds and testing requirements aligned with lender technical models.

Buyer Events of Default

Includes failure to pay, lapse of payment security, insolvency, or government interference.

Seller Events of Default

Includes failure to reach COD, abandonment, insolvency, or material breach.

Termination Compensation

Defines compensation payable for termination following buyer default, political force majeure, or prolonged force majeure.

Lender Step-In Rights

Provides cure rights, substitution rights, and replacement operator protections.

Dispute Resolution

Typically, international arbitration seated in London, Paris, or Singapore under English governing law.

Implementation Agreement

Government agreement covering land rights, tax stabilization, permitting support, and political risk undertakings.

Transmission Risk Allocation

Defines responsibility for evacuation infrastructure readiness and upgrade delays.

FX Convertibility Protection

Ensures repatriation rights and access to hard currency for debt service and dividends.

Tariff Adjustment Mechanisms

May include inflation indexation, exchange-rate adjustment, and Change-in-Law adjustments.

Taxes

Defines treatment of VAT, withholding taxes, import duties, and stabilization protections.

Assignment Rights

Seller permitted to assign to lenders, affiliates, or replacement operators subject to consent requirements.

11.8 MODEL GOVERNMENT GUARANTEE

Utility-Scale Renewable Energy Projects

GOVERNMENT GUARANTEE

This Government Guarantee (“Guarantee”) is issued on [●] (the "Effective Date")

BY

The Government of [Country], acting through the Ministry of Finance and the Ministry of Energy (the **Government**)

IN FAVOR OF

[Project Company] (the **Company**)

The Government and the Company are collectively the **Parties**.

RECITALS

A. The Company has entered or will enter into a Power Purchase Agreement (“PPA”) with a state-owned electricity utility (the **Off taker**).

B. The Company has entered or will enter into project agreements with the Government relating to development of a renewable energy power plant (the **Project**).

C. The Government has agreed to issue this Guarantee to secure the payment and performance obligations of the Off taker under the PPA.

ARTICLE 1 — DEFINITIONS

Capitalized terms not defined herein shall have the meanings given in the PPA.

“Guaranteed Obligations” means all payment, compensation, and performance obligations of the Off taker under the PPA, including without limitation all amounts payable upon termination, curtailment compensation, and capacity and energy payments.

ARTICLE 2 — GOVERNMENT PAYMENT GUARANTEE

The Government hereby **irrevocably and unconditionally guarantees** the full and punctual payment of all Guaranteed Obligations.

If the Off taker fails to pay any amount due under the PPA, the Government shall pay such amount upon written demand by the Company.

This Guarantee constitutes a **primary and continuing obligation** of the Government.

ARTICLE 3 — INDEMNITY

If any Guaranteed Obligation becomes unenforceable for any reason, the Government shall indemnify the Company for all amounts that would otherwise have been payable under the PPA.

This obligation is independent of the payment guarantee.

ARTICLE 4 — PAYMENT MECHANISM

The Government shall pay any undisputed amount within 30 **days** of receiving a written demand, with interest accruing at the rate specified in the PPA from the due date under the PPA until the date of actual payment.

The Company shall not be required to pursue other remedies before claiming under this Guarantee. Interest shall accrue on any amount not paid by the Government by the applicable deadline at the default interest rate specified in the PPA, or if no such rate is specified, at [●] % per annum above [reference rate], from the date such amount was due until the date of actual payment.

ARTICLE 5 — CURRENCY PROTECTION

Payments shall be made in the currency specified in the PPA.

If currency conversion is required for enforcement or judgment:

The Government shall indemnify the Company for any exchange rate losses.

ARTICLE 6 — CONTINUING SECURITY

This Guarantee shall remain in force:

- Until all obligations under the PPA are fully satisfied; and
- Notwithstanding amendments to the PPA or project agreements.

This Guarantee is **in addition to** any other security held by the Company or lenders.

ARTICLE 7 — PRESERVATION OF RIGHTS

The Government’s obligations shall not be affected by:

- Changes in ownership or restructuring of the Off taker
- Amendments to the PPA, provided that the Government shall not be entitled to rely upon any amendment to the PPA that reduces the Off taker's obligations to reduce its own obligations under this Guarantee unless the Company has provided its prior written consent to such amendment
- Failure of the Company to enforce other rights
- Insolvency of the Off taker

- Changes in the electricity sector

ARTICLE 8 — CLAIM PROCEDURE

The Company may make a claim if:

1. An undisputed payment remains unpaid after the PPA cure period; or
2. Termination compensation becomes payable under the PPA.

A demand shall include a certificate signed by an authorized officer of the Company confirming: (i) the amount unpaid; (ii) the date such amount became due under the PPA; and (iii) that the applicable cure period under the PPA has expired without payment. Such certificate shall be conclusive evidence of the matters stated therein in the absence of manifest error.

ARTICLE 9 — SUBROGATION

Any right of the Government to recover payments from the Off taker shall be **subordinated** to the Company’s right to receive full payment under the PPA.

ARTICLE 10 — ASSIGNMENT

The Company may assign its rights under this Guarantee without the consent of the Government to lenders, security agents, and project financiers providing financing to the Project, and to any person to whom the Company's rights under the PPA are assigned in accordance with the PPA. The Government shall, upon request, promptly execute any acknowledgment of assignment reasonably required by such lenders or security agents.

- Lenders
- Security agents
- Project financiers

Government consent shall not be unreasonably withheld.

ARTICLE 11 — DISPUTE RESOLUTION

11.1 Negotiation

The Parties shall first attempt to resolve disputes amicably within 30 days of one Party giving written notice to the other of the dispute (or such longer period as the Parties may agree in writing). If the dispute is not resolved within such period, either Party may refer it to arbitration in accordance with Article 11.2.

11.2 Arbitration

Any dispute shall be finally resolved by international arbitration before a tribunal of three (3) arbitrators.

- Rules: LCIA (London Court of International Arbitration) Rules, as in effect at the date of commencement of the arbitration
- Seat: [City], [Country] (e.g., London, England / Paris, France / Singapore)
- Language: English

Awards shall be final and binding.

ARTICLE 12 — GOVERNING LAW

This Guarantee shall be governed by and construed in accordance with the laws of [Country/State] (excluding any conflict of laws rules that would require the application of another jurisdiction's laws).

ARTICLE 13 — WAIVER OF SOVEREIGN IMMUNITY

The Government confirms that:

- This Guarantee is a commercial transaction.
- It waives sovereign immunity from arbitration and enforcement.
- It consents to enforcement against its assets generally, except assets used for diplomatic purposes or otherwise exempt under customary international law and shall not assert any sovereign immunity as a defense to the enforcement of any award or judgment arising out of this Guarantee.

ARTICLE 14 — REPRESENTATIONS AND WARRANTIES

The Government represents that:

1. It has authority to issue this Guarantee.
2. All approvals required have been obtained.
3. This Guarantee constitutes a legally binding obligation.

ARTICLE 15 — NOTICES

All notices must be in writing and delivered by hand, courier, or email (with confirmation of receipt) to the Parties at the following addresses:

To the Government: [Ministry of Finance address], Attention: [●], Email: [●]

To the Company: [Company address], Attention: [●], Email: [●]

Notices shall be deemed received on the date of delivery if delivered by hand or courier, or on the next business day after transmission if sent by email.

ARTICLE 16 — MISCELLANEOUS

- Amendments must be in writing.
- If any provision is invalid, the remainder remains effective.
- This Guarantee benefits successors and permitted assigns.

EXECUTION

IN WITNESS WHEREOF, the Government has executed this Guarantee.

For the Government of _____

Minister of Finance

Minister of Energy

1.1.1 Building the solar arrays: Enclosed

1.2 Model Data

1.2.1 Simulation Model in DigSilent on the PV Plant and the cable arrays to enable the following simulations: Enclosed

1.2.2 load flow

1.2.3 dynamic simulations

1.2.4 Description of model including

1.2.5 P-Q

1.2.6 P-V

1.2.7 Q-V

1.2.8 Frequency Control

1.3 Single Line Diagram

A single line diagram containing at least the following information in clearly legible form must be provided: Enclosed

1.3.1 AC cable types and length, number of parallel circuits

1.3.2 Configuration of 33/0.4kv kV transformers and circuit breaker, breaker

1.3.3 Switching position of breakers during normal operation

1.3.4 Short-circuit strength of 33 kV busbars, breakers (I thermal, I peak)

1.3.5 Switching position of breakers during normal operation

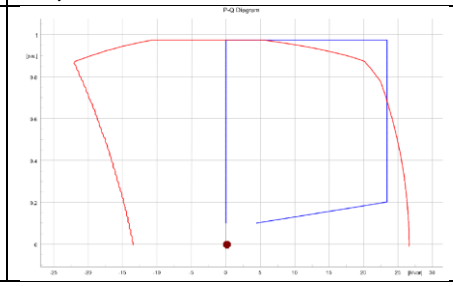
1.3.6 Short-circuit strength of PV Plant busbars, breakers (I thermal, I peak)

1.3.7 Short-circuit strength of high voltage busbars, breakers (I thermal, I peak)

1.4 Inverter System Data of the PV Plant

The Seller is required to provide all of the information about the solar inverters as listed in Table 7.1 in accordance with a timetable to be agreed between the Seller and the Purchaser.

Table 7.1 Solar Inverter data

Manufacturer	HUAWEI
Type	Tring Inverter – SUN2000
Rated Voltage	1100V
Apparent Power (@ 25°C)	110KVA
Apparent Power (@ 50°C)	100KVA
Active Power (@ 25°C)	100KW
Active Power (@ 50°C)	110KW
Maximum Current	133.7A
Power factor (@maximum Active power)	1p.u
Maximum Power factor (overexcited/lagging)	0.8/0.8
Maximum Power factor (under excited/leading)	0.8/0.8
Reactive Power capability curve	

1.5 Reactive Power Compensation Equipment

If reactive power compensation equipment is required so that the site is compliant with the requirements of this document, the minimum data that is required is shown in Table 7.2 and shall be provided by the Seller in accordance with a timetable to be agreed between the Seller and the Purchaser.

Table 7.2 Reactive Power Device

Rated Voltage (kV)	33/KV
Type of equipment	Capacitor Bank
Reactive Power Range (kVAr)	14MVAr

1.6 Transformer Data

Details of all transformers to be installed in the PV Plant to be connected onto the 33kV array network as shown in Table 7.3 shall be provided by the Seller in accordance with a timetable to be agreed between the Seller and the Purchaser.

Table 7.3 Transformer Data

Number of transformers	15
Voltage Ratio (kV/kV)	33/04KV
Rating (kVA)	5MVA
Transformer Cooling	ONAN
Vector Group	Dy11y11
Transformer impedance (% of 100MVA Base)	6%
Transformer resistance (% of 100MVA Base)	6.5%
On load or off load tap changer	On load Tap Changer
Number of taps	5
Transformer tap range	30.255-33.825kv

1.7 0.4kv kV Array Cable Data

Details of each of the XX kV array cables to be installed onto the PV Plant network as shown in Table 7.4 shall be provided by the Seller in accordance with a timetable to be agreed between the Seller and the Purchaser.

Table 7.4 Array Cable Data

Rated Voltage	400V
Cable Type	XLPE
Cable Resistance (% on 100MVA base)	0.568
Cable Reactance (% on 100MVA base)	0.122
Cable Susceptance (% on 100MVA base)	0.29
Cable Rating (kVA)	71

1.8 33KV kV Circuit Breaker Data

Details of all the XX kV circuit breakers to be installed on the PV Plant in Table 7.5 shall be provided by the Seller in accordance with a timetable to be agreed between the Seller and the Purchaser.

Table 7.5 Circuit Breaker Data

Circuit Breaker Manufacturer	ABB
Number of Circuit breakers)	10
Rated Voltage (kV)	33KV
Circuit Breaker break rating (kA)	31.5KA

Circuit Breaker make rating (kA)	83KA

Schedule Requirements for maintenance and dispatch procedures

In addition to complying with the requirements of the Grid Code, the following conditions shall apply to ensure good co-ordination between the Seller and the Purchaser in respect of the operation of the PV Plant during Scheduled and Unscheduled Outages.

1 Annual planned maintenance schedule

1.1 Not later than 90 days prior to the commencement of each Contract Year (save for the first Contract Year, for which the corresponding period shall be 45 days prior to the Commercial Operations Date), the Seller shall submit its plans for full or partial interruptions of the generating capability of the PV Plant for that year following consultation with the Purchaser regarding the Purchaser's anticipated major maintenance outages in that year (each such planned full or partial interruption, a "**Scheduled Outage**").

1.2 A Party may, on no less than 45 days' prior written notice to the other Party, requesting to reschedule a Scheduled Outage to an alternative date and the Party being requested shall use all reasonable endeavors to accommodate such rescheduling if it is consistent with Prudent Utility Practice.

2 Monthly and weekly planned maintenance schedule

No later than 14 days prior to the commencement of the maintenance outages a Party carrying out maintenance works shall notify the other Party in accordance with the annual maintenance plan unless the Parties agree to reschedule.

3 Unscheduled Outages and curtailment

3.1 If there is an unforeseen full or partial interruption of the generating capability of the PV Plant and the Interconnection Facility in the case of the Seller and Purchaser's system in case of the Purchaser, the Party shall immediately inform the other Party on the expected consequences for the output predictions in the short term and reissue its notifications accordingly.

3.2 In case of an Emergency requiring full or partial curtailment of the PV Plant and the Interconnection Facility in case of the Seller and Purchaser's system in case of the Purchaser, the Party having an emergency situation shall notify the other Party within 24 hours after the commencement of the event.

4 Forecasting information

4.1 Weekly forecast generation profile

On a weekly basis, before 09:00 on the last working day prior to the commencement of the week, the Seller shall provide to the Purchaser a week ahead generation forecast, calculated at the Delivery Point, in the following format.

Day	MWh	Available MW
Monday		
Tuesday		
Wednesday		
Thursday		
Friday		
Saturday		
Sunday		

4.2 Daily forecast generation profile

The Seller shall provide on a daily basis, before 09:00 hours before the commencement of each day, the day ahead generation forecast, calculated at the Delivery Point, in the following format:

Time Hours	MWh	Available MW
00:00 - 01:00		
01:00 - 02:00		
02:00 - 03:00		
03:00 - 04:00		
04:00 - 05:00		
05:00 - 06:00		
06:00 - 07:00		
07:00 - 08:00		
08:00 - 09:00		
09:00 - 10:00		
10:00 - 11:00		

11:00 - 12:00		
12:00 - 13:00		
13:00 - 14:00		
14:00 - 15:00		
15:00 - 16:00		
16:00 - 17:00		
17:00 - 18:00		
18:00 - 19:00		
19:00 - 20:00		
20:00 - 21:00		
21:00 - 22:00		
22:00 - 23:00		
23:00 - 24:00		

4.3 Communication Protocol

Sender	**Receiver**
XXX Enterprise Limited XXXXXXXX	Purchaser: Address: Attention:

Determination of payments

1 Energy Charges

The Energy Charges are set out in Part II (*Tariff Information*) of **Schedule 1** (*Seller specific information*).

Deemed Generated Energy

If the Seller is entitled to receive payment in respect of Deemed Generated Energy pursuant to this agreement, then Deemed Generated Energy shall be based on the following proxy for the electrical energy which could have been (but was not) generated by the PV Plant:

Before the Original Scheduled Commercial Operations Date

No Deemed Generated Energy payments will be made in respect of the period prior to the Original Scheduled Commercial Operations Date.

On or after the Original Scheduled Commercial Operations Date but before the Commercial Operations Date

The Seller shall be entitled to Deemed Generated Energy in respect of the amount of capacity, not exceeding the Contracted Capacity, as the Seller determines would have been Commissioned in the relevant Month, subject in each case to the Purchaser's right to refer such determination for adjudication by the Independent Engineer.

