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Small-Scale Renewable Energy Market: Exploring Opportunities and Challenges Within a Selected African Electricity Distribution Company

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ABSTRACT

The market for small-scale renewable energy has increased in Africa as a strategy for the diversification of electricity supply and mitigation of power cuts, thus promoting sustainable energy solutions. The market is however faced with many challenges despite its vast potential The study made an exploration of the small- scale renewable energy (SSRE) market for a selected electricity company in Africa. Specifically, the study identified opportunities and challenges that are associated with participating in this energy market. The Socio-Technical Transition Theory formed a key part of the study. The study adopted a qualitative research approach, with purposive sampling, and a sample size of 20 managers. Semi-structured interviews were conducted online, and data was analysed using thermatic analysis. The results show that the electricity company participation in the SSRE market is important in improving service delivery, enhances benefits amongst various stakeholder categories. However, the study found that participation in the SSRE market is constrained by grid infrastructural issues, high connection and compliance costs, regulatory complexities the low customer awareness and workforce incapacity. The study recommends that the electricity company should invest in the expansion and upgrading of distribution network, implement vigorous marketing campaigns and continued investment in employee training.

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1. Introduction

The electricity distribution sector in Africa is experiencing a profound and complex transition that is shaped by persistent supply deficits, institutional constraints and increasing pressure to align with global decarbonisation imperatives. The state-owned electricity distribution company has supplied electricity to South Africa and the whole of the Southern African region for over a century. The selected electricity distribution company ran a fleet of 27 power stations with a nominal capacity of more than 47,000 MW as of March 2022 (Pram et al., 2022). Despite this capacitation, the utility has had ongoing operational challenges for the past ten years. These challenges have been characterised by frequent load shedding since

2008, which became much more serious between 2019 and 2020, resulting in an energy shortfall of about 1.3 TWh (Wright & Calitz, 2020). These problems are caused by structural inefficiencies in the electricity production system, such as the deterioration of aging coal-fired assets, underperformance of new plants, and delays in commissioning new infrastructure (Bowman, 2020; Pram et al., 2022). As a result, system reliability significantly decreased, with the Energy Availability Factor falling from 65% in 2020 to 53% in 2023 (Business, 2023). Electricity shortages have had detrimental effects on the economy of the selected country, limiting industrial production and fuelling economic instability.

In response, the Electricity Distribution company has embarked on expanding its generation capacity through large-scale infrastructure projects collectively adding to approximately 9,600 MW to the country's national grid (Eskom, 2021; Gregory, 2020). However, these projects were faced by delays, cost overruns and operational inefficiencies, limiting their effectiveness in addressing supply constraints. Complicating this issue is the aging nature of the selected African electricity distribution company's infrastructure, with plenty of it as old as from the 1980s, alongside inadequate maintenance practices that have further weakened plant performance (De Vos, 2019).

In addition, the inherent characteristics of electricity, particularly its limited storability, require real-time generation to meet demand, hence exposes the system to heightened vulnerability when generation capacity is constrained (Kenny et al., 2015). It is against this background that over-reliance on coal-fired generation, which accounts for most of the selected electricity distribution company (ranging between 39,800 MW and 44,013 MW), has become increasingly unsustainable operationally and environmentally (Clark & McGregor, 2024). Globally, the transition towards renewable energy has increased, particularly since the mid-2010s, driven by the need to mitigate climate change and reduce greenhouse gas emissions (Pablo-Romero et al., 2021). In some countries, such as South Africa, this change has been facilitated through the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), which has enabled Independent Power Producers (IPPs) to contribute immensely to the energy mix, generating approximately 71,073 GWh in 2021 (Dmre, 2021). However, participation in the renewable energy generation remains constrained by structural and regulatory limitations in particular the distribution segment (Murombo, 2021).

Within this changing energy ecosystem, the emergence of small-scale renewable energy especially small-scale embedded generation (SSEG) represents a critical shift towards decentralised electricity production. Projections indicate that SSEGs could contribute up to 4,000 MW by 2030, driven largely by residential and small business adoption (South African Local Government, 2020). The selected African electricity distribution company services serves over 7 million customers Eskom (2024) which have been directly impacted by this transition. On the one hand, the increasing adoption of small-scale renewable technologies poses a risk of declining electricity sales, as customers generate their own power and reduce reliance on the grid. On the other hand, it presents significant opportunities for the electricity distribution company to diversify its energy portfolio, enhance supply reliability, and reposition itself within a decentralised and low-carbon energy system (Baker & Phillips, 2019;Mkhwebane, & Ntuli, 2019).

