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Original Article

Rural photovoltaic energy: government strategies and barriers to access

A energia fotovoltaica rural: estratégias governamentais e barreiras ao acesso

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ABSTRACT

Purpose: This study sought, through a systematic review of the literature, to identify the government strategies used to enable photovoltaic energy in rural areas and to analyze the main challenges faced by the rural population in accessing photovoltaic systems.

Methodology: This research is based on a systematic review of the literature in accordance with the PRISMA/2020 protocol. Twenty-two publications were selected from the Scopus and Web of Science databases. These articles were analyzed to identify the main government strategies employed and the challenges faced by rural populations in adopting photovoltaic systems. The final version of this manuscript was translated into English using the DeepL artificial intelligence tool.

Results: The analysis of the articles revealed five government strategies to enable rural photovoltaic energy: (a) economic incentives; (b) rural electrification policies; (c) socioeconomic development strategies; (d) educational strategies; and (e) international awareness and support. As for challenges, four limiting factors were identified for the implementation of photovoltaic energy in rural areas: (a) economic viability; (b) technological barriers; (c) specific public policies; and (d) access to electricity networks.

Originally: This study reveals that active participation by the state is essential for photovoltaic energy to become established in rural areas. The results of this systematic review enrich the theoretical and empirical field on the subject and propose a model to guide public policy makers in the process of adopting photovoltaic energy in rural contexts. It also reveals gaps that should be considered by policymakers involved in rural electrification.

Keywords: Photovoltaic energy; Solar energy; Public policies; Rural areas

RESUMO

Objetivo: Este estudo buscou, por meio de uma revisão sistemática da literatura, identificar as estratégias governamentais utilizadas para viabilizar a energia fotovoltaica em áreas rurais e analisar os principais desafios enfrentados pela população rural no acesso a sistemas fotovoltaicos.

Metodologia: Essa pesquisa está fundamentada em uma revisão sistemática da literatura em conformidade com o protocolo PRISMA/2020. Foram selecionadas vinte e duas publicações coletadas das bases de dados Scopus e Web of Science. Esses artigos foram analisados, para identificar as principais estratégias governamentais empregadas e os desafios enfrentados pelas populações rurais na adoção de sistemas fotovoltaicos. A versão final desse manuscrito foi traduzida para o inglês pela ferramenta de inteligência artificial DeepL.

Resultados: A análise dos artigos revelou cinco estratégias governamentais para viabilizar a energia fotovoltaica rural: (a) incentivos econômicos; (b) políticas de eletrificação rural; (c) estratégias de desenvolvimento socioeconômico; (d) estratégias educacionais; e (e) conscientização e apoio internacional. Quanto aos desafios, foram identificados quatro fatores limitantes para a implementação da energia fotovoltaica em áreas rurais: (a) viabilidade econômica; (b) barreiras tecnológicas; (c) políticas públicas específicas; e (d) acesso às redes de eletricidade.

Originalidade: Esse estudo revela que a participação ativa do Estado é indispensável, para que a energia fotovoltaica se consolide em zonas rurais. Os resultados desta revisão sistemática enriquecem o campo teórico e empírico sobre o tema e propõem um modelo para orientar formuladores de políticas públicas no processo de adoção da energia fotovoltaica no contexto rural e revela as lacunas que devem ser consideradas pelos formuladores envolvidos na eletrificação rural.

Palavras-chave: Energia fotovoltaica; Energia solar; Políticas públicas; Áreas rurais

1 INTRODUCTION

The energy transition towards using renewable energy sources has gained prominence in the public debate on climate change and energy planning, as “green electricity” has become a promising approach to mitigate the harmful effects of greenhouse gas (GHG) emissions (Kaiser et al., 2020). Experts and researchers in the field have estimated models and scenarios that presume global energy production will be fully decarbonized by the year 2050. This projected model indicates a gradual reduction in the use of fossil fuels, along with a simultaneous increase in renewable energy sources (Rogelj et al., 2018).

The government has been accelerating the development of renewable energy sources, mainly by formulating and implementing public policies that keep pace with the evolution of renewable energy generation technologies (Liu & Lin, 2019). Among these sources, solar photovoltaic energy has emerged as a promising market due to its vast potential to reduce pollution from burning fossil fuels and its ability to respond to energy demand pressures (Sen & Ganguly, 2017).

Photovoltaic solar energy is understood as one of the renewable energy sources that has gained prominence and attracted the interest of researchers and the academic community (Garlet et al., 2020; Sampaio & Gonzales, 2017; Spiller et al., 2023; Souza et al., 2024). Researchers' dedication has emerged from technological advances in photovoltaic solutions over the last decade, combined with factors such as economies of scale, improved panel efficiency, public policies and subsidies, investment in research and development, and reduced costs of photovoltaic technology. The combination of these elements contributed to a greater volume of scientific and academic publications and has enabled massive investments in photovoltaic energy, making it a viable and accessible alternative for a growing number of organizations and households worldwide (Wen et al., 2021).

A major challenge observed in several countries is the difficulty of transferring photovoltaic energy technologies to rural areas. The complexity of this issue is further heightened in isolated communities, as the residents in these locations are often dispersed over a large area and have limited access to power grids (Eras-Almeida et al., 2023). Considering the importance of global energy transition, rural residents are at a disadvantage in this process. While many rural inhabitants show interest in participating in the adoption of clean energy and benefiting economically from solar power, structural issues can still constitute limiting factors for the energy transition in these areas (Li et al., 2024).

In this context, relying solely on market mechanisms is insufficient, given that high initial capital costs and the low income of rural populations, who frequently live below the poverty line, hinder access to these technologies. Thus, public authority intervention becomes not only beneficial but imperative to enable the adoption of photovoltaic systems in rural areas (Micheletti, 2023; Mugisha et al., 2021).

Reinforcing this paradigm, studies indicate that without specific government strategies, such as direct subsidies and technical training, photovoltaic projects in rural areas tend to face high rates of premature failure and abandonment due to a lack of maintenance and economic sustainability (Eras Almeida et al., 2023; Lestari et al., 2018). Furthermore, expanding the conventional power grid to these dispersed regions is often economically unfeasible due to high transmission costs (Borhanazad et al., 2013).

Therefore, identifying effective government strategies is essential to narrowing the gap between the available technological potential and the reality of energy poverty faced by rural populations. Photovoltaic energy establishes itself as a viable solution when supported by public policies that promote the economic development and social transformation of these communities (Li et al., 2024; Silva et al., 2024; Zhao et al., 2023).

Therefore, it can be said that the participation of public authorities is essential for the formulation and implementation of sustainable energy policies (urban and/or rural), through the creation of strategies and incentive mechanisms. This raises the following question: what government strategies have been employed to make photovoltaic energy viable in rural areas?