The Deemed Generated Energy shall be calculated as follows:

$$E_{n,deemed} = \sum_j E\,\text{module}_{j,n} * PR_n / 100$$

Where:

(i) $E_{n,deemed}$ = Deemed Generated Energy in billing month *n* (in kWh);

(ii) $E\,\text{module}_{j,n}$ = Calculated energy at the module level as determined based on the formula set out below in each metering interval *j* during which Energy has been deemed to be delivered in billing month *n*;

(iii) PR_n = Estimated PV Plant Performance Ratio (in %) in billing month *n* as set out in the table in Section A (*Estimated PV Plant Performance Ratio*) of Part I (*General*) of **Schedule 1** (*Seller specific information*) and modified for degradation as detailed in that schedule;

(iv) *j* = metering interval of 10 minutes.

On or after the Commercial Operations Date

The Deemed Generated Energy shall be calculated as far as possible on the basis of operating data recorded by the SCADA System as follows:

$$E_{n,deemed} = \sum_j E\,\text{module}_{j,n} * PR_n / 100$$

Where:

(i) $E_{n,deemed}$ = Deemed Generated Energy in billing month *n* (in kWh);

(ii) $E\,\text{module}_{j,n}$ = Calculated energy at the module level as determined based on the formula set out below in each metering interval *j* during which Energy has been deemed to be delivered in billing month *n* but excluding any periods that fall within Scheduled Outages;

(iii) PR_n = the lesser of the Estimated PV Plant Performance Ratio (as set out in the table in Section A (*Estimated PV Plant Performance Ratio*) of Part I (*General*) of **Schedule 1** (*Seller specific information*)) and the average PV Plant Performance Ratio for the previous 30 days prior to the Purchaser Risk Event or No Fault Purchaser Risk Event; and

(iv) *j* = metering interval of 10 minutes.

Calculated energy at the module level

The calculated energy at the module level shall be determined as follows:

$$\text{Emodule}_j = PA * \left(G_j / 1000 * MI / 60 * \eta_{STC} / 100 * \left(1 - \beta / 100 * \left(T\,\text{mod}_n - Tmeas_j\right)\right)\right)$$

Where:

(i) E module $_j$ = Calculated energy at the module level as determined based on the formula set out in this section in each metering interval *j* (in kWh);

(ii) *PA* = Plane of array area of the PV Plant (in m^2) that is available for generation or that would have been available for generation other than for the occurrence of a Purchaser Risk Event of No Fault Purchaser Risk Event;

(iii) η_{STC} = Module efficiency at Standard Test Conditions as per module data sheet (in %);

(iv) G_j = solar irradiance (in W/m^2) is the average irradiance measured during the metering interval *j* by the sensors placed in the plane of array. If such measured data is not available for the period in question, the corresponding data from the preceding year should be used;

(v) *β* = the temperature coefficient from the module's data sheet (in %/°C);

(vi) *MI* = the metering interval of 10 minutes;

(vii) *Tmeas* = the monthly average module temperature measured during each Metering Interval *j* by the temperature sensors placed on the reverse side of the modules (in °C); and

(viii) *T* mod = the average monthly module temperature expected as set out in the table in Section A (*Estimated PV Plant Performance Ratio*) of Part I (*General*) of **Schedule 1** (*Seller specific information*).

Disagreements as to calculations of Deemed Generated Energy

If the Parties disagree on the calculation of the amount of Deemed Generated Energy (including the amount of capacity that would have been Commissioned in a relevant Month pursuant to paragraph 0):

either Party shall be entitled to refer the matter to the Independent Engineer to determine the amount, and its decision shall be final and binding on both Parties in absence of fraud or manifest error;

where the dispute relates to the amount of capacity that would have been Commissioned in a relevant Month pursuant to paragraph 0:

the Purchaser shall pay for the Deemed Generated Energy throughout the period of any dispute (and notwithstanding that the amount is in dispute) on the basis of the Seller's determination of such proportion; and

if it is subsequently agreed or determined that the amount of capacity was overstated, an amount corresponding to the revenue arising from the difference will be refunded by the Seller to the Purchaser from the date of payment to the date of refund.

Energy Charges for Deemed Generated Energy

The applicable Energy Charge for all Deemed Generated Energy:

(i) before the Commercial Operations Date (or the date that would have been the Commercial Operations Date but for the occurrence of a Relief Event which is

a Purchaser Risk Event or a No Fault Purchaser Risk Event) shall be the Early Generation Period Energy Charge; and

(ii) on or after the Commercial Operations Date (or the date that would have been the Commercial Operations Date but for the occurrence of a Relief Event which is a Purchaser Risk Event or a No Fault Purchaser Risk Event) shall be the Operating Period Energy Charge,

in each case as adjusted in accordance with paragraph 1 (*Energy Charges*), including, if applicable, as a result of the event giving rise to the entitlement for Deemed Generated Energy.

Energy and Deemed Generated Energy payments

The provisions of Clause 12.1 (c) and (d) (*Compensation, payment and billing*) in respect of payments for Energy and Deemed Generated Energy shall apply

Schedule 11 – Government Guarantee

GOVERNMENT GUARANTEE

This Government Guarantee (the “Guarantee”) is entered into as of [Insert Date], by and among the Government of [Country], acting through the [Ministry of Finance / relevant authority] (the “Guarantor”), and Gigawatt Renewables Limited (the “Seller”).

WHEREAS:
- The Seller and [Purchaser Name] (the “Purchaser”) have entered into a Power Purchase Agreement dated [Insert PPA Date] (the “PPA”) for the development, construction, and operation of a [#]MW hybrid power plant in [Country];
- The Guarantor desires to promote private sector investment in renewable energy and recognizes the importance of supporting the obligations of the Purchaser under the PPA;

NOW THEREFORE, the Guarantor agrees as follows:

1. Guarantee of Payment
The Guarantor hereby irrevocably and unconditionally guarantees to the Seller the full and prompt payment of all amounts due and payable by the Purchaser under the PPA, including but not limited to energy payments, deemed energy payments, termination compensation, and interest on late payments (the “Guaranteed Obligations”), in the event the Purchaser fails to make such payments when due.

2. Demand for Payment
The Seller may demand payment under this Guarantee if:
- The Purchaser fails to pay any Guaranteed Obligation within [30] days of its due date;
- The Seller notifies the Guarantor in writing and includes evidence of the Purchaser's default;
- The Guarantor shall pay the outstanding amount within [15] business days of receiving such notice.

3. Nature of Guarantee
This Guarantee is a primary, irrevocable, and unconditional obligation of the Guarantor and shall remain in effect for the full term of the PPA, including any extensions or renewals.

4. Waiver of Defenses
The Guarantor waives any rights to contest its obligations based on the invalidity or unenforceability of the PPA or any amendment thereof, or any act or omission of the Seller or the Purchaser.

5. Governing Law and Jurisdiction
This Guarantee shall be governed by the laws of [Country] and subject to the dispute resolution provisions set forth in Clause 19 of the PPA.

IN WITNESS WHEREOF, the Guarantor has executed this Guarantee as of the day and year first above written.

Signed for and on behalf of the Government of [Country]:
Name:
Title:

Ministry:
Seal/Signature:

11.9 POWER PURCHASE AGREEMENT

GIGAWATT GLOBAL

as Seller

and

[Purchaser Name]

as Purchaser

POWER PURCHASE AGREEMENT

RELATING TO [#]MW HYBRID [type of plant] POWERED PLANT

[year]

August 12, 2024, V37

THIS POWER PURCHASE AGREEMENT (this “Agreement”) is made this……. day of _____ [year] between:

GIGAWATT RENEWABLES LIMITED, a private limited company incorporated under the laws of Zambia, whose registered office is at [address in Zambia] (the “Seller” which expression where the context permits will include its successors and assigns) of the one part.

[Purchaser Name], [insert purchaser information] (the “Purchaser” which expression where the context permits will include its successors and assigns) of the one part.

(Each a “Party” and together the “Parties”).

Whereas:

The Seller intends to sell and deliver to the Purchaser, and the Purchaser intends to purchase and accept from the Seller, all the electrical energy generated from the PV-Wind Plant (as hereinafter defined) on the terms and conditions set out in this Agreement.

It is agreed as follows:

Definitions and interpretation

Definitions

In this Agreement, the following terms have the meanings given to them below:

“Abandonment” means the voluntary cessation of the design, procurement, construction, installation, operation or maintenance of the PV/WindPlant or, prior to the Commercial Operations Date, the Interconnection Facilities by or on behalf of the Seller (provided that the completion of any such activity shall not constitute a cessation of that activity) or the permanent withdrawal of all, or substantially all, personnel by the Seller from the Site.

“Achieved Capacity” means the actual maximum alternating current capacity of the PV Plant and wind plant at the Delivery Point expressed in MW, as determined in accordance with paragraph 0 (Calculation of the Achieved Capacity) of Schedule 5 (Commissioning of PV-Wind Plant and PV-Wind Plant Performance Ratio testing).

"“Business Day” means any day other than a Saturday or Sunday, on which business by and between banks may be carried out and which is not a national public holiday in [country of sale]."

“Change in Law” means the occurrence of any of the following:

the enactment of any new Laws of [country of sale];

the repeal, modification or re-enactment of any existing Laws of [country of sale] including for the avoidance of doubt tax laws;

the termination, or cessation of the effect of, or modification of, any existing Industry Documents;

the commencement or entry into effect of any Laws of [country of sale] or Industry Documents which were not formally adopted as at the date of this Agreement;

a change in the interpretation or application of any Laws of [country of sale] or of any Industry Document;

a change in the interpretation or application of any tax related law.

“Check Meter” means the energy meter (and all associated equipment), installed by the Seller adjacent to the Main Meter but on the Seller’s side of the Delivery Point and to be used as part of the Metering System to measure data for back-up and comparison purposes. The Check Meter shall be used for billing of electricity in case of failure of main meter.

“Commercial Operations Date” shall have the meaning as ascribed to it under Clause 5.3.

“Commissioned” means:

in respect of the Interconnection Facilities, that the Interconnection Facilities have passed the PPA Commissioning Tests; and

in respect of the PV-Wind Plant, that the whole PV Plant has passed the PPA Commissioning Tests in accordance with the requirements of Schedule 5 (Commissioning of PV-Wind Plant and PV Plant Performance Ratio testing), including any whole PV Plant tests thereof.

“Commissioning” means, in respect of the Interconnection Facilities, the performance of the PPA Commissioning Tests and, in respect of all or a Phase of the PV-Wind Plant, the performance of the PPA Commissioning Tests in accordance with the relevant requirements of Schedule 5 (Commissioning of PV-Wind Plant and PV-Wind Plant Performance Ratio testing) and “Commission” shall be construed accordingly.

“Conditions Precedent” means the conditions precedent specified in Clause 2 and “Condition Precedent” means any one of them.

“Connection Agreement” means an agreement necessary for the connection of the Seller’s and the Purchaser’s Interconnection Facilities.

“Construction Contract” means the agreement(s) between the Project Developer and the Construction Contractor(s) that sets forth the terms and conditions under which the Construction Contractor(s) will perform the design, engineering, procurement, and construction of the Power Generation facility in accordance with the standards and requirements stipulated in this Agreement.

“Construction Contractor’s” means the entity or entities engaged by the Project Developer to carry out the design, engineering, procurement, construction, and commissioning of the Power Generation Facility. These contractors are responsible for executing the construction work in accordance with the terms and conditions of the Construction Contract, ensuring compliance with applicable standards, regulations, and project specifications.

“Contracted Capacity” means the value, in MW, of alternating current export capacity specified in Section A (General) of Schedule 1 (Project specific information), being the contracted capacity of the PV-Wind Plant, as may be amended in accordance with Clause 0 (Commercial Operations Date).

“Contract Year” means the period starting at 00:00 on 1 January in any calendar year and ending at 24:00 on 31 December in that calendar year, provided that:

the first Contract Year shall be for a period starting at 00:00 on the Commercial Operations Date and ending at 24:00 on 31 December in that year; and

the last Contract Year shall be for a period starting at 00:00 on 1 January in that year and ending at 24:00 on the date that this Agreement terminates or expires.

“Curtailment Event” means an Emergency or other constraint, unavailability, curtailment or failure of the Grid System, or physical conditions prevailing on the Grid System, in each case that prevents or restricts the Seller from delivering or the Purchaser from accepting at the Delivery Point electrical energy that the Plant would otherwise have generated and delivered for any reason, or any amendment by the Purchaser of a standing despatch instruction under Clause 0.

“Curtailment (Fault) Event” means a Curtailment Event which is not a Curtailment (No Fault) Event.

“Deemed Generated Energy” means the amount of electrical energy, in kWh, that the Seller would have generated and/or delivered at the Delivery Point in accordance with the terms of this Agreement, but for the occurrence of any event other than a Force Majeure Event.

“Delivery Point” means the physical point at which the Seller transfers electrical energy to the Purchaser which shall be “Chibombo Substation”.

“Dispute” “means any disagreement of any kind whatsoever between the Parties arising under, in connection with, or relating to, this Agreement or the transactions contemplated herein.

“Due Date” means, with respect to an invoice submitted by a Party pursuant to Clause 0 (Invoicing, billing and payment), the date that is thirty (30) days after the date that the invoice was received by the other Party.

“Early Generation Period Energy” means Energy generated prior to 00:00 on the Commercial Operations Date.

“Early Generation Period Energy Charge” has the meaning given to that term in Part II (Tariff information) of Schedule 1 (Seller specific information).

“Effective Date” means the first date on which all the Conditions Precedent are satisfied in accordance with Clause 0 (Fulfilment of Conditions Precedent).

“Emergency” means any event or circumstance affecting the Grid System which:

is described as an emergency in any Industry Document;

materially or adversely affects (as determined reasonably by the Purchaser) the ability of the Purchaser to maintain a safe, adequate and continuous electrical service to its customers, having regard to the then-current standards of electrical service provided to its customers;

presents a physical threat to persons or property or the security, integrity or reliability of the Grid System; or

the Purchaser reasonably expects to have the effects specified in paragraph 0 or 0 above.

“Energy” means the electrical energy produced by the PV-Wind Plant, expressed in kWh, that is delivered by the Seller to the Purchaser at the Delivery Point in accordance with the terms of this Agreement.

“Energy Charge” means a payment for Scheduled Energy, either the Early Generation Period Energy Charge or the Operating Period Energy Charge, as applicable.

“Environmental Credits” means any and all financial benefits, credits, rights, entitlements or interests of an environmental nature that are created or otherwise arise from the Power Project. Forms of such benefits shall include, but not be limited to, any and all environmental air quality credits, green credits, renewable energy credits, certificates, carbon or other gas emissions reductions (whether or not they are verified or certified), tags offsets, allowances or similar products or rights, howsoever named. Specified in Section A (General) of Schedule 2 (Project specific information).

“Estimated PV-Wind Plant Performance Ratio” means the estimated PV-Wind Plant Performance Ratio, specified in Section A (Estimated PV-Wind Plant Performance Ratio) of Part I (General) of Schedule 1 (Seller specific information), as adjusted from time to time by the degradation factor specified therein.

“Event of Default” means a Seller Event of Default or a Purchaser Event of Default.

“Financial Close” means the first date on which:

Finance Documents committing such funds as may be necessary to finance the implementation of the Project and the PPA Project (other than funds provided to Seller by its shareholders, or otherwise unconditionally committed and available to Seller from its shareholders, whether by way of equity subscription, shareholder loan or otherwise) have been signed and are in full force and effect; and

all conditions precedent to the first drawdown of funds under such Finance Documents have been satisfied or waived, other than any such condition precedent in relation to occurrence of the Effective Date.

“Financial Documents” means the agreements and other documents relating to the provision by the Lenders of the non-recourse credit facilities required by the Seller to finance or refinance the Project.

“Force Majeure Event” shall have the meaning as ascribed to it under Clause 16.

“Functional Test” means the tests described in paragraph 0 (Functional Tests) of Schedule 5 (Commissioning of PV-Wind Plant and PV-Wind Plant Performance Ratio testing).

“Government” means the Government of [country of sale] (whose contact details, in the event of any notices needing to be copied to the Government.