Despite these opportunities, several challenges constrain the effective integration of small-scale renewable energy into the company's distribution network. These include technological limitations related to grid readiness for bi-directional energy flows, slow regulatory adaptation, and institutional resistance to change within established energy regimes (Thopil et al., 2018; Ting & Byrne, 2020). Although the selected electricity distribution company has initiated efforts towards renewable integration such as repurposing coal infrastructure for renewable energy development (Mohlakoana & Wolpe, 2023), its participation within the small-scale renewable energy market remains limited and insufficiently understood.

Extant literature has largely focused on large-scale renewable energy procurement and macro-level energy policy frameworks, with limited attention given to the distribution-

level implications of small-scale renewable energy adoption, especially from the perspective of a selected African electricity distribution company. This poses a critical research gap, as the rapid growth of decentralised energy systems poses significant implications for utility business models, grid management and long-term financial sustainability.

This study seeks to explore opportunities and challenges that comes by participating in the small-scale renewable energy market for the selected African electricity distribution company.

2. Literature Review And Theoretical Framework

2.1. Socio-Technical Transition Theory

The study is underpinned by the Socio-Technical Transition Theory, specifically the Multi-Level Perspective (MLP), a theory propounded by Geels (2002, 2011). The theory describes how big and complicated energy systems evolve over time through interacting with innovations in technology, institutional structures and broader socio- economic factors. The theory is mostly used in energy transition studies by providing a framework for understanding both the emergence of new energy solutions and resistance from the existing ones. The MLP conceptualises changes across three interrelated levels which are the landscape, the regime and the niches. At the landscape level, external factors such as climate change, energy demand increase, policy changes and economic constraints influence the energy sector (Geels, 2011). In the selected African country, these pressures include persistent load shedding, the need for decarbonisation, and rising electricity demand. The regime level represents the dominant and established system, characterised by existing infrastructure, regulations, and organisational practices that tend to resist change due to institutional lock-in and high investment costs (Geels, 2002). In this study, focused on a selected African electricity distribution company, centralised, the coal-based electricity system and its distribution network represent the existing regime. The niche level, on the other hand, refers to spaces where innovations emerge and develop. Small-scale renewable energy systems, particularly (SSEG), represent such niche innovations as they introduce decentralised electricity production and enable consumers to become producers (prosumers) (Mahmud et al., 2020).

A key proposition of the theory is that transitions occur when landscape pressures destabilise the existing regime, creating opportunities for niche innovations to grow and influence the system (Geels, 2011). However, this process is often constrained by resistance from the regime, resulting in both opportunities and challenges during the transition. This theoretical framework directly underpins the current study by explaining the dual focus on opportunities and challenges associated with the selected electricity distribution's participation in the small-scale renewable energy market. The identified opportunities such as improved energy security, decentralised generation, cost efficiencies, and alignment with environmental sustainability goals reflect the growing relevance of niche innovations within the energy system. Conversely, the challenges such as grid infrastructure limitations, financial sustainability concerns, and regulatory complexities stem from the rigidity and constraints of the existing electricity distribution regime, which is not fully designed to accommodate decentralised and bi-directional energy flows. Thus, the Socio- Technical Transition Theory gives a coherent and practical lens to understand how and why small- scale renewable energy may present both opportunities and challenges in the electricity distribution company for the selected African country.

2.2. Small-Scale Renewable Energy and Distributed Generation

The small -scale renewable energy systems which commonly refers to the installations with capacities below 100kW to 1MW, represents a decentralised approach to electricity generation (Hyder, 2024). Contrary to the utility scale systems, that feeds directly to the national grid, such systems are typically installed at the point where consumption happen which therefore mainly serve for local energy needs where sometimes the excess electricity is sometimes exported back to the grid (Hyder, 2024; Marsh, 2021). This form of generation

which is sometimes called the distributed generation (DG), has gained global prominence due to its ability to enhance energy access and improve supply reliability. In the developing countries, especially the Sub- Saharan Africa, small scale renewable energy has played a crucial role in the address of energy poverty thus enabling socio-economic development in the rural and less privileged communities (Kekana, 2020; Terrapon-Pfaff et al., 2014). Off-grid and mini grid systems have facilitated the emergence of localised energy markets that allows communities to generate. The presence of this decentralised system has reduced dependence on centralised utilities and thereby promoting energy resilience.