Considering this problem, the general objective of this research was to identify, through a systematic literature review, the governmental strategies used to make photovoltaic energy viable in rural areas, and to analyze the main challenges faced by the rural population in accessing photovoltaic systems.

To achieve this general objective, the following specific objectives were established: (a) to categorize public policy typologies and government intervention strategies adopted to promote photovoltaic rural electrification; (b) to analyze the economic, technical, and social barriers that hinder the long-term sustainability, operation, and adoption of photovoltaic systems by rural populations; and (c) to map the geographic distribution of studies to understand the predominant motivations and strategies between the Global South and the Global North.

2 METHODOLOGICAL PROCEDURES

This section describes in detail the methodological strategy used to carry out this research. Firstly, the outline for the development of this systematic review is presented. This is followed by a description of the stages involved in selecting the scientific articles used. Finally, the methods used to analyze the results are explained.

2.1 Research design

The methodological strategy of this systematic review study was based on the methods, techniques and procedures established by Tranfield, Denyer and Smart (2003). The construction of this research is based on the research problem and the review protocol Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA/2020) by Page et al. (2021).

After drafting the research problem and the research protocol, the second stage of literature searches began. Recognized as an indispensable part of a systematic review study, investigations were carried out into studies relevant to the topic (Moher et al., 2009; Tranfield et al., 2003). It should be noted that a review usually produces many potentially eligible references, which must be analyzed according to pre-established criteria. The use of reference management software and programs is recommended for this process (Page et al., 2021). At this stage of the analysis, the title, abstract and keywords are read and evaluated to establish the significance of the articles in relation to the topic under analysis, thus discarding studies that do not present a clear relationship with the topic in question.

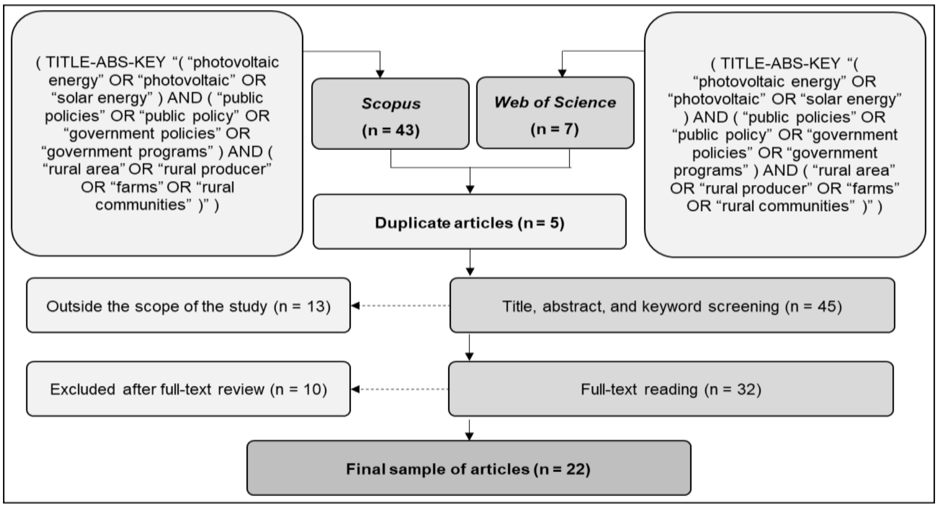
2.2 Data collection

The data collection stage of this systematic review was based on searches for international articles in the Web of Science and Scopus databases. The search filter "title, abstract, keywords" was selected, and the following terms and Boolean operators were applied: ("photovoltaic energy" OR "photovoltaic" OR "solar energy") AND ("public policies" OR "public policy" OR "government policies" OR "government programs") AND ("rural area" OR "rural producer" OR "farms" OR "rural communities").

The collection process took place between the months of May and June 2024, so no filter was applied to limit the publication dates of the studies, nor in relation to the areas of study, since topics related to environmental and energy issues are cross-cutting. Finally, only scientific journals were selected, as they are an important source for academic research.

The initial search identified 50 articles, including duplicates, which were subsequently removed. The inclusion and exclusion criteria were then applied, resulting in a final sample of 22 articles, which were used to establish the codes and categories of analysis for this study. Figure 1 below details the entire data collection process.

Figure 1 - Study Collection and Selection Flowchart



Source: prepared by the authors.

2.3 Research data analysis

To illustrate the methodological process of this research, a research protocol was developed detailing the screening, extraction, and thematic synthesis procedures adopted in conducting this systematic review, as presented in Table 1.

Table 1 - Research protocol for data screening, extraction, and thematic synthesis

Review stage	**Data collected**	
Searches on database and initial screening	- Title - Key words - Summary - Year - Authors	
Material analysis	- Purpose of the article - Main Contributions - Research problems related to the study	Group 1 (all answers yes): - Are the objectives of the article clear? (yes/no) - Do the objectives of the article involve photovoltaics? (yes/no) Does the study reveal its main contributions? (yes/no) Are the findings of the study clear? (yes/no) Related survey questions Group 2 (at least one yes answer): - Does the study present the impacts of government programs or public policies related to photovoltaics? (yes/no) - Does the study present the conditions that influence the adoption of photovoltaic solar energy in rural areas?
Data collection and synthesis of results	- Government policy strategies for photovoltaic energy; - The role of public policies and government programs to access and encourage photovoltaic energy in rural areas; - Country of Study; - Additional observations relevant to the study.	

Source: adapted from Garlet et al. (2020).

The final stage of this study consisted of extracting relevant information on the impacts of public policies and government programs on energy policy, with a specific focus on photovoltaic energy in various countries, also including the identification of the main challenges and difficulties faced by rural populations in the implementation of these systems.

Data synthesis was conducted using a qualitative thematic analysis approach. Initially, two datasets were structured to organize the raw data extracted from the selected articles. The first dataset focused on identifying ‘Government Strategies’, while the second addressed the “Challenges and Difficulties” faced by rural populations in implementing photovoltaic energy.

To ensure the study’s transparency and replicability, the analysis followed an inductive coding process consisting of three stages: (a) open coding, in which excerpts from the ‘Results’ and ‘Discussion’ sections of each article were identified, focusing on government interventions used to promote photovoltaic energy and the challenges reported by the authors; (b) categorization, a stage where related codes were grouped into descriptive themes, for example, codes such as ‘subsidies’, ‘tax credits’, and ‘financing’ were grouped under the theme ‘Economic Incentives’; and (c) definition of analytical categories, at which point two main analytical categories emerged from the interpretation of the results: **Government Strategies** and **Challenges and Barriers**.

From this process, two core analytical categories emerged. The first category, ‘Government Strategies’, was subdivided into five subcategories: (a) economic incentives; (b) rural electrification policies; (c) socioeconomic development strategies; (d) educational strategies; and (e) awareness and international support. The second category, ‘Challenges and Barriers’, was categorized into four limiting factors: (a) economic viability; (b) technological barriers; (c) specific public policies; and (d) grid access.