“Governmental Authority” means the department, authority, instrumentality, court, tribunal, agency or other person, including any regulator, from which a Consent is to be obtained from time to time or which has jurisdiction under the Laws of [country of sale] over the Purchaser or the Seller or their activities, including the Project or the performance or interpretation of this Agreement.

“Grid Code” means the grid code of [country of sale] specified in Section A (General) of Schedule 2 (Project specific information).

“Grid System” means the transmission and distribution facilities through which the Energy will be received and transmitted by the Purchaser to consumers of electrical energy, including, following transfer in accordance with Clause 5.1.2 (Provisions relating to Interconnection Facilities), the Interconnection Facilities.

“Independent Engineer” means the independent consulting engineer or engineering company with relevant experience in photovoltaic electric power generation engaged to act for the Purchaser and the Seller in connection with this Agreement and appointed by both Parties.

“Industry Documents” means:

the currently applicable industry documents specified in Section A (General) of Schedule 2 (Project specific information); or

any other multi-party codes, grid connection or operating procedures, policies, guidelines, standards or regulations which generally apply to entities operating in the power sector in [country of sale], as any of them may be amended from time to time.

Interconnection Facilities means the interconnection equipment, and associated automatic communications, switching equipment and relay protection devices to be constructed and installed by the Seller at the Facility Site.

“kWh” means kilowatt-hours.

“Laws of [country of sale]” means any international (to the extent having direct effect in [country of sale]), federal, national, provincial or local law, order, rule, regulation, bye-law, statutory order, statutory reversionary order, executive order, decree, policy, judicial decision, notification, administrative decision or other similar directive made pursuant thereto, or legally binding instruction, guideline, code or standard issued by an executive, legislative, judicial or administrative entity applicable in [country of sale], including in relation to any Tax, as any of them may be amended from time to time, other than Industry Documents.

“Longstop Commercial Operations Date” means the date which is six (6) months after the Scheduled Commercial Operations Date, or such later date as results from an extension.

“Main Meter” means the energy meter (and all associated equipment), part of the Metering System, installed by the Seller as part of the Interconnection Facilities on the Purchaser’s side of the Delivery Point used to measure and record the Metered Energy.

“Metered Energy” means, in any period, all the Energy (expressed in kWh) that is recorded by the Main Meter (or, where required under Schedule 4 (Metering requirements), the Check Meter) in that period.

“Metering System” means the Main Meter and the Check Meter, as more particularly described in Schedule 4 (Metering requirements).

“Minimum Acceptance Capacity” means the proportion of the Contracted Capacity which must be Commissioned by the Longstop Commercial Operations Date, as specified in Section A (General) of Schedule 2 (Project specific information).

“Month” means a calendar month according to the Gregorian calendar, beginning at 00:00 on the first day of the month and ending at 24:00 on the last day of that month.

“Monthly Energy Payment Amount” has the meaning given to that term in Clause 0 (Monthly Energy Payment Amount).

“MW” means megawatts.

“NCC” means the National Council for Construction for purposes of the National Council for Construction Act No. 13 of 2003.

“O&M Contractor” means any contractor directly engaged by the Seller to undertake the whole or any part of the operations and / maintenance of the PV-Wind plant.

“Operating Period Energy” means all Energy generated after 00:00 on the Commercial Operations Date.

“Operating Period Energy Charge” has the meaning given to that term in Part II (Tariff Information) of Schedule 1 (Seller specific information).

“Performance Test” means the test described in paragraph 0 (Performance Test) of Schedule 5 (Commissioning of PV Plant and PV Plant Performance Ratio testing).

“PPA Commissioning Tests” means the tests and procedures for the PV-Wind Plant and the Interconnection Facilities as set out in Schedule 5 (Commissioning of PV-Wind Plant and PV-Wind Plant Performance Ratio testing).

“Point of Common Coupling” means the point at which the Purchaser’s system and the Seller’s Interconnection Facility interface.

“Project” means the project to design, construct, finance, own, operate and maintain the PV-Wind Plant and, prior to the Commercial Operations Date, the Interconnection Facilities.

“Project Documents” means this Agreement, the Related Agreements, the Construction Contract and any other contract, agreement, deed or other document entered into by or for the benefit of the Seller in connection with the Project, other than any Financing Agreement.

“Prudent Utility Practice” means, in relation to either Party, generally accepted international industry design, construction, operating and maintenance practices with respect to the photovoltaic electric power generation, transmission or distribution industries (as applicable), including the standards of practice of a person exercising that degree of skill, diligence, prudence and foresight which could reasonably be expected from a skilled and experienced person engaged in the same type of undertaking.

“Purchaser Event of Default” has the meaning given to that term in Clause 21.5 (Purchaser Events of Default).

“PV Plant” means the solar photovoltaic electric power generation plant that is located at the Site, together with substations and all balance of plant up to the Delivery Point, whether or not located on

the Site, as more particularly described in Schedule 3 (PV Plant – Minimum functional specifications and standards).

“PV-Wind Plant Performance Ratio” means the performance ratio of the PV-Wind Plant as determined in accordance with paragraph 0 (Performance Test) or paragraph 0 (Calculation of the PV-wind Plant Performance Ratio following the Commercial Operations Date) of Schedule 5 (Commissioning of PV-Wind Plant and PV-Wind Plant Performance Ratio testing) (as applicable).

“PV-Wind Plant” means a Hybrid Wind-Photovoltaic (PV) Plant, refers to a renewable energy generation facility that combines two distinct technologies for electricity production: wind turbines and photovoltaic solar panels. This type of power plant is designed to harness both wind and solar energy resources simultaneously in order to maximize electricity generation and overall energy efficiency.

“Related Agreements” means the agreements specified in Section A (General) of Schedule 2 (Project specific information).

“SCADA Communication Protocol” means the communication protocol for the SCADA System as set out in Annex B of Schedule 3 (PV-Wind Plant – Minimum functional specifications and standards).

“SCADA System” means the supervisory, control and data acquisition (SCADA) system to create, record, process, gather, report, communicate and archive the operating data in the PV-Wind Plant to be installed by the Seller as described in Schedule 3 (PV-Wind Plant – Minimum functional specifications and standards).

“Scheduled Commercial Operations Date” means the date falling Eighteen (18) months after the Effective Date as is specified in Section A (General) of Schedule 2 (Project specific information).

“Scheduled Energy,” refers to the amount of energy declared by the generation plant for a given period and to be dispatched by the System Operator

“Seller Event of Default” has the meaning given to that term in Clause 21.4 (Seller Events of Default).

“Signature Date” means the date on which this contract is signed by all parties, marking the formal execution of the agreement and the commencement of its terms and obligations.

“Site” has the meaning given to that term in Section A (General) of Schedule 2 (Project specific information).

“Standing Order Authorisation” means a letter from Buyer to Account Bank authorising the creation of a monthly standing order in favour of Seller for the purpose set out in Clause 11.1 (Payment);

“Surviving Provisions” means this Clause 0, Clause 0 (Non-fulfilment), Clause 21.6 (Obligations upon termination), Clause 21.8 (Other remedies), Clause 21.9 (Consequential loss), Clause 26 (Confidentiality), Clause 18 (Dispute resolution), Clause 27 (Notices) and Clause 30 (Applicable law).

“Tax” means all forms of taxation, duties, imports, levies and rates however imposed and applicable pursuant to the Laws of [country of sale].

“Technical Limits” means the limits and constraints with which the Project is required to comply, described in Schedule 7 (Technical Limits).

“Threshold Loss Event” means the occurrence of an event or series of events which results in the destruction of, or irreparable damage to, such proportion of the PV Plant as is specified in Section A (General) of Schedule 2 (Project specific information).

“US Dollars” and “USD” means the lawful currency of the United States of America.

[additional definitions needed for “country” and its relevant laws/codes]

Interpretation

In this Agreement:

References to one gender include all genders and references to the singular include the plural and vice versa.

References to:

a person includes any company, partnership or unincorporated association (whether or not having separate legal personality); and

a company includes any company, corporation or anybody corporate, wherever incorporated.

References to a provision of law are references to that provision as amended, extended or re-enacted and include all laws and official requirements made under or deriving validity from it or enacting such modification.

References to this Agreement shall include any Recitals and Schedules to it and references to Clauses and Schedules are to Clauses of, and Schedules to, this Agreement. References to paragraphs and Parts are to paragraphs and Parts of the Schedules.

Headings shall be ignored in interpreting this Agreement.

References to any document (including this Agreement), or to a provision in a document, shall be construed as references to such document or provision as amended, supplemented, modified, restated or novated from time to time.

The words “including”, “include”, “in particular” and words of similar effect shall not be deemed to limit the general effect of the words that precede them.

The language which governs the interpretation of this Agreement is the English language.

A reference to any “Party” includes its successors in title, permitted assignees and transferees.

A reference to a “day” means a 24-hour period beginning at 00:00 on a day and ending at 24:00 on that day.

If the date for satisfaction of any obligation under this Agreement is due to occur on a Saturday, a Sunday or a public holiday in [country of sale], that date shall occur on the next day which is not a Saturday, a Sunday or a public holiday in [country of sale].

Priority of documentation

If there is any inconsistency between any of the provisions of the main body of this Agreement and the Schedules, the main body of this Agreement shall take precedence.

Conditions Precedent and Effective Date

Conditions Precedent

The following conditions shall be satisfied in order for this Agreement to come into full force and effect:

The Seller

The receipt by the Seller of the relevant licenses and approvals (including x Permit), and the submission of reasonably satisfactory evidence of such licenses and approvals to the Purchaser.

The achievement by the Seller of Financial Close; and

The execution of the Connection Agreement.

The Purchaser

shall procure the approval by [relevant party] of this Agreement;

shall procure the approval by the [Attorney General or other equivalent party] of this Agreement.

Purchaser having provided a copy of the Standing Order Authorisation to seller;

Clause 0 (Definitions and interpretation), this Clause 0 paragraphs (i) and (ii), Clause 0 (Construction of the PV-Wind Plant and Interconnection Facilities), Clause 0 (Mutual undertakings of the Parties – general), Clause 0 (Mutual undertakings of the Parties – access and knock-for-knock), Clause 0 (Tax undertakings), Clause 12 (Representations and warranties of the Parties), Clause 26(Confidentiality), Clause 22 (Assignment), Clause 18 (Dispute resolution), Clause 27 (Notices) and Clause 23 (General) shall be effective on and from the date of this Agreement.

Effective Date

The remaining Clauses of this Agreement shall come into full force and effect on and from the Effective Date.

Fulfilment of Conditions Precedent

Each Party undertakes to use reasonable endeavours to ensure the Conditions Precedent are fulfilled within six months from signature date.

Where a Party considers that a Condition Precedent has been satisfied, it shall within a period of 5 business days notify the other Party. If that Party disputes that the Condition Precedent has been satisfied, it shall provide notice to that effect within seven (7) business days, failing which the Condition Precedent shall be deemed satisfied.

Upon satisfaction or waiver of all of the Conditions Precedent either Party may issue a letter to the other confirming the same, and the date of the issuance of such letter shall be the "Effective Date" and such a notification shall form part of this agreement (to be incorporated under appendices).

Each Party may, in its sole discretion, waive any Condition Precedent which is designated as being the responsibility of the other Party by notice in writing to that Party.

Non-fulfilment

If the Conditions Precedent are not satisfied in full, then this Agreement shall not become effective and either party shall have the right to terminate this agreement.

Where this Agreement does not become effective as provided for under Clause [2.2.1], neither Party shall have any claim against the other Party, and both Parties shall be discharged from performance of intended obligations to each other.

Term of Agreement

Term

Subject to Clause 0 (Conditions Precedent), this Agreement shall be effective from the Effective Date and shall continue in full force and effect until the earlier of:

the date of termination of this Agreement in accordance with Clause 21 (Default and termination); and

the date of expiry of a period of twenty-five (25) years from the Commercial Operations Date.

Surviving Provisions

Expiry or termination of this Agreement shall be without prejudice to any accrued rights, remedies, obligations or liabilities of the Parties existing at expiry or termination. The Surviving Provisions shall continue in full force and effect notwithstanding expiry or termination of this Agreement.

Appointment of Independent Engineer

Subject to Clauses 0 and 4.3, the Parties shall appoint a selected Independent Engineer to perform such services and, on such terms, as set out in Schedule 6 (Services of an Independent Engineer).

Four (4) months before Scheduled Commercial Operations Date, the Parties shall obtain necessary approvals so as to permit the appointment of an Independent Engineer from the jointly approved list of acceptable Independent Engineers, pursuant to a competitive price-based tender.

The Independent Engineer shall be appointed jointly by the Seller and the Purchaser, and shall act on behalf of, and owe a duty of care to, both the Purchaser and the Seller equally.

The Seller and the Purchaser shall pay all fees, costs and expenses of the Independent Engineer equally.

If the contract with the Independent Engineer is terminated at any point during the term of this Agreement, a replacement Independent Engineer shall be jointly appointed by the Seller and the Purchaser in accordance with Clauses 4.1, 4.2 and 4.3.

Construction of the Project

Construction of the PV Plant and Interconnection Facilities

The Seller shall design, construct, install and Commission the PV Plant in accordance with the requirements of Schedule 3 (PV-Wind Plant – Minimum functional specifications and standards), the Technical Limits, good engineering and construction practices and Prudent Utility Practice.

The Seller shall design, construct, install and Commission the Interconnection Facilities in accordance with the [country of sale] Grid Code, the Technical Limits, good engineering and construction practices and Prudent Utility Practice.

The Parties shall promptly, following the date of this Agreement, provide all the information reasonably requested by the requesting Party in connection with the design, construction, installation, Commissioning, operation and maintenance of the PV-Wind Plant and the Interconnection Facilities.

The Seller shall at all times comply and shall procure that any third-party contractors and subcontractors comply, with the requirements of Schedule 3, Norms and Performance Standards in relation to the design, construction, installation and Commissioning of the PV-Wind Plant and Interconnection Facilities.

From the effective date of this Agreement to, and including, the Commercial Operations Date, the Seller shall, subject to Clause 0, permit, at any one time, up to ten (10) representatives of the Purchaser for purposes of:

having access to the Site and to the Construction Contractor’s personnel;

knowledge transfer and periodical updates to the Purchaser;

monitoring and observing progress with respect to the construction on an ongoing basis; and

participating in all key stages of the installation processes on Site (and the Seller shall provide all necessary assistance in this regard),

provided that:

in each case such access, permissions and assistance do not materially interfere with the construction of the PV-Wind Plant or the Interconnection Facilities or expose any person on the Site to any danger; and

the Purchaser’s representatives shall at all times comply with the Seller’s site regulations.

The number of Purchaser representatives referred to in Clause 0, may be restricted by the Seller if:

a temporary restriction is necessary, having regard to the construction activities taking place on the Site at that particular time; or

any representative of the Purchaser persistently fails to comply with the Seller's site regulations or fails to comply with the Seller's site regulations in a material respect and, where this paragraph (ii) applies, the Seller may restrict the rights granted under Clause 0 in respect of such defaulting representative only.

Commissioning

The Seller shall carry out Commissioning of the Interconnection Facilities prior to the Commercial Operations Date in accordance with the Grid Code.

The Seller shall carry out Commissioning of the PV-Wind Plant (whether in Phases or otherwise) prior to the Commercial Operations Date in accordance with Schedule 5 (Commissioning of PV-Wind Plant and PV-Wind Plant Performance Ratio testing).

The Seller shall not complete Commissioning of all or any Phase of the PV Plant until the Interconnection Facilities have been Commissioned.

The Purchaser may accept delivery of any Energy necessary to permit Commissioning to occur.

Commercial Operations Date

The Seller shall use all reasonable endeavours to achieve the Commercial Operations Date by no later than the Scheduled Commercial Operations Date.

The Commercial Operations Date shall not occur unless the Achieved Capacity is equal to or greater than the Contracted Capacity.