A big transformation linked with distributed generation is the emergence of "prosumers" entities that both consume and produce electricity (Kotilainen et al., 2019; Mahmud et al., 2020). Through the support of technology such as the battery energy storage systems (BESS), such systems allow greater autonomy in the consumption of energy and contribution to grid stability (Hafez & Bhattacharya, 2012). However, the increased penetration of prosumers come with challenges in grid management, especially in systems that were designed for a one-directional energy flow. Although studies show the technical and socio-economic benefits of distributed electricity generation, there is limited generalisability on how these changes manifest within specific utility environments. This is particularly in developing countries with old grid infrastructure. This hence suggests the need for more context specific analysis that focuses on how utilities such as the selected electricity distribution company can effectively integrate and respond to the growth in such small-scale renewable energy systems.

2.3. Opportunities of Small-Scale Renewable Energy for the Selected Electricity distribution Company in Africa

Expansion of the small-scale renewable energy has presented a range of strategic opportunities for the selected electricity distribution company. Some market opportunities emerge when such existing systems do not meet expectations of customers hence creating a space for alternative solutions (International Renewable Energy, 2020). The main benefit is that it enhances the security of supply. The distributed generation allows electricity production closer to consumption points hence reduces transmission losses and the alleviation of pressure on centralised generation systems (Lovins et al., 2020; Ogunsina et al., 2021). This contributes to network improvement efficiency and resilience. Additionally, the decline in costs of renewable energy have made them highly competitive with fossil fuel-based generation. This creates opportunities for cost savings for both utilities and consumers (Lawrence, 2020).

The participation in the small scale renewable energy market is aligned with national and global sustainability targets that includes commitments to reduce greenhouse gas emissions and the transition towards a low- carbon economy (Pandarum & Mbam, 2023). This furthermore opens avenues for accessing climate finance and investment funding to support infrastructure upgrades and modernisation of network (Oliver, 2021). Some new revenue streams can also be generated through mechanisms such as energy wheeling, renewable energy tariffs and grid service provision (Eskom, 2024).

The advance in technology that includes smart grids and the Internet of Energy (IoE), further enhance these opportunities as it enables efficient integration and management of distributed energy systems (Hua et al., 2022; Mahmud et al., 2020). These innovations support the coordination of prosumers, facilitate development of virtual power plants thus enabling system flexibility and operational performance. Despite these benefits, literature does not sufficiently explore how the selected electricity distribution company can strategically harness these opportunities within its operational and institutional support challenges. Much of the existing literature remains conceptual and generalised that lacks empirical insights into practical realities faced by the selected electricity distribution company in leveraging small scale renewable energy markets. These gaps call for the need for a more focused analysis on the specific benefits that can be realised within this context

2.4. Challenges Associated with Small-Scale Renewable Energy Integration

Despite the potential benefits, the integration of small-scale renewable energy to the selected African electricity distribution company poses some challenges. The main challenge relates to grid infrastructure limitations since the existing distribution systems were made for one directional power flows and are not fully equipped to accommodate the two-way energy flow required by embedded generation (Baker, 2017; Thopil et al., 2018). These limitations requires huge investments in grid upgrades and their modernisation which is constrained by financial limitations. The increased adoption of self-generation by customers reduces demand for supplied electricity that leads to reduced revenue hence threatening the utility's financial viability (Nkosi, 2020; Steyn et al., 2021). This therefore creates a structural tension between the promotion of renewable energy adoption and maintaining financial stability in the company. Also, regulatory and institutional challenges complicate participation within the small-scale renewable energy market. The existing legal frameworks give a guide for the integration of embedded electricity, non-compliance issues, illegal connections and complicated registration processes persist (Oliver, 2021; Salga, 2020; van Schalkwyk & Scholtz, 2024).

Ambiguities with respect to the roles of municipalities and selected electricity distribution company creates some coordination challenges in the management of distributed energy systems (Energypedia, 2014). Uncertainties that are operational and technological also present challenges when it comes to system planning, load forecasting, and managing variability in renewable energy (Ogunsina et al., 2021). The uneven distribution of renewable energy capacity across regions complicates strategic planning and investment decisions. Although these challenges are acknowledged in literature, they are often discussed in isolation or at macro policy levels where limited focus has been given on how they specifically affect the selected electricity distribution company's strategic positioning as well as operational capacity. This gap poses the need for research that examines both opportunities and challenges within the same analytical framework as done in the present study.