This systematic approach served as the foundation for the cross-analysis of the data, allowing for an understanding of how public policies interact with regional specificities. By identifying how government strategies relate to their respective barriers, the adopted structured method ensures that the study's findings are grounded in a transparent and replicable interpretive process.

2.4 Translation process

This paper was originally written in Brazilian Portuguese without any artificial intelligence assistance and was then fully translated into English using the artificial intelligence tool DeepL (https://www.deepl.com/translator). Following the translation process, this article underwent a complete manual review.

3 RESULTS AND DISCUSSION

After describing the methodological strategy employed in this systematic review study, the main results found in the selected articles are presented below, along with their analysis and discussion

3.1 Description of the selected articles

The analysis of the material collected revealed that rural contexts in various countries face series of difficulties when it comes to the transition and large-scale adoption of photovoltaic solar energy. The main difficulties and challenges identified in this study have been grouped into this category of analysis. Although complex, these challenges can be minimized through state intervention and the creation of public policies

For this reason, the study established strategies that can be used to formulate and implement public policies and government programs, so that incentives can be created to guarantee both access to electricity and energy resilience in isolated places. Table 2 lists the articles selected with their respective countries of study.

Table 2 - Overview of international policy studies related to photovoltaics

Article Title	**Studied Country**	**Methodology**	**Author, Year**
A comparison of the drivers influencing farmers' adoption of enterprises associated with renewable energy	United Kingdom	Principal Component Analysis (PCA) and non-parametric tests (Mann-Whitney)	Tate et al., 2012
A Comprehensive Evaluation of Off-Grid Photovoltaic Experiences in Non-Interconnected Zones of Colombia: Integrating a Sustainable Perspective	Colombia	SWOT Analysis and Comparative Case Study (Qualitative)	Eras-Almeida et al., 2023
Assessing the opportunities and challenges facing the development of off-grid solar systems in Eastern Africa: The cases of Kenya, Ethiopia, and Rwanda.	West Africa	Comparative policy analysis and qualitative data synthesis	Mugisha et al., 2021
A survey informed PV-based cost-effective electrification options for rural sub-Saharan Africa	Sub-Saharan Africa	Transition Probability Matrix (Markov Chains) and Agent-Based Modeling (ABM)	Opiyo, 2016
Comparison of externalities of biogas and photovoltaic solar energy for energy planning	Brazil	Economic Valuation of Externalities and Calculation of the Levelized Cost of Electricity (LCOE)	Castro et al., 2024
Do photovoltaic poverty alleviation programs alleviate local energy poverty? - Empirical evidence of 9 counties in rural China	China	Partial Least Squares Regression (PLS-R) and weighted index system	Zhao et al., 2023
Evaluation of the influence of distributed generation on the well-being of the rural community using PLS-SEM	Brazil	Partial Least Squares Structural Equation Modeling (PLS-SEM)	Silva et al., 2024

Article Title	Studied Country	Methodology	Author, Year
Factors affecting customers' attitude towards solar energy products	India	Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and Multiple Regression	Kumar et al., 2020
Financing off-grid rural electrification: Country case Nepal	Nepal	Case Study and Financial Analysis	Mainali & Silveira, 2011
Integrating rooftop solar into a multi-source energy planning optimization model	United States	Multiobjective Linear Programming (Optimization Modeling)	Arnette, 2013
Potential application of renewable energy for rural electrification in Malaysia	Malaysia	Descriptive Statistical Analysis of Renewable Potential and Literature Review	
Research and development aspects on decentralized electrification options for rural households	Global (Focus on developing countries)	Literature Review	Lahimer et al., 2013
Should BIPV technologies be empowered by innovation policy mix to facilitate energy transitions? - Revealing stakeholders' different perspectives using Q methodology	Singapore	Q Methodology (Factor Analysis of Human Subjectivities)	Chang et al., 2019
Solar energy farming as a development innovation for vulnerable water basins	Jordan	Qualitative Case Study focused on the Water-Energy-Food (WEF) nexus	Al-Saidi & Lahham, 2019
Solar energy trial in Folovhodwe South Africa: Lessons for policy and decision-makers.	South Africa	Beneficiary Assessment - BA	Bikam & Mulaudzi, 2006
Solar microgrids in rural India: Consumers' willingness to pay for attributes of electricity.	India	Discrete Choice Experiment analyzed using the Mixed Logit model	Graber et al., 2018

Article Title	Studied Country	Methodology	Author, Year
Solar PV minigrid technology: Peak shaving analysis in the East African community countries	East Africa	Simulation and Optimization using HOMER software (Hybrid Optimization Model for Multiple Energy Resources)	Ihirwe, et al., 2021
Sustainability of renewable off-grid technology for rural electrification: A comparative study using the IAD framework	Indonesia	Ostrom's Institutional Analysis and Development Framework (Qualitative)	Lestari et al., 2018
The economic effects of new patterns of energy efficiency and heat sources in rural single-family houses in Poland	Poland	Simulation Modeling	
The sun rises in the east (of Africa): A comparison of the development and status of solar energy markets in Kenya and Tanzania	Kenya and Tanzania	Qualitative Analysis	Ondraczek, 2013
Understanding the load profiles and electricity consumption patterns of PV mini-grid customers in rural off-grid East Africa: A data-driven study	East Africa	Descriptive analysis based on data (Data-Driven) and Multiple Linear Regression (MLR)	Wassie & Ahlgren, 2024
Visual observation or oral communication? The effect of social learning on solar photovoltaic adoption intention in rural China	China	Hierarchical Multiple Regression to test moderating effects	Liu et al., 2023

Source: prepared by the authors.

As can be seen, the study provides an overview covering several continents, with the exception of Oceania. The analysis includes countries from both the global North and South, without limiting itself to a specific geographical concentration; however, it can be inferred that there is a predominance of research focused on countries in the global South, whose rural populations still lack full access to energy. Despite the economic hegemony of countries in the global North, the scientific literature still lacks in-depth research on this topic in these contexts, possibly due to the perception that their energy infrastructure is already consolidated.

In this global perspective, studies have revealed that although other renewable energy sources may be more advantageous, photovoltaics is the dominant renewable energy technology for rural electrification due to the establishment of the global solar panel market and the availability of solar energy resources worldwide (Castro et al., 2024; Lahimer, et al., 2013).

A general analysis suggests that photovoltaic solar energy stands out as the most widespread renewable energy source in rural areas, due to three main factors: (a) differential public support for specific technologies, through subsidies and financial incentives aimed exclusively at solar energy, making it more accessible and attractive to farmers; (b) the influence of government policies, which includes regulations and programs aimed at promoting photovoltaic energy, stimulating the adoption of solar panels; and, (c) issues related to agricultural management, which require sustainable and economically viable energy solutions capable of reducing operating costs and increasing productivity. This scenario makes it feasible to choose solar photovoltaics as an energy source in rural areas (Tate et al., 2012).