If the Commercial Operations Date is not achieved by the Scheduled Commercial Operations Date, the Seller shall, unless otherwise stated herein, compensate the Purchaser the sum equivalent to the Deemed Energy monthly, subject to Section 12. (d) below and capped at $[•]. Such compensation shall be the Purchaser's sole remedy for failure to achieve the Scheduled Commercial Operations Date.

This Agreement shall terminate nine (9) months after the Scheduled Commercial Operations Date following failure by the Seller to achieve Commercial Operations Date, unless such failure is caused by a Force Majeure Event or by any act or omission of a Governmental Authority, in which case the Scheduled Commercial Operating Date will be extended accordingly.

Sale and purchase of Energy

Sale and purchase

Early Generation Period Energy (before Scheduled Commercial Operations Date)

If, before the Scheduled Commercial Operations Date, the Seller is capable of generating electrical energy and wishes to sell such electrical energy to the Purchaser, it shall notify the Purchaser to that effect with details of the forecast generation profile that is expected to be achievable.

The Purchaser shall confirm on a daily basis in advance whether it wishes to purchase any amount of Early Generation Period Energy in the following day but shall be under no obligation to do so.

Where the Purchaser notifies the Seller that it wishes to take delivery of an amount of Early Generation Period Energy in any day and take such power, the Purchaser shall pay for it.

Operating Period Energy

Subject to and in accordance with the terms of this Agreement, on and from the Commercial Operations Date, the Seller shall sell and deliver to the Purchaser, and the Purchaser shall purchase and accept from the Seller and pay for, all Operating Period Energy up to the Contracted Capacity at the Operating Period Energy Charge.

Delivery and title to Energy

Delivery of Energy shall be completed when electrical energy generated by the PV-Wind Plant is delivered by the Seller at the Delivery Point.

The title to and risk of loss of Energy shall pass to the Purchaser at the Delivery Point.

Operation, maintenance and dispatch

The provisions of Schedule 8 (Requirements for maintenance and dispatch procedures) shall apply in respect of dispatch procedures.

The Purchaser agrees that:

in respect of Early Generation Period Energy on or after the Scheduled Commercial Operations Date, there shall be a standing dispatch instruction from time to time to deliver part or all of electrical energy capable of being generated by all Phases of the PV Plant that have been Commissioned at the relevant time; and

in respect of Operating Period Energy, with effect from the Commercial Operations Date, there shall be a standing dispatch instruction to deliver all electrical energy capable of being generated by the PV-Wind Plant, in each case, excluding any output resulting from installed capacity in excess of the Contracted Capacity.

The Seller shall, have the right without the Purchaser's prior written consent, to deliver electrical energy at the Delivery Point up to ten percent (10%) in excess of the Contracted Capacity. Any such excess energy shall be deemed part of the energy supplied under this Agreement and shall be subject to the terms and conditions outlined herein, including but not limited to pricing, and payment provisions.

Back feed energy

When on stand-by, the plant shall receive back feed energy from [Purchaser] for use. This back-feed energy will be charged at the same tariff as specified in Clause 12.1.c (Energy Charge)

The power plant shall ensure that average power factor over any month at the delivery point for the back-feed energy is maintained at 0.92 lagging or more. And for the purpose of this Agreement, leading power factors shall not be permitted. The respective power plant shall be subject to a penalty for any power factor values outside the specified limits as approved by the Grid code. The low power factor

surcharge penalty mechanism to be applied shall be the applicable approved mechanism by the [country of sale relevant board/party].

Metering

Metering System

The Seller shall, prior to Commissioning, at its own expense, procure, install, test and commission the Metering System at the Delivery Point in accordance with Schedule 4 (Metering requirements).

The Seller shall maintain the Main and Check Meters in accordance with Schedule 4 (Metering requirements).

The Purchaser shall be entitled to install its own meter at the Point of Common Coupling.

The Purchaser shall, without undue delay or hindrance, grant the Seller the necessary right-of-way and access permission on the grid infrastructure to facilitate the transmission and supply of solar and wind energy generated by the Seller to the grid.

Measurements of Energy

Energy delivered by the Seller to the Purchaser shall be measured in accordance with paragraph **Error! Reference source not found.** (Reading Metering System) of Schedule 4 (Metering requirements).

Operation, maintenance, and annual PV-Wind Plant Performance Ratio

The Seller undertakes to operate and maintain the PV-Wind Plant in accordance with Schedule 8 (Requirements for maintenance and dispatch procedures), any manufacturer guidelines, Prudent Utility Practice, and the Technical Limits.

The Seller shall at all times comply and shall procure that any third-party contractors and subcontractors comply, with the requirements of Annexure A of schedule 3, Norms and Performance Standards in relation to the operation and maintenance of the PV-Wind Plant.

The annual PV-Wind Plant Performance Ratio shall be calculated at the end of each Contract Year on the basis of operating data recorded by the SCADA System for that year and shall be determined in accordance with the formula set out in paragraph 0 (Calculation of the PV-Wind Plant Performance Ratio following the Commercial Operations Date) of Schedule 5 (Commissioning of PV-Wind Plant and PV-Wind Plant Performance Ratio testing).

The Parties agree that such sums represent a genuine pre-estimate of the Purchaser's loss arising from the failure by the Seller to operate and maintain the PV-Wind Plant in accordance with this Clause 0.

Contractors

The Purchaser acknowledges that the Seller may contract with:

a Construction Contractor to design, construct, install and Commission the PV-Wind Plant and Interconnection Facilities.

an O&M Contractor to operate and maintain the PV-Wind Plant.

The appointment of any Construction Contractor, O&M Contractor or other third-party contractor shall not relieve the Seller of any of its obligations or potential liability regarding designing, constructing, insuring, installing or Commissioning, operating or maintaining the PV-Wind Plant and Interconnection Facilities or any liability whatsoever resulting from a breach of any term or condition of this Agreement.

General undertakings of the Parties

Mutual undertakings of the Parties – general

Each Party undertakes that it shall:

comply in all material respects with all Laws of [country of sale], Industry Documents and Consents, in each case, to the extent that such Laws of [country of sale], Industry Documents and Consents are applicable to the Project or each Party's respective rights and obligations;

use all reasonable endeavours to hold and maintain in good order and validity, and renew and comply with, all Consents required for the performance of its respective obligations under this Agreement and the Related Agreements; and

Mutual undertakings of the Parties

The Seller shall provide the Purchaser with access to its property at reasonable hours, and upon reasonable notice, for any reasonable purpose in connection with the performance of the obligations imposed on a Party by this Agreement and the Related Agreements, the Laws of [country of sale] or the Industry Documents.

Undertakings of the Seller

The Seller, unless otherwise stated herein shall not:

stop or suspend deliveries of electrical energy to the Delivery Point; or

sell or deliver electrical energy generated by the PV-Wind Plant to any person other than the Purchaser (net of any on-site consumption by the PV-Wind Plant or for any ancillary purpose).

Insurance undertakings

The Seller shall, at its own cost and expense, take out and maintain:

on and from the Effective Date until the Commercial Operations Date, construction phase insurances;

on and from the Commercial Operations Date, operating phase insurances; and

such other insurance cover as is customary, desirable, and consistent with Prudent Utility Practice and the Laws of [country of sale]in respect of the PV-Wind Plant

Where the Seller becomes aware that any insurance (or a term or condition of any insurance) is not available, it shall:

promptly (and in any event within seven (7) days) notify the Purchaser of the same and the steps it will take in order to mitigate such unavailability. The said mitigation shall be within the period of thirty (30) days;

upon the reasonable request of the Purchaser, approach the insurance market at reasonable intervals, but not less frequently than once a year, to determine whether the relevant circumstances have ceased to apply and shall keep the Purchaser fully informed of such approaches.

The Seller shall, on an annual basis, provide to the Purchaser copies of insurance policies effecting the insurances required to be taken out and maintained by the Seller under Clause 0. The Purchaser may request (no more frequently than annually) the Seller to provide proof that all relevant premiums have been paid and that the relevant policy or policies remain in existence.

The Seller shall apply all proceeds of any insurance claim made due to loss or damage to the PV Plant or (prior to the Commercial Operations Date) and the Interconnection Facilities (other than claims under any loss of revenue policies) towards reinstatement, reconstruction, replacement, repair or renewal of such loss or damage, unless:

the Purchaser, acting reasonably, otherwise agrees; or

a Threshold Loss Event occurs.

The Seller shall be responsible for the payment of all deductibles in respect of the insurances provided pursuant to Clause 0.

Tax undertakings

Each Party shall be responsible for payment of all Taxes payable by that Party in accordance with tax laws in the [country of sale] as amended from time to time.

Compensation, payment and billing

Monthly Energy Payment Amount

The Purchaser shall pay to the Seller an amount in respect of the aggregate of the Metered Energy and Deemed Generated Energy in any Month, less deemed energy owed to the Purchaser, calculated as a product of:

the Energy Charges; and

the sum of the Metered Energy and Deemed Generated Energy, less deemed energy owed to the Purchaser, for the period during that Month during which the relevant Energy Charge applied in kWh,

and determined in accordance with Schedule 9 (Determination of payments) (such amount being the “Monthly Energy Payment Amount”).

The effective Energy Charge in the operating period, which shall be denominated in $USD and from the Effective Date, shall be US $cents “7.75”/kWh.

The Deemed energy charge shall be 100% of the operating Energy charge which is US $cents“7.75”/kWh.

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Monthly statement

On or after the first day of each Month, the Seller shall submit a monthly statement to the Purchaser stated in US Dollars for the following:

the Monthly Energy Payment Amount due in respect of the previous Month; plus

any value added tax chargeable in respect of the supply of the Energy and other services provided by the Seller to the Purchaser; plus

any adjustment amounts payable as a result of any inaccuracies in the Metering System pursuant to paragraph 0 of Schedule 4 (Metering requirements); plus

other than where the Purchaser has already made a payment, any disputed amounts withheld by the Purchaser but determined to be owing to the Seller; less

other than where the Seller has already made a payment in accordance with the disputed amounts, any disputed amounts previously paid by the Purchaser but determined not to be owed to the Seller; less

the amounts (if any) due from the Seller to the Purchaser from time to time in respect of the previous Month; plus, or less

any other amounts then due and payable by the Seller to the Purchaser or by the Purchaser to the Seller under this Agreement.

The monthly statement shall contain reasonably detailed calculations of the amounts payable under it, together with such further supporting documentation and information as the Parties may agree.

Invoicing, billing and payment

Payment from Collection Account. On or before the [first (1st)] Day of each Month following any Delivery Month, Buyer shall make a payment of a fixed sum according to the amount due as per Schedule A to Seller by way of a standing order from the Collection Account and such sum shall be applied in settlement of the Invoice in respect of such Delivery Month delivered in accordance with Clause 11 (Billing).

If the monthly statement delivered in accordance with Clause 0 (Monthly statement) shows that an amount is due from the Purchaser to the Seller, the Seller shall, together with the delivery of the monthly statement, submit an invoice for that amount to the Purchaser.

If the monthly statement delivered in accordance with Clause 0 (Monthly statement) shows that an amount is due from the Seller to the Purchaser, then the Purchaser shall submit an invoice for that amount to the Seller.

The relevant Party shall pay to the other Party the amount shown in the invoice as due on or before the Due Date.

Any invoice delivered pursuant to this Clause 11.3 shall be paid in US Dollars.

Subject to this Agreement, the payment of the net amount set out in the monthly statement shall be made without (and free and clear of any deduction for) set-off or counterclaim.

The Purchaser's obligation to pay any amount under this Agreement shall remain in full force and effect.

Payment Guarantee

Not more than one (1) month prior to the earlier to occur of the Target Commercial Operation Date or, if earlier, the commencement of the Early Operation Period, the purchaser shall procure at its own cost and expense the Payment Security, to be issued by an Acceptable Bank, which Payment Security shall be on terms satisfactory to the Seller and its Lenders and shall be held as security for the timely payment of all sums due hereunder to the Seller by the Buyer.

The Purchaser shall provide the payment security in the form of either a Standby Letter of Credit or Escrow Account. The Escrow account shall be supported by either a minimum balance or by assignment of receivables. The form of the said instruments shall be as set out in Schedule [●] (Form of Payment Security) attached hereto.

Indexation

The Energy Tariff shall be increased annually by 2% (two percent) with effect from the first anniversary of the project Commercial Operations Date. In making such calculation, the Energy Charge shall be rounded up to the nearest 0.01 of a cent.

Disputed payments

If the Purchaser disputes a monthly statement (in whole or in part), the Purchaser shall notify the Seller in writing of any disagreement with or exception to the calculation, including details of the monthly statement concerned, the amount in dispute and the basis for disputing the amount. The Purchaser shall continue to pay all undisputed portions of the monthly statement when due regardless of status of the amounts in dispute,

Where the Purchaser disputes a monthly statement pursuant, the Parties shall confer within twenty-one (21) days thereafter to resolve in good faith any such exceptions and disputes.

On the expiry of the twenty-one (21) day period, the matter shall be settled in accordance with Clause 18 (Dispute Resolution).

Upon settlement or determination of a Dispute, any amount paid but agreed or determined not to be owed to the Seller shall be repaid by the Seller within fourteen (14) days, in accordance with Clause 0.

REPRESENTATIONS AND WARRANTIES OF [PURCHASER]

[Purchaser] represents and warrants to Gigawatt Renewables that:

it is a validly existing legal entity under the laws of the [country of sale];

it is a limited company incorporated under the laws of the [country of sale] which has been in continuous existence since incorporation;

it has the full legal ability and authority to enter into and carry out its obligations under this Agreement, and this Agreement constitutes a valid, legally binding and enforceable obligation by [Purchaser];

all approvals necessary to allow [Purchaser] to enter into this Agreement and to carry out the transactions contemplated hereby have been given or received and remain in full force and effect;

there are no applicable constitutional provisions, laws, regulations, decrees or rules of the Government authorities of the [country of sale] in force on the date of execution of this Agreement or any provisions of any organisational document of [Purchaser] or of any agreement by which [Purchaser] is bound, which restrict or prohibit the ability of [Purchaser] to enter into and perform the terms of this Agreement; and

it has sufficient uncontracted transmission capacity and the necessary associated equipment to receive and transmit the electrical energy generated by GIGAWATT RENEWABLES up to the Contracted Capacity.

REPRESENTATIONS AND WARRANTIES OF GIGAWATT RENEWABLES

Gigawatt Renewables represents and warrants to [Purchaser] that:

it is a validly existing legal entity under the laws of the [country of sale], which is governed on the date of this Agreement by the laws of the [country of sale];

it has the full legal ability and authority to enter into and carry out its obligations under this Agreement, and this Agreement constitutes a valid, legally binding and enforceable obligation of Gigawatt Renewables;

there are no applicable constitutional provisions, laws, decrees or rules of the Governmental authorities of the [country of sale] in force on the date of this Agreement or any provisions of any organisational document of Gigawatt Renewables or of any agreement by which it is bound, which restrict or prohibit the ability of GIGAWATT RENEWABLES to enter into and perform the terms of this Agreement.

all approvals necessary to allow Gigawatt Renewables to enter into this Agreement and to carry out transactions contemplated hereunder have been given or received and remain in full force and effect; and

this Agreement does not conflict with any provisions of any law, including any regulation of the [country of sale] in effect on the date of execution of this Agreement.

COVENANTS

During the term of this Agreement, GIGAWATT RENEWABLES shall not sell to third Parties, without the consent of [Purchaser], the electrical power it shall supply to [Purchaser] pursuant to this Agreement PROVIDED that the foregoing limitation shall not apply to:

sales to contractors, or sub-contractors and, in general, to any entity or person which carries out works or activities on behalf of or provides services to GIGAWATT RENEWABLES at the time or other facilities owned by GIGAWATT RENEWABLES supplied via the Delivery Points.