3. Data And Methodology

The research adopted an interpretivist philosophy that assumes that reality is socially constructed and is best understood through subjective experiences and views of research participants (Creswell & Creswell, 2018). Interpretivism was considered appropriate as the study sought to explore views of managers for the selected African electricity distribution company about the opportunities and challenges that comes through participation in the small-scale renewable energy market. The study adopted a qualitative research approach that explored complex, context specific phenomena and rich, detailed insights of participants (Creswell & Creswell, 2018; Ramanadhan et al., 2021). The qualitative approach enabled researchers in the present study to uncover deep perspectives that are not available in literature. Data were collected through semi-structured interviews. This allowed for flexibility to probe responses while maintaining an alignment with the main aim of the study.

The research employed a qualitative narrative research design to understand participants' experiences consistent to the interpretivist paradigm (Muzari et al., 2022). The study explored how managers perceived their organisation's participation in the small-scale renewable energy market (Creswell & Creswell, 2018). The target population consisted of a selected African Electricity Distribution Company's management employees (Managers, Engineers and Senior Advisors) involved in small-scale embedded generation initiatives in the selected two provinces of the selected African country. From a population of 50 managers, a sample of 20 participants was selected through the saturation principle. Purposive sampling was used to identify participants with relevant expertise and direct involvement in decision-making and implementation processes related to small-scale renewable energy. This ensured that the collected data were rich, relevant and aligned with the study objectives. Data were collected via semi-structured interviews conducted online, which allowed participants flexibility in scheduling. Data saturation was achieved, when similar themes emerged across

participants. The data were analysed using thematic analysis, which involved identifying, analysing, and interpreting patterns within the qualitative data. Ethical considerations which include informed consent, anonymity, privacy and obtaining ethical clearance, were adhered to.

4. Results

This section presents the findings from interviews conducted to explore the opportunities and challenges of the SSEG market for the selected African electricity distribution company. Participants were asked to reflect on the opportunities and challenges of the company's participation in the small-scale renewable energy market.

4.1. Challenges of Participating In The Small-Scale Renewable Energy (SSEG) Market Customer Participation and Engagement

Participants emphasised that customer engagement is important to successful SSEG uptake. Different participants note that when customers are educated on the benefits of participating, the SSEG market grows, which increases compliance and a reduction in illegal connections. P1 highlighted the issue of customer uncertainty:

"Customers are not certain on what process is to be followed and what the company will charge them. I would say reduce the cost in your pricing then increase customer awareness."

P19 stressed the importance of trust and relationship-building: *"I think there is need for a program to rebuild our trust and reframe who we are in the eyes of customers."* P3 reflected on the historical precedent for dedicated engagement units, stating, ……. *"We do need in the distribution specialised units that comes with specialised knowledge which can do marketing to customers and come back with feedback……"*

Participants observed that effective communication channels such as conferences, publications, and workshops could enhance engagement. P18 noted, *"We have recently been doing a lot of workshops…* P7 added, *"Customer service actually also talks to the customers to advertise distribution and the benefits of the customers connecting to the renewables that distribution will be venturing in."*

The challenge in the theme includes the lack of awareness, unclear processes, and perceptions of regulatory policing, which discourage customers participation. P15 emphasized the regulatory complexity: *"The customer must apply for registration or a license to operate their generator… and after, they will go to the electricity distribution company and require information to ensure that the grid is still stable and is safe to connect."*

4.2. Financial Considerations and Cost Barriers

Participants consistently highlighted high upfront costs as a barrier to SSEG adoption but also recognized financial benefits for the selected electricity distribution company. P20 explained, *"If you're looking at the homeowner and you're asking for an EGI, for an engineer to go to someone's home and sign off that report, which is costly."* P18 added, *"One of the biggest quests specifically for residents now, one of the biggest costs for that certificate, which we need to find other innovative ways for customers to get those certificates."*

On the benefits side, participants suggested that the company could reduce costs for customers while generating revenue internally. P3 stated, *"We know that illegal connections come with remedial charges, maybe waiving those charges for the initial phasing of the programme."* P17 highlighted the potential for financial facilitation: *"Customers take up to 18 months to install the system because this is all dependent on the customer's financial state. So maybe if there could be some financial institutions that are willing to fund customers on these projects as well."*

The other barrier was related to administrative cost. P20 noted, *"……the admin fees are higher than the offset value……..."* This suggests that cost reduction, enabling customer financing and creating profitable mechanisms for customers, enables participation in the SSEG market.