Although solar energy has great potential for implementation in rural areas, it should be noted that most of the studies analyzed identified the challenges and difficulties faced by rural populations in adopting photovoltaic solar energy. As well as the challenges, government strategies will also be presented and discussed below.

3.2 Challenges and difficulties in implementing photovoltaic systems in rural areas based on existing public policies

This study identified four challenges that could hinder the implementation of photovoltaic energy in rural areas, even with the existence of public policies for the sector, as illustrated in Figure 2. The challenges highlighted in this research should be seen as public order issues, which require government strategies to be resolved or minimized.

Figure 2 - Challenges identified for implementing solar energy in rural areas.

Source: prepared by the authors.

The challenge related to economic viability is linked to factors such as: (a) the high initial cost of implementing photovoltaic systems in rural areas; (b) the difficulty in creating a culture of payment in rural communities (Eras-Almeida et al., 2023; Graber et al., 2018; Lahimer et al., 2013).

The high initial costs of equipment and decentralized electricity supply networks represent a major challenge for rural electrification; nevertheless, decentralized networks are gradually expanded. However, expansion and implementation of renewable energies in rural areas may be rendered unfeasible due to the high cost of transmission and distribution network implementation, the low electricity demand, the reduced consumption, and the excessive dependence on donors (Borhanazad et al., 2013; Lahimer et al., 2013). Although some studies cite low demand as a barrier (Borhanazad et al., 2013), others indicate that suppressed demand can quickly exceed generation capacity once access is provided (Wassie & Ahlgren, 2024).

In face of these problems, a viable option emerges to enable photovoltaic energy in rural areas: the models of community grids, described by Opiyo (2016). Despite this possibility, the high initial costs still represent a barrier, which requires state subsidies to encourage the adoption of this format of solar energy generation. Likewise, photovoltaic microgrid systems, frequently adopted by rural populations, are also affected by high initial costs and face additional challenges, such as the risks arising from political uncertainties and ambiguities. Because of these identified problems, the adoption of photovoltaic microgrid systems in rural areas may be compromised by discouraging investor interest (Graber et al., 2018).

Another challenge identified in the category of economic viability is related to the difficulty of creating a 'payment culture' among solar energy users living in rural areas or rural communities. This occurs because, in many cases, the supply of electricity is the first public service to be made available in these locations. Thus, rural communities may not be aware of the necessity of paying to ensure the continuity of the service, which requires maintenance and periodic repairs to remain operational (Bikam & Mulaudzi, 2006; Eras-Almeida et al., 2023). However, Graber et al. (2018) show that people are willing to pay (Willingness to Pay - WTP) if reliability is high.

This problem is also common in photovoltaic microgrid systems, since the economic model of these systems differs considerably from the conventional model of power plants, which consequently increases the difficulties in making this type of photovoltaic solution viable in the long term. The self-sufficiency of microgrids is constantly questioned, as many of their users are either unwilling or even unable to bear the costs required for the supply and maintenance of photovoltaic systems (Graber et al., 2018).

Ihirwe et al. (2021) revealed that a significant portion of solar microgrid projects are in the early stages and subject to limitations, largely due to the lack of robust public policies and adequate financial support. In this way, the obstacles related to initial costs and the maintenance of energy services represent challenges that must be considered. To solve this problem, coordination among the State, institutions, and rural communities is necessary to develop specific strategies and public policies that guarantee the support and continuity of these systems (Zhao et al., 2023).

The second challenge identified in this study is the need to formulate specific public policies for each type of renewable energy and to create adequate regulations. This was evidenced because many studies emphasize that the energy policies created in many countries ignore the specificities of photovoltaic energy. From this perspective, the policies formulated and implemented often group together different types of renewable energy, and problems of this kind can discourage the implementation of certain types of renewable energy - such as solar photovoltaics - to the detriment of others (Castro et al., 2024; Graber et al., 2018; Mainali & Silveira, 2011; Silva et al., 2024; Zhao et al., 2023).

The study conducted by Castro et al. (2024), which compares energy derived from biogas with solar photovoltaics, suggests the importance of formulating and implementing differentiated public policies that can effectively promote each renewable energy source, considering their particularities (technical, economic and environmental) and their respective impacts.

Mainali and Silveira (2011) describes that the Nepalese government prioritizes rural electrification through specific policies that promote the use of renewable technologies, such as photovoltaic solar energy, in the rural context. However, the authors focus on programs that meet the specific needs of the rural population, and not on differentiated policies for each type of renewable energy, as is advocated in this category of analysis. Although the study focuses on the needs of the rural population, public policies and programs have enabled an increase in the demand for electricity from renewable sources in rural areas.

The lack of specific public policies aimed at photovoltaic systems can hinder the implementation of productive and residential solar energy arrangements, according to the distributed generation model. It is understood that the distributed generation model of photovoltaic solar energy can have a direct and positive effect on the living conditions of rural communities, improving quality of life and fostering sustainable development. It is therefore essential to create specific programs and policies to guide the technical and political decisions of public policy entrepreneurs and thus facilitate the implementation of photovoltaic solutions in rural communities (Silva et al., 2024).

An analysis of studies discussing micro and mini photovoltaic grids suggests that specific policies and regulations are essential to develop the particularities of these systems. Due to the dynamics present in this model, governments and political actors have constantly incorporated new measures based on experiences learned at both international and local levels (Graber et al., 2018; Księżopolski et al., 2020; Ihirwe et al., 2021). This scenario suggests that the development of integrated policies and regulations involving tariffs, electrification plans, licenses, among other needs, is essential for the structuring of solar mini and micro grids in rural communities (Ihirwe et al., 2021).

The third challenge identified in this analysis is characterized by the difficulty that photovoltaic systems have in obtaining **network access**, i.e., distributed solar power generation units installed in rural areas face great adversity in connecting to electricity transmission and distribution grids. However, the preference of rural communities and the government for connections to the centralized electricity grid may compromise the continuity of autonomous energy projects (Lestari et al., 2018).

Reinforcing this issue, Silva et al. (2024) highlighted that the studies identified in the literature on rural distributed generation and energy poverty are predominantly linked to isolated systems, to the detriment of an approach based on the parameters of the distributed generation model connected to the grid.