DAMAGES AND LIMITATION OF LIABILITY

Except as otherwise provided herein, in the event of a breach by any Party of the terms and conditions of this Agreement, the non-breaching Party shall be entitled to submit a claim for damages to Arbitration in accordance with the provisions of Clause 19 of this Agreement. The claim for damages shall be limited to compensatory damages only and shall be limited to all reasonably foreseeable damages arising as direct result of such breach including, in the case of a breach by [Purchaser] any incremental costs reasonably incurred by GIGAWATT RENEWABLES in obtaining from third Parties or itself generating electrical power to replace that which [Purchaser] has failed to deliver in accordance with this Agreement, but shall not include any claim for profits or other consequential damages resulting there from.

Nothing contained in this section shall entitle a Party to claim or receive an award of punitive damages as a result of any ensuing breach.

[Purchaser]'s liability for any breach or series of related breaches of this Agreement which occur in any one year shall not exceed an amount equal to the total Energy Charges payable in the relevant Contract Year, such that if any such breach or series of related breaches are committed over a period exceeding one year from the date on which such or related breaches were first committed [Purchaser]'s limit of liability in respect of each year, commencing on the anniversary of the Effective Date in which such breach or related breaches are committed shall be such amount per year. For the avoidance of doubt, this limitation shall not apply to the Purchaser's obligation to pay undisputed invoiced amounts.

GIGAWATT RENEWABLES 's liability for any breach or series of related breaches of this Agreement which occur in any one year shall not exceed US$ 1,000,000.00 (Read as One Million United States Dollars), such that if any such breach or series of related breaches are committed over a period exceeding one year from the date on which such breach or related breaches were first committed GIGAWATT RENEWABLES 's limit of liability in respect of each year, commencing on the anniversary of the Effective Date, in which such breach or related breaches are committed shall be US$ 1,000,000.00 (Read as One Million United States Dollars), per year.

Liability for both Parties for breaches of contract based on common law other than of contents of this Agreement which occur in any one year shall in all cases not exceed US$1,000,000.00 (Read as One Million United States Dollars), provided such breach is brought to the attention of the defaulting Party and no remedy is found within 90 days thereof.

FORCE MAJEURE

Neither Party shall be liable to the other in respect of the non-performance of any of its obligations under this Agreement, or the operation of the Reticulation Infrastructure if it is prevented, hindered or delayed due to Force Majeure where and to the extent that such non-performance is the direct result of or has been directly caused by Force Majeure.

The Parties shall not be excused from paying any money that falls due before the occurrence of a Force Majeure event including without limitation, any obligation of [Purchaser] to pay the Power Tariff calculated in accordance with this Agreement.

Definition

Force Majeure means in relation to any event or circumstance or number of events or circumstances or any combination thereof, which:

is beyond the reasonable control of such Party (the 'Non-Performing Party');

could not have been avoided through the use of Prudent Utility Practice;

materially prevents, hinders or delays the Non-Performing Party in its performance of any of its obligations under this Agreement;

is without fault or negligence on the part of the Non-Performing Party; and

is not the direct or indirect result of a breach or failure by the Non-Performing Party to perform any of its obligations under this Agreement.

Inclusions and Exclusions

Subject to the foregoing, Force Majeure may include any of the following events or circumstances:

acts of terrorism;

war (whether declared or undeclared), threat of war, act of public enemy, blockade, revolution, riot, insurrection, public demonstration, civil commotion, invasion or armed conflict;

sabotage or acts of vandalism, criminal damage or the threat of such acts;

extreme weather or environmental conditions including lightning, earthquake, drought, partial drought, flood, wind, storm, fire, landslip, accumulation of snow or ice, natural disasters and phenomena including meteorites and volcanic eruptions or any other act of God or natural calamity;

the occurrence of pressure waves caused by aircraft or other aerial devices travelling at supersonic speeds, impact by aircraft, explosion including nuclear explosion, radioactive or chemical contamination or ionising radiation;

any strike, lock-out or other industrial action which is part of a labour dispute of a national character occurring in [country of sale] or which is part of a national electrical industry strike within [country of sale];

the outbreak and continuance of epidemic, famine or plague;

Provided that Force Majeure shall not include:

lack of funds and/or late payment of money;

ordinary wear and tear;

mechanical or electrical breakdown or failure of machinery or plant owned or operated by either Party; or

a strike, lock-out or any other industrial action not falling in Clause 16.4(f) above;

failure to comply with any applicable law, regulation, licence condition, approval or consent.

Obligations in Event of Force Majeure

If the Non-Performing Party is unable to carry out any or all of its obligations under this Agreement or the operation of the Reticulation Infrastructure is interrupted due to an event or circumstance of Force Majeure this Agreement shall remain in effect.

the Non-Performing Party's relevant affected obligations shall be suspended for a period equal to the duration of the event or circumstance of Force Majeure; and

the obligations of the other Party owed to the Non-Performing Party under this Agreement which the other Party is unable to carry out directly as a result of the suspension of the Non-Performing Party's obligations shall be suspended for a period equal to the event or circumstance of Force Majeure;

Provided that:

the suspension of performance is of no greater scope and of no longer duration than is required by the event or circumstance of Force Majeure;

no obligations of either Party that arose before the event or circumstance of Force Majeure causing the suspension of performance are excused as a result of the Force Majeure;

the Non-Performing Party gives the other Party notice within 48 hours describing the event or circumstance of Force Majeure, including the nature thereof and it's expected duration if possible, and continues to furnish regular reports with respect thereto during the period of Force Majeure. Similarly, the affected Party shall give the other Party notice within fourteen (14) days of the cessation of the event and restoration of normal conditions. The burden of proof of the existence and extent of the alleged event and the enforceability thereof shall rest on the Party claiming Force Majeure.

the Party receiving notice in terms of Clause 16.5(iii) shall within 7 (seven) days of receipt thereof notify the other Party of its acceptance or otherwise of the claim. If the claim is not accepted, the Parties shall be deemed to be in dispute, and the provisions of Clause 18 (Dispute Resolution) shall apply. If the party receiving the notice fails to respond within seven days, it shall be deemed to have accepted the notice of force majeure; and

The Non-Performing Party uses all reasonable efforts to prevent, avoid or mitigate the effects of the event or circumstance of Force Majeure on its ability to perform.

Continuing obligation to Make Payments

Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of [Purchaser] to make payments to GIGAWATT RENEWABLES under this Agreement to the extent that delivery has taken place.

INDUSTRY AGREEMENT, [country of sale's energy board/party]

The Parties agree to promote the agreement and execution of an Industry-wide Agreement which recognises the importance of co-ordination and management of the [country of sale]'s electricity

system, its interconnections within and outside [country of sale] and which co-ordinates any agreed refurbishment and development programme to be undertaken by either of the Parties.

The Parties acknowledge and accept the jurisdiction of the [relevant body] as stipulated in the [law] to regulate the operations and performance of entities that generate, transmit, distribute and supply electricity.

DISPUTE RESOLUTION

If any dispute arises relating to this Agreement or any claims for damages is made as the result of a breach of any obligation hereunder (including, but not limited to, any claims for damages arising under this Clause 18), the Parties shall use their best efforts to resolve such disputes through good faith negotiation.

Each Party shall designate executive management and/or other senior representatives to conduct such good faith negotiations. Any dispute or claim, as applicable, not resolved by such negotiation within 28 days of one Party notifying the other of the existence of the dispute shall be resolved by Arbitration as provided in Clause 19 of this Agreement by the service of either Party of the notice of intention to arbitrate referred to in Clause 19.1. While a dispute is continuing, both GIGAWATT RENEWABLES and [Purchaser] are required to continue to perform their respective obligations under this Agreement (including, without limitation with respect to each of the Parties, in the case of [Purchaser], the making of any payment due to GIGAWATT RENEWABLES and, in the case of GIGAWATT RENEWABLES, the tendering of electrical power to [Purchaser], other than, with respect to GIGAWATT RENEWABLES's obligation to tender electrical power, in circumstances specified in Clause 6 and 19 and, with respect to [Purchaser]'s obligations to make payments to GIGAWATT RENEWABLES, in circumstances specified in Clause 19, until such dispute has been fully and finally resolved).

ARBITRATION

If after 28 days, the Parties have failed to resolve their disagreement or dispute by such mutual consultation, then either Party may give notice to the other Party of its intention to commence arbitration, as hereinafter provided, as to the matter in dispute, and no obligation in respect of this matter may be commenced unless such notice is given. Any dispute or disagreement shall be finally settled by arbitration administered by the [relevant arbitration] in accordance with the [relevant arbitrator's Rules]. The decision of the Arbitrator shall be final and binding on the Parties. The Parties shall jointly appoint an Arbitrator. Should the Parties fail to appoint an Arbitrator within fourteen (14) days of notice requiring them to appoint the Arbitrator, the [relevant arbitration] shall appoint the Arbitrator. The seat shall be [arbitrator's city] and the venue shall be [arbitrator's city, country]. The language of arbitration shall be English.

Notwithstanding any reference to arbitration herein, the Parties shall continue to perform their respective obligations under the Agreement unless they otherwise agree.

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TERMS OF AGREEMENT

This Agreement shall come into full force and effect on the Effective Date.

Notwithstanding Clause 21, this Agreement shall remain valid for the period of 25 YEARS from COD.

This Agreement is subject to renewal for such other term as may be by mutual agreement of the Parties. The notice to renew shall be given by either Party in writing not later than 6 (six) calendar months prior to the commencement date of such a renewal period.

TERMINATION AND DEFAULT

GIGAWATT RENEWABLES may terminate this Agreement:

in the event of a material breach of terms and conditions hereof by [Purchaser], which breach is not cured within 180 days of notice of such breach having been delivered by GIGAWATT RENEWABLES to [Purchaser]; or

if GIGAWATT RENEWABLES cites a Force Majeure Event as the cause of its failure to supply power in accordance with this Agreement for twelve successive months and such failure is not rectified within Ninety (90) days of notice of intent to terminate having been delivered by GIGAWATT RENEWABLES to [Purchaser]; or

if any of the following events occur:

the appointment of a provisional liquidator in a proceeding for the winding up of [Purchaser] after notice to [Purchaser] and due hearing, which appointment has not been set aside or stayed within ninety (90) days of such appointment; or

save where such resolution or order is made for the purpose of amalgamation or reconstruction, the passing of a resolution by the shareholders of [Purchaser] for the winding up of [Purchaser] or the making by the court of an order winding up [Purchaser].

If GIGAWATT RENEWABLES, for Six (6) consecutive months' supplies power which is less than 50% of the declared demand in the latest Schedule (A) delivered by [Purchaser] in accordance with this Agreement.

[Purchaser] may terminate this Agreement:

in the event of a material breach of the terms and conditions hereof by GIGAWATT RENEWABLES, which breach:

is not cured within 180 days of notice of such breach having been delivered by [Purchaser] to GIGAWATT RENEWABLES; and

causes [Purchaser] to suffer loss which cannot be or has not been reasonably compensated for by damages payable hereunder;

if [Purchaser]'s Maximum Demand should fall below:

50% of the declared kVA in Schedule B in six (6) successive months and, in each such month, or

If [Purchaser] has cited a Force Majeure Event as the cause of such reduced level of demand for six consecutive months and such Force Majeure does not end or is not rectified within a period of ninety calendar days (90) after [Purchaser] gives Notice to Terminate the Agreement;

(d) if any of the following events occur:

the appointment of a provisional liquidator in a proceeding for the winding up of [Purchaser] after notice to [Purchaser] and due hearing, which appointment has not been set aside or stayed within ninety (90) days of such appointment; or

save where such resolution or order is made for the purpose of amalgamation or reconstruction the passing of a resolution by the shareholders of GIGAWATT RENEWABLES for the winding up of GIGAWATT RENEWABLES or the making by the court of an order winding GIGAWATT RENEWABLES.

Any termination of this Agreement shall be without prejudice to accrued rights and obligations hereunder and, in particular, to any rights to damages pursuant to Clause 15, nor shall it affect any Arbitration previously instigated pursuant to Clause 19.

Seller Events of Default

Unless caused by a Force Majeure, each of the following events shall be a “Seller Event of Default” which, if not remedied within the time permitted in this Clause 21.4 shall give rise to the right on the part of the Purchaser to terminate this Agreement:

Completion

The failure by the Seller to achieve the Minimum Acceptance Capacity by the Longstop Commercial Operations Date.

Abandonment

Abandonment occurs for a continuous period of thirty (30) days or for non-continuous periods of greater than seven (7) days which together subsist for a cumulative period of 30 days over the course of any fifty-two (52) week period.

Material breach

The occurrence of any of the following events:

a failure by the Seller to supply power at the Delivery Point as provided for under this Agreement for more than eighteen (18) sun hours, which failure is not remedied within fourteen (14) days;

a failure by the Seller to pay any undisputed amount due and outstanding to the Purchaser under this Agreement within forty-five (45) days following notice from the Purchaser stating that such payment is overdue;

a failure by the Seller to comply with the Laws of [country of sale], Grid Code or Consents which (a) could materially and adversely affect its ability to perform under this Agreement, and which is not remedied within three (3) months;

a failure by the Seller to comply with the insurance undertakings in Clause 0 (Insurance undertakings), which failure is not remedied within seven (7) days following notice from the Purchaser requiring such failure to be remedied;

a transfer or assignment of this Agreement by the Seller to a third party, except where such transfer or assignment is affected in accordance with Clause 22 (Assignment); or

the Seller sells or delivers electrical energy generated by the PV Plant to third parties in breach of this Agreement, which failure is not remedied within fourteen (14) days.

Purchaser Events of Default

Each of the following shall be "Purchaser Event of Default" which, if not remedied within the time permitted shall give rise to the right on the part of the Seller to terminate this Agreement:

Material breach

The occurrence of any of the following events:

a failure by the Purchaser to pay any undisputed amount due and outstanding to the Seller under this Agreement within 30 (thirty) days following notice from the Seller stating that such payment is overdue;

a failure by the Purchaser to comply with the Laws of [country of sale], Grid Code or Consents which (a) could materially and adversely affect its ability to perform under this Agreement, and which is not remedied within three (3) months;

a transfer or assignment of this Agreement by the Purchaser to a third party, except where such transfer or assignment is affected in accordance with Clause 22 (Assignment).

Insolvency

The occurrence of any of the following events:

the passing of a resolution by the shareholders of the Purchaser for the dissolution or winding up of the Purchaser;

the voluntary filing by the Purchaser of a petition of bankruptcy, moratorium on debt payments or other similar relief;

the Purchaser makes an assignment for the benefit of its creditors;

the appointment of a receiver or trustee over the whole or any part of the assets of the Purchaser which is not vacated within one hundred eighty (180) days of such appointment;

the appointment of a liquidator in proceedings for the winding up of the Purchaser, after notice to the Purchaser and due hearing, which appointment has not been set aside or stayed within one hundred and eighty (180) days of the appointment; or

the making by a court with jurisdiction over the Purchaser of an order of winding up the Purchaser, that is not stayed or reversed by a court of competent jurisdiction within one hundred and eighty (180) days.

Termination procedure on Events of Default

If any Event of Default occurs and is continuing, the non-defaulting Party may deliver a notice ("Notice of Intent to Terminate") to the defaulting Party, which notice shall specify in reasonable detail the Event of Default giving rise to the Notice of Intent to Terminate and a cure period during which such Event of Default should be remedied. Such cure period, unless resulting from the failure to pay money when due, shall be not less than forty-five (45) days from the date on which the Event of Default first occurred and has not been remedied.

Subject to Clause **Error! Reference source not found.**, in the event that the defaulting Party has not, following its receipt of a Notice of Intent to Terminate, remedied such Event of Default before the expiry of the cure period, the non-defaulting Party may terminate this Agreement by delivering a notice of termination to the defaulting Party. This Agreement shall terminate on the date that notice is delivered to the defaulting Party.

A Party may not issue a notice of termination unless it has complied with the applicable termination procedure set out in this Clause.

Obligations upon termination

Except as provided in Clause 21.5 on the expiration or termination of this Agreement, the Parties shall have no further obligations or liabilities hereunder except for the Surviving Provisions.