4.3. Regulatory and Procedural Challenges

Participants mentioned that complex regulations and cumbersome registration processes limit participation in the SSEG market. P4 observed, *"……Let's do away with red tape and not compromise on quality……"* P9 similarly emphasized simplification: *"**....** the regulations need to be simplified……" Coordination with stakeholders was frequently cited as a challenge. P20 noted, "……There is poor communication from the company to us as customers……." P15 posits that the electricity distribution company and local utilities could handle applications on behalf of customers: "Those interested should direct them to their local utilities…".*

4.4. Grid Infrastructure and Network Preparedness

To support dispersed generation, participants emphasized the significance of capacity planning and grid upgrades. *" An investment in smart technologies and grid modernization will help facilitate the integration of small-scale renewable systems,"* stated P4. P2 elaborated, *"Once you establish how much energy you want to buy, you first build your networks, upgrade the networks so that you have available, say 3000 MW of evacuation at a certain area."*

The challenge lies in long-term planning and network investment. Without adequate infrastructure, the grid may not support the rapid uptake of SSEGs, limiting both the company's ability to integrate renewable energy and customers' ability to connect safely.

4.5. Opportunities of participating in the small-scale renewable energy (SSEG) market Skills Development and organisational capacity

Participants highlighted the need for training and organisational alignment. P10 emphasized, *"For as long as we only think of Distribution as wires and Transformers, and we're not looking at renewable energy technologies, it will make Distribution stay out of the market for small-scale renewable energy."* P11 added, *"Employ and quickly train competent staff to support the initiative… Engineers and technologists to be registered with an organisation so that they are competent to actually sign off the technical evaluations."*

Training in DC systems and renewable energy technology was identified as a dual benefit: improving safety, quality, and efficiency while also creating employment and skills transfer opportunities. P10 noted, *"We need to start looking at rolling out courses on DC systems… that will assist with upskilling and creating jobs in the market."*

4.6. Localisation and Supply Chain Considerations

Participants noted that reliance on imported equipment raises expenses and causes delays. *"We will work more closely with institutions... maybe even produce a cheaper battery that is tailored for a local household,"* P6 stated. "*Where we are having our own sub-stations, we can acquire some land to build some of the renewables closer to our substations, so that when the renewables are charged, we can feed from the renewables from a closer range*," P7 said, highlighting the possibility of utilizing current company land for installations.

Local manufacturing, research, and effective use of infrastructure were identified as critical for reducing costs, improving supply chains, and increasing uptake.

4.7. Strategic Partnerships and Policy Support

Participants highlighted that strategic partnerships and policy incentives are essential enablers. P4 stated, *"Probably this is essential to educate the consumers about the benefits and opportunities… fostering partnerships with private sector companies, financial institutions, academic institutions… which can drive innovation and develop training programmes."*

Funding models and incentives for lower-income households were also critical. P17 noted, *"If the current government could reduce some of the import taxes for solar panels and converter batteries, so that it's not too expensive for the customer."* P12 emphasized dedicated teams for policy implementation: *"We need to capacitate the teams that are party to this and probably have a dedicated team that focuses on this… including implementation and designs, so that we can move quicker and cover all areas."*

5. Discussion

The findings demonstrate that the electricity distribution company's participation in small-scale renewable energy presents both opportunities and difficulties. The possibility of increased customer engagement is one of the advantages. The chosen business also encourages a sense of accountability and ownership among users through prosumer involvement, which can lower theft and illicit connections. Robison & Riaz (2021) and Kotilainen et al. (2021) emphasize the relevance of prosumer engagement in propelling energy transformations in the dimensions where power has historically been centralized. This illustrates the dynamic interaction between specialized innovations like SSEG and the established electricity regime in the context of the Multi-Level Perspective ,where low-level participation can exert some pressure on the established institutional and technical routines to change (Geels, 2011).

The findings demonstrate that financial factors can serve as a possible channel for value generation, as well as a barrier. Customer penetration was found to be limited by high upfront costs resulting from engineering signoffs. The findings are consistent with those of Baker (2017) and Kekana (2020), who found that the primary factors influencing the adoption of distributed energy are capital and transaction expenses.

However, the power distribution business might turn these financial obstacles into opportunities for income generation while also lowering participant costs by internalizing some technological procedures and offering streamlined services. This demonstrates a regime niche interaction in which conventional revenue models change to consider the expansion of cutting-edge energy solutions.