Off-grid photovoltaic mini-grid installations represent a widely used option in rural areas of several countries, since in certain locations the difficulties of constructing interconnected network structures can be significant. In this context, solar-based microgrids are implemented to provide electricity to rural areas where the extension of the central grid is, in principle, neither technically nor economically viable (Graber et al., 2018; Wassie & Ahlgren, 2024). Nevertheless, this model may prove economically unfeasible for rural populations due to factors such as insufficient energy demand, high levels of consumption, and unmet load (Wassie & Ahlgren, 2024)

Finally, the final challenge identified in this systematic review is technological barriers. In this category, the results revealed that the implemented photovoltaic energy solutions are not adequately adapted to the context in which the solar panels will be installed. This problem indicates that these technologies are, in many cases, designed for urban environments or industrialized countries, where climate, infrastructure, and energy need contrast with those of rural regions or less industrialized countries (Eras-Almeida et al., 2023).

Beyond the technological barriers related to the difficulties of adapting photovoltaic technology imported from other countries, there are technical challenges that can affect the performance of photovoltaic panels, with the magnitude of this problem being intensified in rural areas. Borhanazad et al. (2013) described common problems identified in rural photovoltaic installations, such as: (a) environmental factors, including dust and debris, may reduce the efficiency of photovoltaic systems. To prevent such problems, regular maintenance and cleaning of the panels are essential; (b) the lack of adequate technical and commercial information may hinder sound economic decision-making.

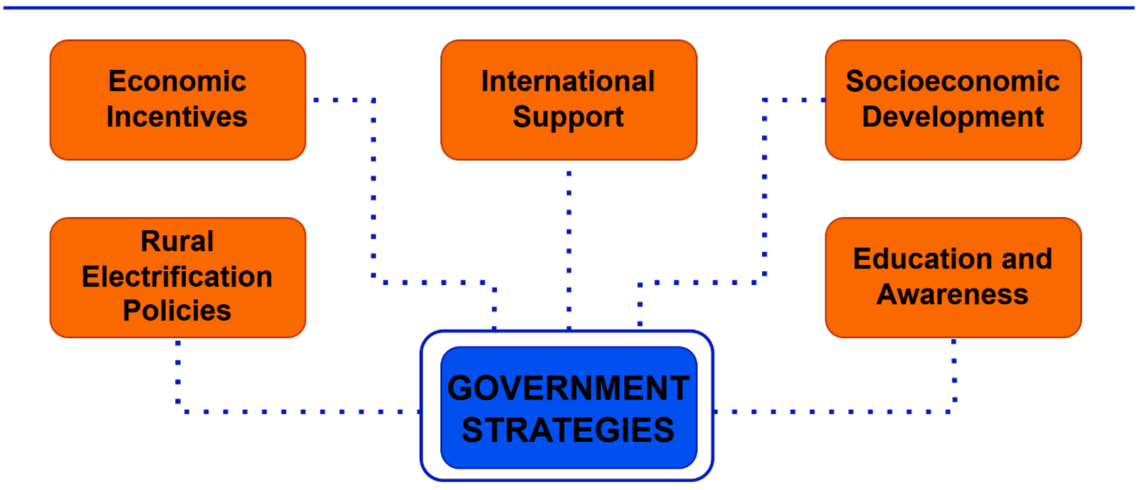
When considering the technological capacity of photovoltaic systems in rural areas, Al-Saidi & Lahham (2019) and Lestari et al. (2018) emphasize that the lack of technical knowledge among farmers, along with the limited involvement of public institutions in providing even minimally adequate technical support, are considerable challenges. These should be addressed through the training and capacity-building of personnel to deal with the maintenance of this type of technology.

In comparative terms, Lestari et al. (2018) found that solar technology poses greater technical challenges than hydropower, largely due to its greater fragility and complexity. Aligned to the category of technological barriers, the authors further highlight that the lack of technical support for maintenance and the scarcity of replacement parts undermine the continuity of solar projects. In connection with this issue, Bikam and Mulaudzi (2006) observed that, during the implementation phase of photovoltaic systems, one of the most recurrent challenges is the maintenance logistics and the component replacement. It is worth stressing that problems of this nature can become even more complex in rural contexts.

3.3 Government strategies to make photovoltaic energy viable in rural areas

Although the study identified the main challenges and difficulties, this systematic review essentially highlights government strategies. To this end, five strategies that were identified can be used by public authorities to promote the adoption of photovoltaic energy in rural areas (Figure 3).

Figure 3 - Government strategies to stimulate the adoption of photovoltaics



Source: prepared by the authors.

The strategies identified show that government economic incentives are widely used instruments, especially financial mechanisms. Among these mechanisms, the most common are the feed-in tariff and net-metering, which have contributed the most to increasing the adoption of solar panels in various countries.

In the global context, a predominance of programs operating through a political strategy of economic incentives has been identified. Nevertheless, public policies based on Feed-in Tariffs (FITs) have stood out for their benefits, primarily by establishing long-term contracts that ensure higher monetary returns for energy producers who sell the surplus of renewable energy generated (Arnette, 2013). This idea is reinforced by Tate et al. (2012), who point out that the creation of FIT-based programs is a promising public policy to encourage the adoption of photovoltaic panels in rural areas.

It is worth highlighting that economic incentives can be understood as specific public policies aimed at solar prosumers (producers and consumers). Among the principal methodologies to promote the implementation of photovoltaic systems in rural contexts, programs based on FITs and the Net Metering system are examples. It is possible to state that the creation of these instruments has led to an exponential increase in photovoltaic installations in many countries (Tate et al., 2012; Silva et al., 2024).

When considering the study by Silva et al. (2024), which focuses on distributed generation in rural communities, the researchers highlight that the formulation and implementation of FIT policies can be an appropriate strategy to encourage the creation of solar energy cooperatives, thereby making the commercialization of surplus energy more accessible.

Another point identified is that government subsidies can help reduce the initial cost of installing photovoltaic systems, thereby increasing accessibility for consumers (Kumar et al., 2020). It is understood that the purpose of lowering the implementation costs of these systems is an effective strategy capable of promoting the widespread adoption of solar panels, including rural areas. The combination of FIT policies, tax incentives, and subsidies allows for cost reductions and constitutes government instruments that can increase the rate of return on investments in photovoltaic systems (Al-Saidi & Lahham, 2019; Księżopolski et al., 2020).

The second strategy identified in this study is rural electrification policies, which consist of government actions that can be adopted to expand access to electricity in remote areas, as is the case of rural populations. However, the continuity and effectiveness of government programs are decisive factors for the expansion and sustainability of the solar energy market (Ondraczek, 2013). For this reason, Lestari et al. (2018) emphasize that the implementation of rural electrification policies and programs should consider not only the immediate supply of electricity, but also its long-term sustainability, the continuous support of the government and other stakeholders, as well as the possible challenges arising from connecting these rural systems to conventional power grids.

Studies by Ihirwe et al. (2021) indicate that government support has enabled the creation of specific policies and national electrification regulations, ensuring that rural populations can access and maintain electricity through photovoltaic mini-grid systems. The main benefits provided by the materialization of these public policies and electrification regulations include income generation, energy autonomy, energy democracy, and community empowerment (Silva et al., 2024).