Termination for Convenience:

The Purchaser may, upon giving twelve (12) months' written notice, terminate this Agreement for convenience, provided that upon any such termination the Purchaser shall pay to the Seller a termination compensation equal to the present value of the remaining Energy Charges for the unexpired Term, calculated using a discount rate to be agreed between the Parties, together with any outstanding amounts due to the Seller. Termination of this Agreement shall be without prejudice to accrued rights and obligations in terms of this Agreement.

Other remedies

The termination of this Agreement shall be without limitation of or prejudice to any other relief, remedy or antecedent right or obligation of either Party under or in connection with this Agreement. Save as expressly indicated, remedies are cumulative, and the exercise of, or failure to exercise, one or more remedy by a Party shall not limit or preclude the exercise of, or constitute a waiver of, other remedies by such Party.

Replacement Off-taker(s)

The Parties agree that they shall, at any time during the Term, at the instigation of either Party, undertake discussions on a good faith basis to determine if an alternative offtake arrangement, including any trading arrangements via the SAPP, can be put into place on terms that are acceptable to each of the Parties.

Without prejudice to the Seller's right to terminate this Agreement in accordance with Clauses 21.1 and 21.5.3, the Seller may, following a Buyer Event of Default, at its sole option, enter into separate power purchase agreement(s) with alternative off taker(s) for part or all of the Energy produced by this Plant and in such case:

the Parties shall, acting reasonably, enter into discussions to agree any amendments to this Agreement in order to give effect to such separate power purchase agreement(s); and

The Buyer shall, if required, grant the necessary rights to the Seller to: (i) allow the Plant to remain connected to the Grid; (ii) access the Grid and (iii) wheel such electricity through Grid.

Consequential loss

Without prejudice (and subject) to the payments expressly provided for in this Agreement, including Clause 0 (Operation, maintenance and annual PV Plant Performance Ratio), no Party shall be liable to the other Party under this Agreement in respect of any loss of opportunity, loss of profit, loss of revenue, loss of use, loss of contract or loss or diminution of goodwill, any indirect or consequential loss or any punitive damages.

Nothing in this Agreement shall exclude or limit the liability of either Party for death or personal injury to third parties, resulting directly from the negligence of the first-mentioned Party or any of its officers, directors, employees, Contractors and agents, and that Party shall indemnify and keep indemnified the other Party from and against any Claims which the other Party may suffer or incur by reason of any claim on account of death or personal injury or damage to property to the extent resulting from the negligence of the Parties or the negligence of any of its officers, directors, employees, Contractors or agents.

In the event that any Claims in relation to any death or personal injury, or damage to property, or any third-party Claims arise out of or result from the joint or concurrent negligence or the intentional conduct of both Parties, each Party shall be liable in proportion to its degree of negligence or fault.

The Parties shall make all reasonable endeavours to mitigate any losses they may suffer as a result of the breach of any of the other Party's material obligations under this Agreement.

ASSIGNMENT

This Agreement shall not be assigned (which, for the purposes of this Agreement shall mean a novation or transfer of rights and/or obligations hereunder) by any Party without the prior written consent of the other Party, such consent not to be unreasonably withheld. Notwithstanding the foregoing:

[Purchaser] shall not unreasonably withhold, delay or impose conditions on its consent to GIGAWATT RENEWABLES assignment of this Agreement to any enterprise or entity that will own or operate all or part of the Reticulation Infrastructure with respect to the part or all of the project;

[Purchaser] shall not unreasonably withhold, delay or impose conditions on its consent to any assignment to any person that provides financing to GIGAWATT RENEWABLES for the development, rehabilitation or expansion of the project and/or related facilities (or facilities which may be developed by GIGAWATT RENEWABLES in the same area);

GIGAWATT RENEWABLES shall not unreasonably withhold, delay or impose conditions on its consent to [Purchaser]'s assignment of this Agreement to any enterprise or entity that is its successor as the owner of the electricity transmission and distribution system;

GIGAWATT RENEWABLES shall not unreasonably withhold, delay or impose conditions on its consent to any assignment to any person that provides financing to [Purchaser] for the development, expansion or refurbishment of electrical generation, transmission or distribution systems within [country of sale];

Neither GIGAWATT RENEWABLES nor [Purchaser] respectively (and each shall procure that any assignee of its interest herein) shall enter into any agreement reasonably requested by any such assignee or by GIGAWATT RENEWABLES or by [Purchaser] in order to acknowledge and consent to such assignment and to provide for appropriate undertakings to be given by such assignee to discharge future obligations of the relevant assignor hereunder; and

Neither GIGAWATT RENEWABLES nor [Purchaser] shall withhold its consent to the granting by the other of any security over this Agreement in favour of any person who has provided finance to the other for the acquisition of its assets. Each Party will, upon request from the other, in good faith negotiate and enter into a direct agreement with the other Party's lenders on reasonable, market standard terms.

A refusal of consent by either Party shall be deemed unreasonable for the above purposes if it is not based on a reasonable concern as to the creditworthiness or technical capacity of the proposed assignee.

SUCCESSORS AND ASSIGNEES

This Agreement shall inure to the benefit of and shall be binding upon the Parties hereto and their respective successors and permitted assignees.

Deemed Generation

Subject to Clause 14.3, if the Seller is prevented from, or restricted in, delivering (or from Commissioning the PV Plant and commencing delivery of) Metered Energy then, due to the Purchaser's Default event other than a Force Majeure event, the Purchaser shall pay for the Deemed Generated Energy, calculated in accordance with Schedule 9 (Determination of Payments).

Notwithstanding Clause 24.1, no payment shall be made for Deemed Generated Energy accruing over the first seventy (70) hours equivalent in any Contract Year for which the Seller would, but for this Clause 24.2, be entitled to such payment.

The Purchaser shall only be obliged to pay for any Deemed Generated Energy included in any monthly statement submitted pursuant to Clause 11.2 (Monthly statement).

August 12, 2024, V37

Anti-Bribery, Corruption, Sanctions Representations and Public Audit

Anti-Bribery

Neither the Seller nor any of its respective subsidiaries or affiliates, nor any director, officer, agent, employee or other person associated with or acting on behalf of the Seller or any of its subsidiaries or affiliates, has

used any corporate funds for any unlawful contribution, gift, entertainment or other unlawful expense relating to any activity,

made any direct or indirect unlawful payment to any of the Purchaser's employee, director, officer, agent, employee or other person associated with or acting on behalf of the Purchaser or any public officer or any employee or official of the Government of the [country of sale],

violated or is in violation of any provision of the [Anti-Corruption act] [(Chapter x of the Laws of country of sale)] or any applicable law on combating bribery or any other similar law of any other jurisdiction in which the Seller operates its business, including, in each case, the rules and regulations thereunder,

taken, is currently taking or will take any action in furtherance of an offer, payment, gift or anything else of value, directly or indirectly, to any person while knowing that all or some portion of the money or value will be offered, given or promised to anyone to improperly influence official action, to obtain or retain business or otherwise to secure any improper advantage or,

otherwise made any bribe, rebate, payoff, influence payment, unlawful kickback or other unlawful payment; the Seller will continue to maintain, policies and procedures reasonably designed to promote and achieve compliance with the laws referred to in (iii) above and with this representation and warranty; and none of the Seller's officers or servants or agents or other person associated with the Seller will directly or indirectly use the proceeds of this Agreement, to contribute or otherwise make available such proceeds to any person or entity for the purpose of financing or facilitating any activity that would violate the laws and regulations referred to in (iii) above.

Money Laundering

The operations of the Seller are and have been conducted at all times in compliance with all applicable financial record keeping and reporting requirements, anti-terrorist financing legislation and money laundering statutes of all applicable jurisdictions and any related or similar rules, regulations or guidelines issued, administered or enforced by any governmental agency (collectively, "Money Laundering Laws"); the Seller has in place policies and procedures reasonably designed to ensure that its and its subsidiaries operations will continue to be conducted in compliance with all applicable Money Laundering Laws and no action, suit or proceeding by or before any court or governmental agency, authority or body or any arbitrator involving the Seller or any of its respective subsidiaries with respect to Money Laundering Laws is pending or, to the best knowledge of the Seller threatened.

Confidentiality

Restriction

Subject to the exceptions provided in Clause 26.2 (Exceptions), each Party shall treat as strictly confidential and not disclose or use (other than solely for the purposes of the Project) any information or data disclosed to it by the other Party in connection with this Agreement and any Related Agreement or this Agreement and any Related Agreement itself (the "Confidential Information") from the date of this Agreement until three years following the termination of this Agreement.

For the purposes of this Clause 26, the term "Confidential Information" shall not include information which:

at the time of disclosure or at any time thereafter is in, or becomes part of, the public domain otherwise than as a result of a breach of this Clause 26;

is required by law or appropriate regulatory/constitutional authority to be disclosed to any person who is authorised by law to receive the same;

the Party receiving the information can prove was already known to it, or was independently acquired or developed by it without being in breach of its obligations under this Clause 26;

was or is obtained from a third party who is free to divulge the same and which was or is not obtained under any obligation of confidentiality; or

is independently developed by the receiving party.

Exceptions

Clause 26.1 (Restriction) shall not prohibit disclosure or use of any Confidential Information if and to the extent that:

the other Party has given prior written approval to the disclosure or use;

the disclosure or use is required for the purpose of any judicial or arbitral proceedings arising out of this Agreement or any Related Agreement;

the disclosure is made to any professional advisors, Governmental Authority, shareholders (direct or indirect), agents, consultants, contractors, potential transferees or purchasers of the interests of a shareholder (direct or indirect), insurers, any Lenders, actual or potential financiers of either Party or one of its affiliates or any of their advisors on terms that such recipients undertake to comply with the provisions of this Clause 26 in respect of the Confidential Information as if they were a party to this Agreement; or

the disclosure is required by law, any governmental or regulatory body or any recognised exchange upon which the share capital of the Party or any affiliate of the Party making the disclosure is proposed to be, from time to time, listed or dealt in.

The Parties acknowledge and agree that their confidential obligations and undertakings under this Agreement shall continue and in particular they shall survive the performance, expiration or termination of this Agreement.

Notices

Writing and delivery

Except for day-to-day operational communications, any notice or other communication in connection with this Agreement (each, a "Notice") shall be in writing, in English and delivered by email and by hand or courier using a recognised courier company to the following address:

If to [Purchaser] [address] Telephone: Email: Attention:	If to GIGAWATT RENEWABLES LIMITED; at [address in country of sale] Telephone: "+260 977 721 969 & +972 544844391" Email: weldon.turner@gigawattglobal.com emmanuel@gigawattglobal.com Attention: Chief Operating Officer

Time of receipt

A Notice shall be effective upon receipt and, for these purposes, shall be deemed to have been received:

at the time of delivery, if delivered by hand or courier and dully acknowledged; or

at the time of transmission in legible form, if delivered by email and dully acknowledged.

AMENDMENT AND VARIATION

Any amendment of the terms and conditions of this Agreement, including any modification or variation of the scope of the Agreement, may only be made by written agreement between the Parties. Any such written amendment or addendum shall be attached to this Agreement and shall be effective as of the date specified therein. The terms and conditions of this Agreement shall remain in full force and effect, except as specifically amended by the addendum.

Where a variation results in a change in price, any additional funds shall be committed before issue of the variation, unless such funds are already provided by any committed amount for contingencies for similar matters.

A Party seeking an amendment to this Agreement, other than to the Schedules set out in Clause 3, shall notify the other Party, giving 30 (thirty) days or shorter period as may be agreed by both Parties notice of its intention to amend the Agreement, the nature of the amendment being sought and the date, time and venue in [country of sale] of the meeting to discuss the amendment.

All addenda, amendments, or modifications to this Agreement shall be binding upon and inure to the benefit of the Parties hereto and their respective successors and permitted assigns.

Except as specifically modified or amended by any addendum, all terms and conditions of this Agreement shall continue in full force and effect and shall be applicable to any addendum executed in accordance with this clause.

For [Purchaser], an amendment shall only take effect upon seeking the legal advice of the Attorney General.

ENTIRE AGREEMENT

All of the present agreements and understandings between the Parties are embodied in this Agreement which supersedes all prior agreements and undertakings, oral or written, between the Parties with respect to the supply of electrical power to [Purchaser] by GIGAWATT RENEWABLES LIMITED.

This Agreement expressly excludes any warranty, condition or other undertaking implied at law or by custom or otherwise arising out of any other agreement between the Parties or any representation not contained in a binding written legal agreement entered into by the Parties. Each Party acknowledges and confirms that it does not enter into this Agreement in reliance on any warranty, condition, undertaking, agreement or representation so excluded.

GOVERNING LAW

This Agreement shall be governed and construed in accordance with the laws of the [country of sale].

COUNTERPARTS

This Agreement may be executed in any number of counterparts, each of which when so executed and delivered shall be a duplicate original and all the counterparts shall together constitute a single Agreement.

Public Audit

The Auditor General or public officer, agent, or specialist consultant authorized by him, shall have access to and shall exam all books, records and other documents relating to the utilization of funds under this agreement pursuant to the Public Audit Act number 29 of 2016 (as may be amended from time to time).

WAIVER

No delay or forbearance by any Party in exercising any right, power or remedy under this Agreement shall imply or be construed as a waiver of such right, power or remedy. Any waiver by one Party of the obligations of another Party under this Agreement shall be in writing, signed by the Party giving the waiver and shall not affect obligations of any Party not specified in such waiver. Any single or partial

exercise of any such right, power or remedy shall not preclude other or further exercise thereof or the exercise of any other right, power or remedy.

SURVIVAL

The performance, expiration or termination of this Agreement for any reasons shall not release either Party from any outstanding liabilities or obligations which remain to be performed set forth in this Agreement or which by their nature would be intended to be applicable following any such performance, expiration or termination.

PARTIAL INVALIDITY

The illegality, invalidity or unenforceability to any extent of any provision of this Agreement under the law of any jurisdiction shall not affect its legality, validity, or enforceability in such jurisdiction to such extent only and shall not affect its legality, validity or enforceability under the law of any other jurisdiction, nor the legality, validity or enforceability of any other provision.

TIME OF THE ESSENCE

Time shall be of the essence in this Agreement; both as regards the dates and periods mentioned and as regards any dates and periods which may be substituted for them in accordance with this Agreement.

NO JOINT VENTURE OR PARTNERSHIP

Nothing in this Agreement shall create nor be construed to create a Partnership or Joint Venture between the parties hereto save as expressly provided in this Agreement. Neither Party shall enter into nor have authority to enter into any engagement or make any representation or warranty on behalf of or pledge the credit of or otherwise bind or oblige the other party hereto.

CORPORATE AUTHORITY AND STANDING

[Purchaser] has full power and authority to enter into and perform this Agreement and this Agreement when executed will form a valid and binding obligation in accordance with its terms.

Gigawatt renewables is a corporation in good standing duly organised and validly existing under the Laws of [country of sale] and has all corporate power and legal authority to carry on business as now being conducted.

RELATIONSHIP BETWEEN THE PARTIES

Nothing in this Agreement shall constitute or be deemed to constitute a partnership between the Parties or confer on any Party any authority to bind the other or to contract in the name of the other or to incur any liability or obligation on behalf of the other or make or deem to be the agent of the other in any way.

SEVERABILITY

If any provision or condition of the Agreement is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provision of the Agreement.

FURTHER ASSURANCE

Each Party shall afford to the other Party such co-operation, and shall execute such documents, at the request and cost of that Party, as shall reasonably be required in order to give the Party making the request the full benefits of the rights, powers and obligations under the terms of this Agreement.

GOVERNING LANGUAGE

The language, which governs the interpretation of this Agreement, shall be the English language. All notices required to be given by either Party and all other communications and documentation which are in any way relevant to this Agreement or the performance or termination of this Agreement, including but limited to any dispute resolution proceedings, shall be in English language.

JOINT VENTURE OR CONSORTIUM

If a Party is a joint venture or Consortium, all of the parties shall be jointly and severally liable to the other for the fulfilment of the provisions of the Agreement and shall designate one party to act as a leader with authority to bind the joint venture or consortium. The composition or the constitution of the joint venture or consortium shall not be altered without the prior consent of the Party

IN WITNESS WHEREOF the Parties have duly executed this Agreement and affixed their common seals, the day and the year first above written.

