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Transitioning to Renewable Energy in Small Island Developing States: Current Status, Opportunities, Challenges, and Policy Pathways for a Sustainable Future

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Abstract: Small Island Developing States (SIDS) face disproportionately high energy costs due to heavy reliance on imported fossil fuels for energy and transportation. This dependency exacerbates economic instability, undermines environmental sustainability, and heightens vulnerability to climate change impacts. However, SIDS' geographic isolation and abundant natural resources including solar, wind, and geothermal energy, position them to leverage renewables for energy security. This study conducts a systematic literature review to analyze opportunities, challenges, policy responses, and case studies related to renewable transitions in SIDS. Findings reveal that the gradual adoption of renewables has reduced fossil fuel dependency and stabilized energy costs by insulating SIDS from volatile global markets. Renewables

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also curb carbon emissions and enhance climate resilience, as demonstrated by solar microgrids in Tuvalu and wind-diesel hybrids in Cape Verde. However, transitions are hindered by high upfront costs, land scarcity, and fragmented grids. The study recommends aligning SIDS' energy policies with global climate targets (e.g., the Paris Agreement), deploying decentralized systems tailored to island geographies, and strengthening international finance mechanisms to address equity gaps. Prioritizing localized energy audits, community engagement, and regional partnerships could further accelerate progress toward a sustainable energy future.

Keywords: climate change; energy security; decentralized energy systems; climate resilience

1. Introduction

Small island developing states (SIDS) are recognized as a distinct group of island countries that share similar ecological, economic and environmental challenges. The thirty-nine SIDS are located in three geographical regions in the world: the Caribbean, the Pacific, and the AIMS region (the Atlantic, Indian Ocean, Mediterranean and South China Sea) [1].

The majority of SIDS are located far from the mainland, which makes it challenging to access transportation, technology and global markets. The small size of SIDS has resulted in the presence of less arable land and clean freshwater, which restricts agricultural production, industrial development and economic diversification. Therefore, SIDS often rely on imported agricultural and manufactured products and fossil fuels to meet the food, commodity and energy needs of the countries [2,3].

Furthermore, the energy demand in SIDS has continued to increase throughout the past decades. This is due to increased tourism and trade activities, increased population growth, economic growth and diversification, and advancement of technology and transport sectors which require energy-intensive applications. It has been reported that the cost of energy in the transportation sector in SIDS is significantly higher than in non-island countries [4,5]. SIDS do not have grid connections between adjacent islands or the mainland due to the high costs associated with submarine transmission cables. Extreme weather conditions can also affect the reliability of the power supply in SIDS. Due to economic constraints, rural areas in SIDS may not have access to a continuous power supply [6]. Therefore, to satisfy the increasing demand, the energy sector in the majority of SIDS relies on imported fossil fuels. Approximately 60% of SIDS import over 90% of their fossil fuel supply for electricity generation. The fluctuations in fuel prices result in increasing import costs, which in turn can significantly impact the economic stability of SIDS [1]. It has been estimated that some SIDS spend more than 20% of their import costs on the importation of fossil fuels, which can result in reducing the amount of resources available for other critical development requirements [1,7].

However, energy is one of the basic requirements of a nation, which supports many associated industries and livelihoods. The main economic drivers of a country, including agricultural, industrial and tourism-related activities, are highly dependent on a reliable and affordable energy supply. Access to affordable energy is a key determinant of the quality of life. Energy poverty is defined as the inability to access or afford clean energy for cooking or indoor heating [5]. In SIDS, people are affected by energy poverty due to unaffordable energy consumption costs and the unavailability of energy [8]. When people are affected by energy poverty, they need to spend more money on energy; thus, they will have less money to spend on other basic needs such as food and medical needs. This will lead to poor physical health conditions and result in mental stress [9]. Furthermore, Sustainable Development Goal 7 (SDG 7) by the United Nations aims to ensure access to affordable, reliable, sustainable and modern energy for all. The COP28 meeting focused on global collaboration in renewable energy implementation by investment projects for clean energy initiatives in underdeveloped nations, technology advancement, and capacity-building activities to achieve a more equitable, sustainable, and adaptable global energy system [10,11]. At COP28, a key energy goal related to SIDS was to significantly increase funding and support for their transition to renewable energy sources, which will help these nations to decentralize energy generation, diminish their reliance on imported fuels, and promote energy self-sufficiency at the national and global levels.

The present study focuses on assessing the key opportunities and challenges for adopting renewable energy in SIDS over the past decade. This is achieved by conducting a systematic bibliometric analysis and a literature review to identify the case studies from 2010-2024 that highlight both successes and obstacles in renewable energy projects in SIDS. In addition, the study assesses the policy responses in SIDS towards a successful transition from non-renewable to renewable energy sources. The literature review is organized as follows: Section 2 explains the methodology followed in the selection of literature and the bibliometric analysis. Sections 3-6 present the results of the literature review and the bibliometric analysis, and Section 7 presents the conclusions and recommendations.