Some challenges also arise through regulatory and procedural complexities. The existing framework that governs small scale generation is regarded as cumbersome (van Schalkwyk & Scholtz, 2024). In the MLP framework, these entrenched routines exemplify regime lock-in, creating friction for niche technologies seeking mainstream adoption. Streamlining registration and licensing procedures, while maintaining safety and compliance, represents a necessary adaptation to facilitate the co-evolution of niche innovations and the incumbent system.

Another critical concern is that of the existing infrastructure to accommodate distributed generation. Traditional grids are designed for a one-way power flow as such face technical constraints when integrating bidirectional energy from multiple small-scale generators. Previous studies shows that grid rigidity is a major inhibitor to distributed energy uptake (Baker, 2017).

Another opportunity and challenge that surfaced was human capital. The study made clear that in order to guaranty competent administration of SSEG installations and operations, workforce upskilling and capacity building are necessary. Similar skill gaps are often

encountered by utilities around the world making the shift to distributed energy generation (Ogunsina et al., 2021). The MLP asserts that the regime's capacity to adopt specialized innovations depends on both technological infrastructure and the skills and abilities of system players. Investing in knowledge transfer and training guarantees that human resources meet the changing operational and technological requirements of dispersed generation.

In addition, the localization of equipment and materials came as both a strategic opportunity and a challenge. Developing domestic manufacturing of PV panels, inverters and batteries can reduce costs, minimize supply chain delays and stimulate local economic activity. Literature shows that integrating production capabilities within the local context strengthens the resilience and scalability of renewable energy niches (Kekana, 2020; Manana, 2023). In MLP terms, this represents an alignment between technological niches and socio-economic landscapes, facilitating the embedding of innovations within the regime and broader societal structures.

To overcome these barriers, policy support and multi-stakeholder collaboration are crucial. Incentives, financing schemes and partnerships with academic institutions, the private sector, and government agencies may help stimulate uptake and embed SSEG within the company's operational paradigm. Studies show that such collaborative arrangements accelerate distributed energy adoption, reduce institutional resistance and enhance socio-technical integration (Oliver, 2021; Walwyn & Brent, 2015). From the perspective of MLP, such mechanisms play a mediation role between the niche and the regime, allowing innovations to influence policy, institutional practices, and market dynamics while enabling the regime to adapt in a controlled and sustainable manner.

6. Conclusion

The study examined the challenges and opportunities of the selected African power distributor's involvement in the SSEG market. The findings suggest that involvement in this market can improve grid dependability, lower carbon emissions, increase energy security, and create new revenue streams. Additionally, it promotes stakeholder engagement and customer retention. The company's incorporation of SSEG into its operations meets national obligations and is in line with global energy trends. The results, however, highlight systemic issues such as limited network capacity, complicated regulations, high consumer and operational costs, a shortage of experienced workers, and sluggish organizational adoption of new technology. These limitations demonstrate the deeply ingrained rigidity of the conventional electrical regime, confirming the applicability of the current framework and highlighting the necessity of coordinating specialized advances with regime-level structures to facilitate sustainable energy transitions. Therefore, the company's active participation in the SSEG industry offers both a transformative challenge and a strategic opportunity. The utility's capacity to update infrastructure, expedite regulatory procedures, cultivate strong customer participation, and enhance technical competence will determine its success in this market.

6.1. Recommendations

6.1.1. Policy recommendations

Policymakers should concentrate on establishing a regulatory framework that encourages consumer participation in the adoption of small-scale energy systems. Additionally, incentives for research institutions and private sector collaborations could spur innovation and local production of renewable energy technologies, promoting industrial growth and job creation. Therefore, the policy must be created to guarantee the financial and operational viability of the relevant parties in addition to meeting regulatory and environmental goals.

6.1.2. Recommendations for practice

Practically, the business can think about launching initiatives that offer complete support for SSEG installation. These include site evaluations, uniform safety checks, and installation support, which lessen the need for pricey outside services and raise customer satisfaction.

6.1.3. Areas for further research

The present study adopted a qualitative research approach in exploring the opportunities and challenges of the selected company's participation in the small-scale renewable energy market. As such, future research could adopt a mixed-methods approach to complement qualitative findings with quantitative data.

Authors Contribution

Nozipho Innocentia Mpanza: Conceptualisation, data collection and analysis, write up
Cecile Gerwel Proches: Conceptualisation and crafting of paper
Mthombeni Admire: Conceptualisation and crafting of paper

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