For and on behalf of [Purchaser]:

[signer]

Name: _____

Signature: _____

Witnessed by:

Name: _____

Signature: _____

For and on behalf of “GIGAWATT RENEWABLES LIMITED”

Chief Executive Officer

Name: _____

Signature: _____

Witnessed by:

August 12, 2024, V37

Name: _____

Signature: _____

Schedule 1 - Seller Specific Information

A secure boundary fence along the full perimeter of the site with a security gate house at each site entrance should be provided. The installation shall have a gatehouse, area lighting, electrically operated sliding gates and road barriers.

The perimeter fence shall be galvanized chain link with galvanized steel pipe poles with a minimum height of 2.5 metres. The top of the fence shall be installed with barbed wire with a minimum height of 0.5 metres.

Internal fences for the security of any particular installations within the site shall be erected complete with gates.

All fencing, gates, doors, and other similar metallic components should be adequately connected to the earthing system.

Drainage

A drainage system should be designed and executed in order to protect the Project from flash floods and erosion. The design should be based on the ambient conditions at the Site (climatic and topographical) and the adequacy of drainage for floods should be verified by the correct return period

of peak floods in accordance with the hydrology studies. The design shall include segregated drainage systems for the following:

Surface water run-off;

Oily water; and

Domestic and sanitary waste (sewage).

All drains and liquids discharged from the Project shall be disposed of in a manner in accordance with applicable environmental regulation, including any environmental and social impact assessment for the Project (ESIA).

Roads

Save as specified in the Project Documents, all works related to access and internal roads are the responsibility of the Seller. A traffic management plan should be developed and implemented in accordance with the ESIA.

Access roads should be adequate and suitable for the construction and operational phases of the Project and should be designed in consultation with the relevant authorities.

Internal roads should be adequate and suitable for the operational phase of the Project. All such roads should either allow vehicles to drive in a loop without having to reverse or with suitable distance to prevent any possible damage to modules and other structures.

The roads shall be designed such that the rainwater flows to the longitudinal and/or transversal slope of the roads and is disposed of via the drainage system. A drainage ditch shall be included for all roads.

Site Surveillance

Outdoor CCTV cameras shall be provided in order to monitor the whole plant perimeter without dead areas. CCTV cameras shall also be provided at each inverter house and substation. The output of the cameras shall be available on LCD/LED monitor installed in the control room. Recordings shall be securely stored and remain accessible for a minimum of 3 months.

Housing of cameras used for indoor installation shall be of IP 55 whereas outdoor camera housing shall be of IP 66 or equivalent. It should also be protected against lightning.

Site Lighting

The primary purpose of lighting is for security (as a deterrent and for security guard patrols). The secondary purpose is to facilitate night-time maintenance of the PV modules when they are not generating. All lighting should be of the column-mounted type controlled via a photoelectric cell with manual override switch. The lighting system shall be designed in order to minimise the shadow cast over the PV modules and to minimise the potential for solar generation at night-time.

All lighting shall utilise low loss control gear. Switches must be provided as necessary.

Lighting requirements of EN 12464 shall be followed.

Annex A: Applicable Norms & Standards

The list/table of standards below is not an exhaustive list and it will remain the responsibility of the Seller to ensure that the Project complies with this Agreement and the Related Agreements, together with the Laws of [country of sale], Industry Documents and applicable international standards and codes of practice, as might be used in accordance with Prudent Utility Practice.

All critical equipment shall be designed and manufactured under a quality assurance program in accordance with the latest ISO 9001. This requirement applies to all suppliers and subcontractors involved in the manufacture and installation of equipment.

In the case of a conflict between standards and/or codes, the more onerous shall apply.

A consistent set of standards shall be used for the design of all equipment and structures (i.e. American or British Standard to be used consistently for the design of concrete structures). In addition, the latest version of all applicable standards should be used.

ally agreed upon by the Parties;

the Seller shall have the right to witness any such reading;

if a Seller representative is present at such reading, then such reading shall be jointly taken and recorded;

if a Seller representative is not present at such reading, then the Purchaser representative shall take and record such reading and make a photographic record thereof;

the Purchaser shall maintain a log of all such meter readings; and

the cumulative recorded measurements for the relevant period shall be delivered by the Purchaser to the Seller within five days of the readings being taken.

If, in any test carried out pursuant to this Schedule 4, the Main Meter is found to be less accurate than the level specified in paragraph **Error! Reference source not found.** (Specifications of Metering System) or is otherwise unavailable or functioning improperly, then, subject to paragraph 0, the correct amount of Energy delivered to the Purchaser for the actual period during which inaccurate measurements were made, if any, will be determined as follows, in the stated order:

the readings of the Check Meter will be used to determine the Metered Energy delivered to the Purchaser for the relevant period, unless the Check Meter is found to be less accurate than the level specified in paragraph **Error! Reference source not found.** (Specifications of Metering System) or is otherwise unavailable or functioning improperly;

the Seller and Purchaser shall jointly prepare an estimate of the correct reading on the basis of all available information, including the telemetered data, and such guidelines as may have been agreed to between the Seller and the Purchaser; and

if the Purchaser and the Seller fail to agree upon an estimate for the correct reading, the Independent Engineer shall determine the amount and its decision shall be final and binding on both Parties in absence of fraud or manifest error.

If the period of inaccuracy cannot be accurately determined, it will be deemed to have begun on the date which is midway between the date a Main Meter was found to be inaccurate and the date of the last meter reading accepted by the Parties as accurate, provided however that such period shall not exceed three Months. In no event, however, will any such adjustment be made for any period prior to the date on which that Main Meter was last tested and found to be accurate within the level specified in paragraph **Error! Reference source not found.** (Specifications of Metering System) and not otherwise functioning improperly.

The difference between the previous payments by the Purchaser for the period of inaccuracy and the recalculated amount will be offset against or added to the next payment to the Seller under this Agreement, as appropriate.

Sealing of Metering System

After completion of each test of the Metering System, the Metering System will be jointly sealed by the Parties or, in respect of the Main Meter, if the Seller is not present, by the Purchaser and, in respect of the Check Meter, if the Purchaser is not present, by the Seller.

The seal on the Main Meter will be broken only by the Purchaser's personnel acting in accordance with the terms of this Agreement. The Purchaser will give the Seller at least five days' advance notice before the seal on the Main Meter is broken. The notice will specify the time at which a meter seal will be broken by the Purchaser's personnel, and the Seller will be given the opportunity to be present when such seal is broken.

The seal on the Check Meter will be broken only by the Seller's personnel acting in accordance with the terms of this Agreement. The Seller will give the Purchaser at least five days' advance notice before the seal on the Check Meter is broken. The notice will specify the time at which a meter seal will be broken by the Seller's personnel, and the Purchaser will be given the opportunity to be present when the seal is broken.

Schedule 5

Commissioning of PV Plant and PV Plant Performance Ratio testing

General

The PPA Commissioning Tests in respect of the PV Plant comprise (i) the Mechanical Completion Test described in paragraph 0 (Mechanical Completion Test), (ii) the Functional Tests described in paragraph 0 (Functional Tests) and (iii) the Performance Test described in paragraph 0 (Performance Test).

The PPA Commissioning Tests will be performed to ensure that the PV Plant will perform in conformance with the requirements specified in Schedule 3 (PV Plant – Minimum functional specifications and standards) and Schedule 7 (Technical Limits). Only after successful completion of these tests will the PV Plant be considered to be successfully Commissioned.

All tests shall comply with the requirements of the standards or codes, including the Grid Code and the norm IEC 62446.

During all PPA Commissioning Tests, the Seller's start-up and operating personnel will be present and will be responsible for the operation of the units.

If the PV Plant fails to achieve the requirements of any test described in this Schedule 6, the Seller shall have the opportunity to remedy such failures, and repeat tests shall be carried out.

The Seller shall provide a report to the Purchaser certifying that the PPA Commissioning Tests have been successfully completed. The report shall include the results of tests conducted.

Review of test procedures

The Seller shall, within 60 days prior to the date that it proposes to commence the first PPA Commissioning Tests, submit the test procedures to the Purchaser and the Independent Engineer for approval, such approval not to be unreasonably withheld or delayed, and will be deemed given unless the Purchaser and the Independent Engineer presents to the Seller its objections in writing within 30 days of submission of the test procedures.

Where the Seller purposes to Commission the PV Plant in Phases, the test procedures shall clearly identify the Phases, the proposed testing programme and which of the PPA Commissioning Tests are to be repeated on a whole PV Plant basis.

Witnessing of PPA Commissioning Tests

The Seller shall give the Purchaser and the Independent Engineer no less than 30 days' prior written notice of the anticipated date for the start of Commissioning. The Seller shall notify the Purchaser and the Independent Engineer as soon as reasonably practicable if the date on which it expects to start Commissioning subsequently changes.

The Purchaser and the Independent Engineer shall be permitted to have personnel at the Site, provided that such personnel abide by the rules set forth in the safety plan, general regulations and the Laws of

[country of sale], to observe and verify all procedures and tests performed by the Seller, its contractors and their sub-contractors or suppliers.

Mechanical Completion Test

The Mechanical Completion Test is the first test to be undertaken as part of the PPA Commissioning Tests in respect of the PV Plant. The Mechanical Completion Test is the standard procedure to verify that the PV Plant has been built according to the requirements of Schedule 3 (PV Plant – Minimum functional specifications and standards) and the Laws of [country of sale] and that there are no major technical shortcomings or visual defects.

Areas for inspection include:

Site infrastructure;

Security systems (i.e. fences, alarms);

Civil works;

Mounting structure;

PV modules;

Cabling;

Inverters;

Direct current distribution system;

Transformers;

Medium voltage system;

Power evacuation cable;

Monitoring system and meteorological system; and

Metering System.

The Independent Engineer shall determine whether the Mechanical Completion Test has been successfully completed in accordance with the procedures set out in Paragraph 4 (Mechanical Completion test) of this Agreement.

Functional Tests

The Functional Tests shall be performed after successful completion of the Mechanical Completion Test.

As a minimum the Functional Tests shall include the following:

PV array commissioning tests, according to IEC 62446, including at least:

Continuity of earthing tests;

Polarity test;

String open circuit voltage test;

String short circuit current test;

Insulation resistance of the DC circuits;

Inverter commissioning tests, as per the equipment manufacturers' commissioning procedures;

Tracking system (when applicable) commissioning test, as per the manufacturers' recommendations and procedures;

Low Voltage equipment test according to IEC 62446-6 and IEC 62446-7;

Medium Voltage (MV) equipment, including at least:

MV transformers according to IEC 60076 and IEC 60726;

MV switching equipment for protection of feeders and transformers according to IEC 60298;

Uninterruptible Power System, according to IEC 60086;

Instrumentation and Control equipment, as per manufacturer's guidelines, including at least:

SCADA System;

Metering equipment;

Meteorological station; and

Grid Code compliance tests including:

Reactive power capability; and

Type testing.

The Independent Engineer shall determine whether the Functional Test has been successfully completed in accordance with the procedures set out in the Independent Engineer Agreement.

Performance Test

The Seller shall provide confirmation together with supporting evidence to the Independent Engineer of the completion of the Mechanical Completion Test and the Functional Test at least ten days prior to the proposed commencement of the Performance Test. The Independent Engineer may, within five days of receipt of such confirmation, request from the Seller any additional information it considers necessary to determine whether the Mechanical Completion Test and Functional Tests have been successfully completed.

The Performance Test shall be carried out after successful completion of the Mechanical Completion Test set out in paragraph 0 (Mechanical Completion Test) and all the Functional Tests of main equipment set out in paragraph 0 (Functional Tests).

The objective of this test is to prove that the PV Plant is able to produce energy continuously and with the PV Plant Performance Ratio of at least 75% of the monthly Estimated PV Plant Performance Ratio corrected for temperature.

The Performance Test shall have a 10 days' duration accounting for the following criteria:

the daily total irradiation on the plane of the array shall be at least 4.75kWh/m²;

in case the minimum daily irradiation is not achieved the test will be extended accordingly by the relevant number of days until 10 days meet the minimum irradiation of 4.75 kWh/m²; and

availability of the PV Plant and the grid shall be 100 per cent. In the event of unavailability, the testing period will be extended accordingly by the relevant number of days (or fraction of a day).

In the event the test is suspended for more than five (5) times during the testing period, the Performance Test shall be restarted.

The PV Plant Performance Ratio shall be calculated on the basis of operating data recorded by the SCADA and metering Systems

The Performance Test will be considered successful if the PV Plant has achieved a PV Plant Performance Ratio of at least 75% of the monthly Estimated PV Plant Performance Ratio for the relevant month of testing, corrected for temperature. If the testing period overlaps two Months, then the Estimated PV Plant Performance Ratio will be derived based on a weighted average of the estimated value for each Month.

Compliance with Technical Limits

During the duration of the Performance Test, all the relevant parameters defined in Schedule 7 (Technical Limits) will be measured in order to confirm that the PV Plant complies with the Technical Limits when operating under normal conditions.

Additionally, any other test prescribed in the Industry Documents with which the PV Plant must comply, as specified in Schedule 7 (Technical Limits), should be undertaken (i.e. tolerance to abnormal operating conditions and sudden voltage drops and peaks).

Calculation of the Achieved Capacity

After successful completion of the Performance Test, the Seller shall calculate the Achieved Capacity. This calculation shall take consideration and provide evidence of:

DC capacity in kW peak according to the Construction Contract which is the sum of PV modules' peak power as stated in the modules' labels and datasheets.

Installed DC capacity in kW peak resulting from the sum of the modules' flash test peak power. This must exceed the installed AC capacity.

Installed AC capacity, based on the sum of the inverters' maximum capacity in kW (when $\cos \phi = 1$)

Where PRSTC is the Performance Ratio at STC temperature conditions and shall be calculated according to the following formula (where all the terms have the same meaning as defined in paragraph 0 (Performance Test) of this Schedule 6):

Independent Engineer and Commercial Operations Date

Within ten days of completion of the Performance Test, the Independent Engineer shall send, to both Parties, a test report containing the test results and relevant analysis of the Performance Test and calculation of the Achieved Capacity. Such testing report, shall certify that:

the Performance Test has been completed successfully; and

the Achieved Capacity is as calculated by the Seller.

If the Independent Engineer determines that:

the Performance Test has not been completed successfully; or

subject to Clause 0, the Achieved Capacity is below the Contracted Capacity

it shall promptly notify the Parties. The Independent Engineer shall promptly take such steps as are necessary to remedy such failure and shall thereafter repeat the Performance Test.

The Commercial Operations Date (COD) of the PV Plant shall occur at 00:00 on the subsequent day following the certification that the Performance Test has been completed successfully

The Seller shall, prior to the month in which the COD is to occur, communicate to the Purchaser in writing to confirm the date on which the Commercial Operations Date.

Calculation of the PV Plant Performance Ratio following the Commercial Operations Date

The PV Plant Performance Ratio shall be calculated at the end of each Contract Year on the basis of operating data recorded by the SCADA and metering Systems for that year excluding intervals where:

the irradiance on the plane of the array is below 100W/m²; and

operation of the PV Plant is affected by any event or circumstance (or combination thereof) for which the Seller is entitled to relief in accordance with Clause 19.1.1 (Force Majeure Events).

The PV Plant Performance Ratio pursuant to Clause 0 (Operation, maintenance and annual PV Plant Performance Ratio) or calculating Deemed Generated Energy, shall be determined in accordance with the formula set out below (where all the terms have the same meaning as defined in paragraph 0 (Performance Test) of this Schedule 6):

$$PR_{meas} = \frac{\sum_j E_{meas,j}}{P_{nom} \cdot \sum_j \left(\frac{G_j}{G_{ref}} \cdot \left(1 - \frac{\beta}{100} \cdot (T_{mod} - T_{meas,j}) \right) \right)}$$

If the Parties disagree on the calculation of the PV Plant Performance Ratio, the matter shall be settled in accordance with the Dispute Resolution.