Zhao et al. (2023) describe how the Photovoltaic Poverty Alleviation Projects implemented in China have established conditions to make photovoltaic systems more accessible to rural communities that have historically been marginalized in terms of access to electricity. The results presented by the authors reveal that the communities served by the program experienced a significant reduction in energy poverty, which consequently translated into financial and economic gains.

From the perspective of off-grid rural electrification, it is clear that policymakers must carefully analyze local specificities during the planning and implementation of government programs. To this end, it is necessary to assess the various factors that make up the local context, among which the following stand out: (a) access to and availability of equipment; (b) nature and intensity of rural productive activities carried out by the community; (c) specific regional climatic conditions; and (d) socioeconomic characteristics. Under this logic, it is understood that the adaptation of programs to the specific needs of each community is a determining factor in ensuring the effectiveness and sustainability of rural electrification initiatives (Wassie & Ahlgren, 2024).

In light of these considerations, it is clear that government support is a determining factor in enabling the installation of micro and mini solar grid systems in rural areas. For this, rural electrification policies must be structured to encourage the adoption of solar panels and, at the same time, improve operating models to increase sustainability and profit margins (Graber et al., 2018; Ihirwe et al., 2021).

The third strategy identified concerns socioeconomic development, as public policies designed for the population should encourage the use of solar energy, not only for domestic use but also for productive activities in the countryside, thus promoting social inclusion around photovoltaic projects. Materialization of policies of this nature makes it possible for photovoltaic systems to meet the energy needs of rural producers, in addition to maximizing financial profitability, which can be converted into development (Al-Saidi & Lahham, 2019; Mugisha et al., 2021; Wassie & Ahlgren, 2024).

The analysis of the social inclusion dimension revealed low participation of women in decision-making processes for solar energy projects. Given this inequality, public policy formulation must include women from the design to the implementation of photovoltaic solutions. These differences can be corrected through participatory methods, which promote more inclusive regional development by recognizing the role of women as agents of change in their own communities. Following this logic, it becomes essential for residents to strengthen community ties to minimize gender inequalities and ensure the effective involvement of women in medium- and long-term projects (Eras-Almeida et al., 2023).

Among the strategies identified in this study, the fourth deals with education and awareness, since the studies analyzed suggest that this component tends to be the most neglected in rural electrification policies. In this category of analysis, there are two distinct but interrelated dimensions: first, the need for technical training for the operation and maintenance of photovoltaic systems; second, broader efforts to raise awareness of the environmental benefits of decarbonizing the energy matrix. Given this situation, it is clear that the absence of robust educational programs can compromise even technically well-executed projects, since rural communities without adequate knowledge may have difficulty solving basic operational problems (Borhanazad et al., 2013; Lestari et al., 2018).

According to Zhao et al. (2023), farmers' social class and educational level significantly impact energy poverty reduction. This suggests that reducing energy poverty is not only a technical problem but also a social one, with social class and educational level acting as determining factors in the energy transition process. From this perspective, it is clear that by prioritizing educational policies and providing economic and financial support, public authorities can fundamentally offer opportunities for rural communities to participate in the transition to clean energy sources.

In addition, the way rural residents interact with one another often shapes their decisions about adopting green technologies. From this perspective, government intervention strategies can continue to support the adoption of solar energy through education and awareness programs that promote social learning (Liu et al., 2023). Ondraczek (2013) adds that there is a virtuous cycle between the growing spread of photovoltaic solar systems and the increase in consumer awareness, which occurs mainly through word of mouth.

Kumar et al. (2020) are categorical and argue that sustainable purchasing behavior and government policies are factors responsible for increasing consumer awareness of solar energy product adoption. This indicates the need for government strategies to increase awareness among rural consumers and other consumer groups about photovoltaic technologies and their applications. Thus, awareness campaigns and direct subsidies to new entrants can substantially increase understanding and acceptance of solar technology (Ondraczek, 2013).

Finally, the last governmental strategy for the development of photovoltaic systems identified in this study concerns the establishment of partnerships with international organizations. The collaboration among various international institutions, such as the World Bank and the Organisation for Economic Co-operation and Development (OECD), can contribute to enabling public policies that foster the development of photovoltaic energy systems in several countries, particularly in remote communities such as rural populations (Graber et al., 2018).

The support of international organizations strengthens the development of photovoltaic systems through: (a) the establishment of multilateral partnerships; (b) the provision of financial resources; (c) the provision of technical support; and (d) the implementation of incentive policies. The use of these mechanisms, when properly planned and executed, can accelerate the process of implementing solar systems in regions with precarious electrical infrastructure (Mugisha et al., 2021).

Public subsidies from international organizations or national budgets for the installation of photovoltaic solar systems help mitigate the negative consequences of using fossil fuels in energy production and directly improve the economic conditions of the most vulnerable rural populations (Księżopolski et al., 2020).

Therefore, it is worth emphasizing that the pursuit of global partnerships, as suggested by the Sustainable Development Goals (SDGs), fits fundamentally within the support strategies of international organizations to promote photovoltaic solar energy. From this perspective, SDG 17 highlights the importance of strengthening the implementation and revitalizing the global partnership for sustainable development, which can be directly applied to the context of policies to promote photovoltaic solar energy in rural areas.

3.4 Critical analysis: Consensuses, debates and gaps

The systematic review allowed the identification of convergence points in international literature on the subject. It is observed that there is a consensus that economic viability represents the main barrier to the adoption of photovoltaic systems in rural areas, making government intervention an indispensable condition for making these projects feasible. Studies conducted in Asia, Africa, and Latin America point out that, in the absence of capital subsidies or feed-in tariffs, the initial cost remains inaccessible for low-income rural populations (Eras-almeida et al., 2023; Mainali & Silveira, 2011; Mugisha et al., 2021).

Furthermore, it was identified that the lack of local technical capacity for the operation and maintenance of the systems constitutes the main cause of premature project failures. This problem transcends geographical barriers, having been evidenced in different contexts, such as Indonesia, Colombia, and Ethiopia (Eras-almeida et al., 2023; Lestari et al., 2018; Wassie & Ahlgren, 2024).

However, the literature presents divergences regarding the most appropriate subsidy model and the form of interaction with the electrical grid. While Zhao et al. (2023) fundamentally advocate for the adoption of direct subsidies as a strategy for the immediate alleviation of energy poverty in China, authors such as Chang et al. (2019) and Mainali & Silveira (2011), on the other hand, warn of the risk of market dependency and suggest innovation- or credit-oriented policies, referred to by the authors as ‘smart subsidies’.