Schedule 6

Services of the Independent Engineer

Review of Commissioning procedures

The Independent Engineer shall review the Commissioning test procedures submitted by the Seller. Based on the conditions of the Power Purchase Agreement, the applicable test codes and standards, the manufacturers' recommendations and the accepted international industry practices, the Independent Engineer shall comment on the adequacy and appropriateness of the proposed test plans and procedures.

Performance Test witnessing

The Independent Engineer shall undertake a single visit to the Site for [x] days for the Commissioning of the PV Plant and each Phase, at the time of the Performance Test in order to:

Confirm mechanical completion by means of spot checks on the items listed in the Mechanical Completion Checklist and physical inspection of workmanship, connections and equipment;

Confirm that the Functional Tests have been passed satisfactorily; by means of discussions with the Seller, the Construction Contractor, and confirmation of the existence of testing documentation and other evidence observed on-site; and

Witness part of the Performance Test; to confirm that it is undertaken in accordance to the approved testing procedures and assess the adequacy of the data collected by the different measurement systems and by the SCADA System.

Where the Seller has elected to Commission the PV Plant in Phases, on the Commissioning of the final Phase the Independent Engineer shall be required to confirm, on a whole PV Plant basis, that the Functional Tests of any common parts of the PV Plant (such as transformers and instrumentation and control systems) have been passed satisfactorily.

PV Plant Completion Form

The Independent Engineer shall review the testing report and a complete set of recorded test data issued by the Seller upon the successful completion of the Performance Test, containing the test results and relevant analysis, in order to assess the validity of the performance testing. Within ten days after receiving such report and data, the Independent Engineer shall issue a certificate (the "PV Plant Completion Form") confirming that, based on the information provided by the Seller, and exercising the skill and care consistent with this Independent Engineer Agreement:

The Performance Test has been completed successfully; and

The Achieved Capacity is as calculated by the Seller.

Where the Seller has elected to Commission the PV Plant in Phases, on the Commissioning of the final Phase the final Performance Test shall be based on the whole PV Plant, from which the calculation of the Achieved Capacity and the PV Plant Performance Ratio of the PV Plant shall be derived.

Certification Services

Review of Commissioning procedures

The Independent Engineer shall review the Commissioning test procedures submitted by the Seller. Based on the conditions of the Power Purchase Agreement, the applicable test codes and standards, the manufacturers' recommendations and the accepted international industry practices, the Independent Engineer shall comment on the adequacy and appropriateness of the proposed test plans and procedures.

Performance Test witnessing

The Independent Engineer shall undertake a single visit to the Site for [●] days for the Commissioning of the PV Plant and each Phase, at the time of the Performance Test in order to:

Confirm mechanical completion by means of spot checks on the items listed in the Mechanical Completion Checklist and physical inspection of workmanship, connections and equipment;

Confirm that the Functional Tests have been passed satisfactorily; by means of discussions with the Seller, the Construction Contractor, and confirmation of the existence of testing documentation and other evidence observed on-site; and

Witness part of the Performance Test; to confirm that it is undertaken in accordance to the approved testing procedures and assess the adequacy of the data collected by the different measurement systems and by the SCADA System.

Where the Seller has elected to Commission the PV Plant in Phases, on the Commissioning of the final Phase the Independent Engineer shall be required to confirm, on a whole PV Plant basis, that the Functional Tests of any common parts of the PV Plant (such as transformers and instrumentation and control systems) have been passed satisfactorily.

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the Performance Test has been completed successfully; and

the Achieved Capacity is as calculated by the Seller.

Where the Seller has elected to Commission the PV Plant in Phases, on the Commissioning of the final Phase the final Performance Test shall be based on the whole PV Plant, from which the calculation of the Achieved Capacity and the PV Plant Performance Ratio of the PV Plant shall be derived.

Schedule 7

Technical Limits

Introduction

This Schedule contains a set of technical limits with which the PV Plant must comply.

Normal Operating Conditions

The system voltage at the point of connection to the Grid System under normal condition can vary between 62.7kV and 69.3kV (+/- 5%) and the PV Plant should remain connected at all times with no technical limitations within these voltage limits. For voltages outside these limits refer to paragraph 0 below.

The system frequency range under normal conditions is defined as 50Hz ± 0.15Hz

Abnormal Conditions

The system frequency range under fault conditions can vary between 47.5Hz and 52.5Hz and the PV Plant must remain connected to the system with no technical limitations

Under extreme system conditions the PV Plant is expected to disconnect from the system if the voltage condition at the point of connection is:

Less than (-20% of nominal voltage) for more than 1.5 seconds, or;

Less than (-10% of nominal voltage) for more than 180 seconds, or;

Higher than (+20% of nominal voltage) for more than 1.5 seconds, or;

Higher than (+10% of nominal voltage) for more than 60 seconds.

It should be noted at all other voltage levels the PV Plant is expected to remain connected to the system.

Under extreme system conditions the PV Plant is expected to disconnect from the system if:

The frequency is higher than 52.5Hz for more than 5 seconds, or;

The average system frequency is equal to or greater than 52.5Hz for 1 minute, or;

The frequency is less than 47.5Hz for more than 5 seconds.

Fault Ride Through

The Fault Ride Through (FRT) capability range for PV Plants is the ability to remain connected to the system during and following grid faults. The capability takes the form of Low Voltage Fault Ride Through (LVFRT) and High Voltage Fault Ride Though (HVFRT), the limits of which are detailed below.

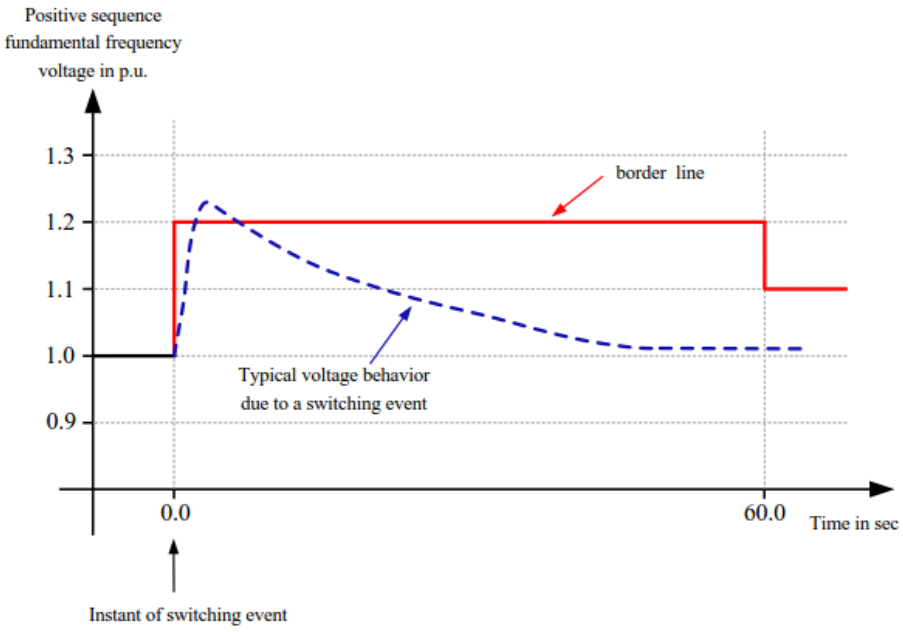
Low Voltage Fault Ride Through limits in Figure 7.1 below show the transient voltage ride through requirement of the PV Plant connected to the power system in [country of sale]. The red line in the figure shows the limit above which generation is to remain connected to the system. If the voltage

recovery on the system is lower than the red line, the generation may disconnect. It is a requirement that the PV Plant return to its pre-event output as quickly as the technology allows after fault clearance.

Figure 7.1 Low Voltage Fault Ride Through Requirement at the Point of Connection

High Voltage Fault Ride Through Requirement limits shown in Figure 7.2 show the transient voltage ride through requirement of the PV Plant connected to the Grid System. The PV Plant is required to remain connected to system if the voltage level at the point of connection is at or below the level shown by the red line in Figure 7.2 below.

Figure 7.2 High Voltage Fault Ride Through Requirement at the Point of Connection



Power Islanding

Under fault conditions which result in the loss of infeed from the Grid System to the point of connection the PV Plant should be disconnected by means of Loss of Mains Protection and only reconnect when the Grid System has been returned to service.

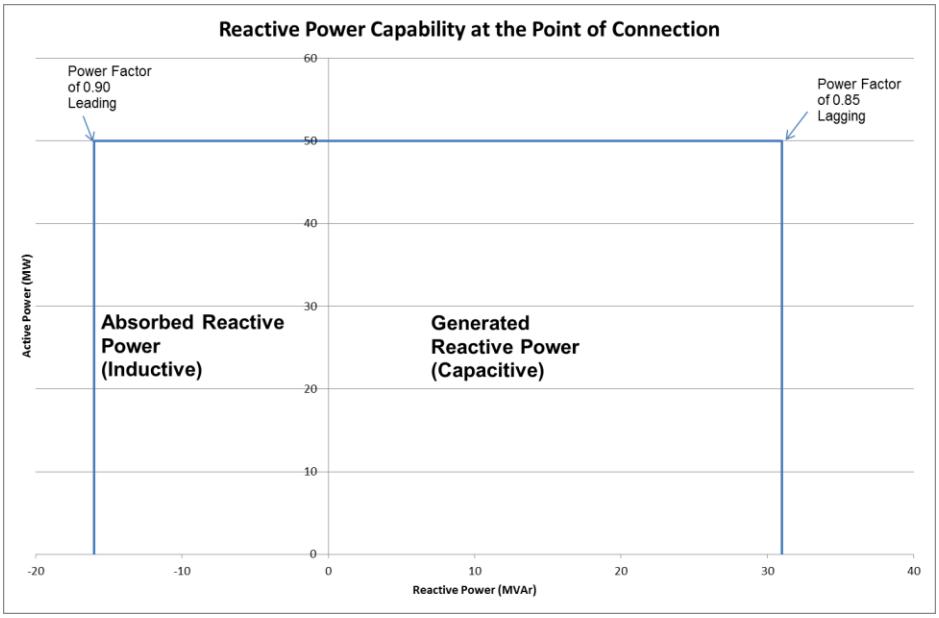
Frequency response

The PV Plant is not required to offer frequency response for when the frequency at the point of connection is below 52.5Hz and above 47.5Hz, but if the Grid System frequency reaches 52.5Hz, or above, the PV Plant must start to reduce its active power at a rate to be agreed with the Purchaser (unless otherwise stated this rate is to be 5MW/sec) until the system frequency reaches 50.15Hz, at which point the active power output can return to its pre-event output.

Reactive Power Output

The PV Plant must be capable of operating from a power factor of 0.9 leading to a power factor of 0.85 lagging at full load at the point of common coupling. For a PV Plant of 50MWp it should be capable of operating at any point within the range shown in Figure 7.3.

Figure 7.3 Require reactive range at the point of connection



The PV Plant must be capable of generating or absorbing the maximum required reactive power requirement throughout the full range of normal operating voltage at the point of connection to the Grid System The reactive power of the PV Plant must be controllable at all times and the PV Plant should under normal system condition operate in either:

Reactive Power Control

Power Factor Control

Unless otherwise instructed, the PV Plant will operate at unity power factor at the point of coupling. It must be possible to change the reactive power set point on instruction from the Purchaser within 5 minutes, following receipt of an instructed change.

Under extreme conditions, if the voltage at the point of coupling is above 1.05pu or below 0.95pu for over 10 minutes the PV Plant is expected to change to Voltage Control mode and only revert to the original control mode when:

the system voltage has returned to less than 1.04pu or above 0.96pu(these values are to be confirmed by [Purchaser]), or

the PV Plant has reached a reactive power limit.

When the PV Plant reverts to the original control mode the reactive power from the PV Plant should remain at the new Reactive Power set point until otherwise instructed by the Purchaser.

The PV Plant should have a control system which shall be capable of controlling the increase in active power ramp rate to within the maximum active power per minute ramp rate set by the transmission system operator. Unless otherwise agreed the maximum increase in active power is to be 10MW/minute.

Black Start

The PV Plant is not required to have a Black Start capability.

Power Quality

The power quality requirements of the PV Plant must take into account the adverse effects that the PV Plant could have on the Grid System, the items detailed below are the limits that have been set.

The PV Plant shall install power quality meters meeting the requirements of [country of sale's relevant party] for the purpose of measuring the impact of the power plant on the grid at the connection point.

Sudden Voltage Changes

The voltage changes caused by switching operations have to be in accordance with IEC 61000-3-6, i.e., switching an individual Solar Array cable may not cause a voltage change larger than 2% of Umax and switching of a PV Plant may not cause a voltage change larger than 5% of Umax.

Phases Unbalanced

Under normal operation, the maximum negative phase sequence component of the phase voltage of the power system should remain below 2%.

The relevant standard is [country of sale's relevant party].

Harmonic Limits

Harmonics generate waveforms that distort the fundamental 50 Hz wave. The limits for harmonic distortion levels are given in the following documents:

[country of sale's code]

UK Engineering Recommendation G5/4, February 2001 "Planning levels for harmonic voltage distortion and the connection of non-linear equipment to transmission systems and distribution networks".

The maximum total levels of harmonic distortion on the system under normal operation conditions, planned outages and fault outage conditions (unless under system stress) shall not exceed the values shown in the Table 7.1 Below

Table 7.1 Maximum Harmonic Distortion at the point of connection

Voltage Level	Acceptable Harmonic Distortion Levels
66kV and Higher	The Total Harmonic Distortion should not exceed 1.5%
Below 66 kV	The Total Harmonic Distortion should not exceed 5%

Protection Requirements

The Seller shall at all times maintain the protection installations that comply with the Grid Code.

This is done in order to:

Ensure agreed power quality to customers

Minimise damage to primary plant

Prevent damage to healthy equipment that conducts fault current during fault events

Limit safety hazards to the public and power utility staff.

General Protection Arrangements

The PV Plant shall be designed and operated with protective devices in accordance with the requirement of the Purchaser.

Fault clearance times shall be within the limits established by the Purchaser in accordance with the protection philosophy.

The Purchaser and the Seller shall each be solely responsible for the protection system of the electrical equipment and facilities at their respective sides of the point of coupling.

Loss of Main Protection

The PV Plant is to be immediately disconnected if the facility detects that it is isolated from the Grid System.

Ground Requirement

The Purchaser shall inform the Seller of the grounding method to be used on the grid system. The specification of the equipment shall consider the maximum voltage surge that could be imposed on the equipment during phase to ground faults.

Protection Coordination

All protection devices on the PV Plant must be coordinated with the protection on the Grid System.

SCADA requirements

The Seller shall provide Purchaser with the following indications and measurements:

MW output of the PV Plant - Upto 50 MW AC

MVAr output of the PV Plant - MVAr required for catering to idle changing of power and inverter transformers are provided which is normally rated for 2% of the transformer rating or based on the power transformers no load current.

MWh output of the PV Plant - XXXX MWh per Day

Voltage at the XXX kV collector busbar - XXXXX Volt

Frequency at the collector busbar - 49 - 51 Hz

Indications of circuit breaker status may be requested by the Purchaser

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Monitoring of the solar plant switchgear status under the SCADA specifications

Any additional data as specified by the Purchaser.

Data Requirement

The Seller is required to provide all of the information listed below in accordance with a timetable to be agreed between the Seller and the Purchaser.

General Data

Name of PV Plant - 500 MW AC Solar Power Plants (14 Sites)

– Site Location and coordinates -

SITE	COORDINATES

Scheduled In-Service Date (back feed date): [Day] [Month] [Year] – 31/07/25

Nominal Power (MWAC): [Nominal Capacity] - Up to 50 MW

Peak Power (MWp): [Peak Capacity] - Up to 50 MW

Point of Interconnection: [Name] [kV level] -330KV, 132KV, 88KV, 66KV, or 33 KV

Site conceptual design shown