Another profound point of debate concerns user behavior in the face of conventional grid expansion. While Lestari et al. (2018) observed that off-grid systems are often abandoned once the power grid becomes available—even if it is unstable—authors such as Opiyo (2016) and Graber et al. (2018) argue that, in contexts like Kenya and India, the low reliability of the national grid motivates the population to maintain autonomous or hybrid systems, using them as a backup or even as a higher-quality primary power source.

The analysis of these 22 studies reveals that, despite the growing interest in the subject, critical theoretical gaps persist. There is a notable lack of longitudinal studies

(>5 years) that capture the social dynamics of post-implementation technological abandonment, as most research focuses on the implementation or initial adoption phase. Furthermore, impact measurement remains centered on domestic/consumptive use; although Wassie & Ahlgren (2024) explore productive use (PUE), there is a lack of evidence on how rural PV effectively transforms local income beyond basic subsistence. Finally, the absence of standardized indicators prevents direct comparability between different national policies, fragmenting findings into isolated local methodologies.

4 FINAL REMARKS

This systematic review has identified that rural populations and communities in various countries still have difficulties accessing energy due to a series of structural problems, such as the lack of adequate grid infrastructure, high installation costs, the absence of public subsidy policies, inadequate regulations and technological barriers. In theory, these identified challenges are not restricted to the rural context alone; problems of this nature could jeopardize the global energy transition movement and the expansion and diffusion of photovoltaic solar energy around the world.

A recurring challenge identified in the literature analyzed refers to the formulation of specific public policies for photovoltaic systems. The studies show that most policies aimed at the energy transition approach photovoltaic solar energy in a generic way, integrating it with other renewable sources without considering its technical and operational specificities.

This research found that rural dwellers have difficulties related to the high economic cost of photovoltaic technologies, which is seen as a major factor affecting rural dwellers' participation in the energy transition. It is therefore essential that public authorities act to reduce economic problems, making photovoltaic energy more viable and encouraging the rural population to get involved in the process of transitioning to green energy.

In this sense, the findings of this study suggest that the formulation, implementation and continuity of public policies aimed at the adoption of photovoltaic systems in rural areas can generate multidimensional benefits for local populations. These benefits include: (a) economic development; (b) increased access to energy; (c) energy sovereignty; (d) environmental preservation; (e) improved quality of life, (f) income generation; (g) community strengthening; and (h) local empowerment.

Considering that the general objective of this research was to identify, through a systematic literature review, the government strategies used to make photovoltaic energy viable in rural areas, as well as to analyze the main challenges and difficulties faced in this context. As a result of the analysis, four critical challenges and five key government strategies were identified to promote the implementation of photovoltaic systems in these locations.

The government strategies identified include economic incentives, rural electrification policies, socio-economic development initiatives, education and awareness programs, and international support. Their implementation can solve public challenges in the expansion of rural photovoltaics. The energy transition offers environmental, economic and social benefits in line with the SDGs.

This systematic review study contributes to a theoretical model based on various international studies, which have revealed that government strategies are mechanisms that enable access to rural electricity to materialize. The findings of this research offer strategic guidelines for public policymakers involved in processes to implement photovoltaic systems in rural contexts.

The limitations of this study stem fundamentally from methodological heterogeneity, characterized by the coexistence of qualitative approaches, such as institutional analysis, and quantitative methods, such as Partial Least Squares Structural Equation Modeling (PLS-SEM) and techno-economic simulations. This diversity hinders the performance of direct meta-analyses due to the lack of standardization in the indicators used to measure policy success.

Another identified limitation refers to the geographical concentration of studies in the Global South, especially in East Africa and Asia, which may lead to a contextual bias. The specific challenges of developing countries, such as the lack of a payment culture and dependence on external resources, may limit the generalizability of the results to the Global North, where technological adoption is predominantly driven by market incentives and environmental values rather than basic access needs.

Finally, potential search biases must be considered, as the prioritization of keywords related to 'public policies' and 'government programs,' combined with the restriction to peer-reviewed journals, may have unintentionally excluded market-driven initiatives and relevant technical data frequently found in grey literature, such as government reports and technical documents, which typically encompass the most recent updates on rapidly evolving solar technologies.

REFERENCES

Al-Saidi, M., & Lahham, N. (2019). Solar energy farming as a development innovation for vulnerable water basins. *Development in Practice*, *29*(5), 619-634. https://doi.org/10.1080/09614524.2019.1600659

Arnette, A. N. (2013). Integrating rooftop solar into a multi-source energy planning optimization model. *Applied Energy, 111*, 456-467. https://doi.org/10.1016/j.apenergy.2013.05.003

Bikam, P., & Mulaudzi, D. J. (2006). Solar energy trial in Folovhodwe South Africa: Lessons for policy and decision-makers. *Renewable Energy, 31*(10), 1561-1571. https://doi.org/10.1016/j.renene.2005.07.015

Borhanazad, H., Mekhilef, S., Saidur, R., & Boroumandjazi, G. (2013). Potential application of renewable energy for rural electrification in Malaysia. *Renewable Energy, 59*, 210-219. https://doi.org/10.1016/j.renene.2013.03.039

Castro, P. H. G., Oliveira Filho, D., Rosa, A. P., Gracia, L. M. N., & Silva, T. C. A. (2024). Comparison of externalities of biogas and photovoltaic solar energy for energy planning. *Energy Policy, 188*, 114070. https://doi.org/10.1016/j.enpol.2024.114070

Chang, R., Cao, Y., Lu, Y., & Shabunko, V. (2019). Should BIPV technologies be empowered by innovation policy mix to facilitate energy transitions?-Revealing stakeholders' different perspectives using Q methodology. *Energy Policy, 129*, 307-318. https://doi.org/10.1016/j.enpol.2019.02.047

Eras-Almeida, A. A., Vásquez-Hernández, T., Hurtado-Moncada, M. J., & Egido-Aguilera, M. A. (2023). A Comprehensive Evaluation of Off-Grid Photovoltaic Experiences in Non-Interconnected Zones of Colombia: Integrating a Sustainable Perspective. *Energies, 16*(5), 2292. https://doi.org/10.3390/en16052292

Garlet, T. B., Ribeiro, J. L. D., de Souza Savian, F., & Siluk, J. C. M. (2020). Value chain in distributed generation of photovoltaic energy and factors for competitiveness: A systematic review. *Solar Energy, 211*, 396-411. https://doi.org/10.1016/j.solener.2020.09.040

Graber, S., Narayanan, T., Alfaro, J. F., & Palit, D. (2018). Solar microgrids in rural India: Consumers' willingness to pay for attributes of electricity. *Energy for Sustainable Development, 42*, 32-43. https://doi.org/10.1016/j.esd.2017.10.002

Ihirwe, J. P., Li, Z., Sun, K., Bimenyimana, S., Wang, C., Asemota, G. N. O., ... & Mesa, C. K. (2021). Solar PV minigrid technology: Peak shaving analysis in the East African community countries*. International Journal of Photoenergy, 2021*(1), 5580264. https://doi.org/10.1155/2021/5580264

Kaiser, M., Bernauer, M., Sunstein, C. R., & Reisch, L. A. (2020). The power of green defaults: The impact of regional variation of opt-out tariffs on green energy demand in Germany. *Ecological Economics, 174*, 106685. https://doi.org/10.1016/j.ecolecon.2020.106685

Księżopolski, K., Drygas, M., Pronińska, K., & Nurzyńska, I. (2020). The economic effects of new patterns of energy efficiency and heat sources in rural single-family houses in Poland. *Energies, 13*(23), 6358. https://doi.org/10.3390/en13236358

Kumar, V., Hundal, B. S., & Syan, A. S. (2020). Factors affecting customers' attitude towards solar energy products. *International Journal of Business Innovation and Research, 21*(2), 271-293. https://doi.org/10.1504/IJBIR.2020.104819

Lahimer, A. A., Alghoul, M. A., Yousif, F., Razykov, T. M., Amin, N., & Sopian, K. (2013). Research and development aspects on decentralized electrification options for rural household. *Renewable and Sustainable Energy Reviews, 24*, 314-324. https://doi.org/10.1016/j.rser.2013.03.057

Lestari, H., Arentsen, M., Bressers, H., Gunawan, B., Iskandar, J., & Parikesit (2018). Sustainability of renewable off-grid technology for rural electrification: A comparative study using the IAD framework. *Sustainability, 10*(12), 4512. https://doi.org/10.3390/su10124512

Li, L., Gu, J., & Wu, D. (2024). Mechanism analysis of rural residents' participation in green energy transition: A community-level case study in Nanjing, China. *Heliyon, 10*(13). 10.1016/j.heliyon.2024.e33951

Liu, D., Qi, S., & Xu, T. (2023). Visual observation or oral communication? The effect of social learning on solar photovoltaic adoption intention in rural China. *Energy Research & Social Science, 97*, 102950. https://doi.org/10.1016/j.erss.2023.102950

Liu, J., & Lin, X. (2019). Empirical analysis and strategy suggestions on the value-added capacity of photovoltaic industry value chain in China. *Energy, 180*, 356-366. https://doi.org/10.1016/j.energy.2019.05.100

Mainali, B., & Silveira, S. (2011). Financing off-grid rural electrification: Country case Nepal. *Energy, 36*(4), 2194-2201. https://doi.org/10.1016/j.energy.2010.07.004

Micheletti, D. H. (2023). *A contribuição da energia solar fotovoltaica para o desenvolvimento rural sustentável*. [The contribution of photovoltaic solar energy to sustainable rural development] (Doctoral dissertation). Universidade Estadual do Oeste do Paraná, Marechal Cândido Rondon, Brazil.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *PLoS Medicine, 6*(7), e1000100. https://doi.org/10.1371/journal.pmed.1000100

Mugisha, J., Bergqvist, A., & Bymolt, R. (2021). Assessing the opportunities and challenges facing the development of off-grid solar systems in Eastern Africa: The cases of Kenya, Ethiopia, and Rwanda. *Energy Policy, 150*, 112131. https://doi.org/10.1016/j.enpol.2020.112131

Ondraczek, J. (2013). The sun rises in the east (of Africa): A comparison of the development and status of solar energy markets in Kenya and Tanzania. *Energy Policy, 56*, 407-417. https://doi.org/10.1016/j.enpol.2013.01.007

Opiyo, N. (2016). A survey informed PV-based cost-effective electrification options for rural sub-Saharan Africa. *Energy Policy, 91*, 1-11. https://doi.org/10.1016/j.enpol.2015.12.044

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*, n71. https://doi.org/10.1136/bmj.n71

Rogelj, J., Shindell, D., Jiang, K., Fifita, S., Forster, P., Ginzburg, V., Handa, C., Kheshgi, H., Kobayashi, S., Kriegler, E., Mundaca, L., Séférian, R., & Vilariño, M. V. (2018). Scenarios towards limiting global mean temperature increase below 1.5 °C. *Nature Climate Change, 8*(4), 325-332. https://doi.org/10.1038/s41558-018-0091-3

Sampaio, P. G. V., & González, M. O. A. (2017). Photovoltaic solar energy: Conceptual framework. *Renewable and Sustainable Energy Reviews, 74*, 590-601. https://doi.org/10.1016/j.rser.2017.02.081

Sen, S., & Ganguly, S. (2017). Opportunities, barriers and issues with renewable energy development-A discussion. *Renewable and Sustainable Energy Reviews, 69*, 1170-1181.

Silva, E. T., Martins, M. A. F., Rodríguez, J. L. M., & Ferreira, A. S. (2024). Evaluation of the influence of distributed generation on the well-being of the rural community using PLS-SEM. *Journal of Cleaner Production, 442*, 141023. https://doi.org/10.1016/j.jclepro.2024.141023

Souza, V., Figueiredo, A. M. R., & Espejo, M. M. D. S. B. (2024). Challenges and strategies for managing end-of-life photovoltaic equipment in Brazil: Learning from international experience. *Energy Policy, 188*, 114091. https://doi.org/10.1016/j.enpol.2024.114091

Spiller, E., Esparza, R., Mohlin, K., Tapia-Ahumada, K., & Ünel, B. (2023). The role of electricity tariff design in distributed energy resource deployment. *Energy Economics, 120*, 106500. https://doi.org/10.1016/j.eneco.2022.106500

Tate, G., Mzibabain, A., & Ali, S. (2012). A comparison of the drivers influencing farmers' adoption of enterprises associated with renewable energy. *Energy Policy, 49*, 400-409. https://doi.org/10.1016/j.enpol.2012.06.043

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management, 14*(3), 207-222. https://doi.org/10.1111/1467-8551.00375

Wassie, Y. T., & Ahlgren, E. O. (2024). Understanding the load profiles and electricity consumption patterns of PV mini-grid customers in rural off-grid East Africa: A data-driven study. *Energy Policy, 185*, 113969. https://doi.org/10.1016/j.enpol.2023.113969

Wen, D., Gao, W., Qian, F., Gu, Q., & Ren, J. (2021). Development of solar photovoltaic industry and market in China, Germany, Japan and the United States of America using incentive policies. *Energy Exploration & Exploitation, 39*(5), 1429-1456. https://doi.org/10.1177/0144598720979256

Zhao, Y., Shuai, J., Wang, C., Shuai, C., Cheng, X., Wang, Y., ... & Zhou, N. (2023). Do the photovoltaic poverty alleviation programs alleviate local energy poverty?-empirical evidence of 9 counties in rural China. Energy, 263, 125973. https://doi.org/10.1016/j.energy.2022.125973

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4. Funding acquisition	√	√	√
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6. Methodology	√		√
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Data will be available upon request