2. Methodology

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed to screen documents for the literature review and bibliometric analysis [12,13]. Google Scholar, Dimensions AI and Scopus databases were used to search for literature. The keywords “Small Island Developing States” AND “Renewable Energy” AND “Sustainability” were used to find the relevant literature. Searches were restricted to full-text English publications issued from 2010 onwards. The literature search was conducted in April 2025. The inclusion and exclusion criteria and the number of articles selected at each step of the PRISMA are presented in Figure 1. The bibliometric analysis was conducted in VOSviewer 1.6.20.

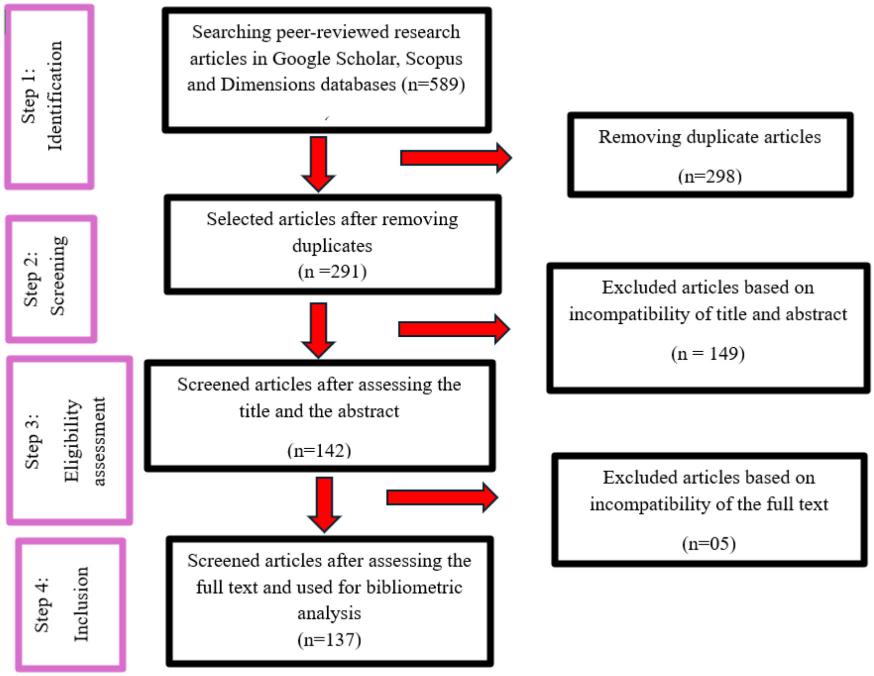

Figure 1. The flow diagram indicating the steps of selecting articles for the bibliometric analysis based on the PRISMA guideline.

The specific inclusion criteria for bibliometric analysis identified peer-reviewed journal articles that explicitly focused on SIDS, addressed renewable energy technologies, systems, or policies, and engaged with at least one sustainability dimension (environmental, social, or economic sustainability). Articles were excluded if they were duplicated across databases, were non-English, were published before 2010, were conference abstracts and if they did not explicitly integrate SIDS, renewable energy, and sustainability. Grey literature (including policy briefs, government reports, working papers, and institutional reports) identified during the search process was screened but omitted from the bibliometric dataset to maintain methodological consistency and comparability, as citation-based bibliometric indicators are not uniformly applicable to non-indexed sources. However, highly relevant policy documents were reviewed qualitatively to provide contextual background where necessary.

3. Bibliometric Analysis

The initial search of Google Scholar (n = 358), Dimensions AI (n = 122) and Scopus (n = 109) databases resulted in 589 articles. At the screening step, 298 duplicate articles were removed, and the remaining 291 articles were assessed for eligibility by assessing title and abstract, and 149 articles were removed due to non-compatibility with the objectives of the literature review and unavailability of full papers. After reading the full text, 5 articles were excluded because of non-compatibility with the inclusion criteria and grey literature, and a total of 137 articles were selected for bibliometric analysis (Figure 1).

Time series analysis of the scientific literature related to renewable energy development in SIDS is presented in Figure 2. The time series analysis identifies the current status and helps to predict future research prospects in the related field [14]. According to the annual number of publications in the field of "Renewable energy in SIDS", two main phases can be identified: Phase 1 – Embryonic phase (2010-2015) and Phase 2 – Development phase (2016-2025). In the embryonic phase, from 2010 to 2015, this field showed a slow development. However, in the development phase (2016-2025), a significant increase in the number of publications compared with the previous phase can be identified, with the number of publications per year doubling compared to the previous phase (Figure 2). This significant improvement can be attributed to the identification of new renewable energy sources and the implementation of renewable energy projects in SIDS.

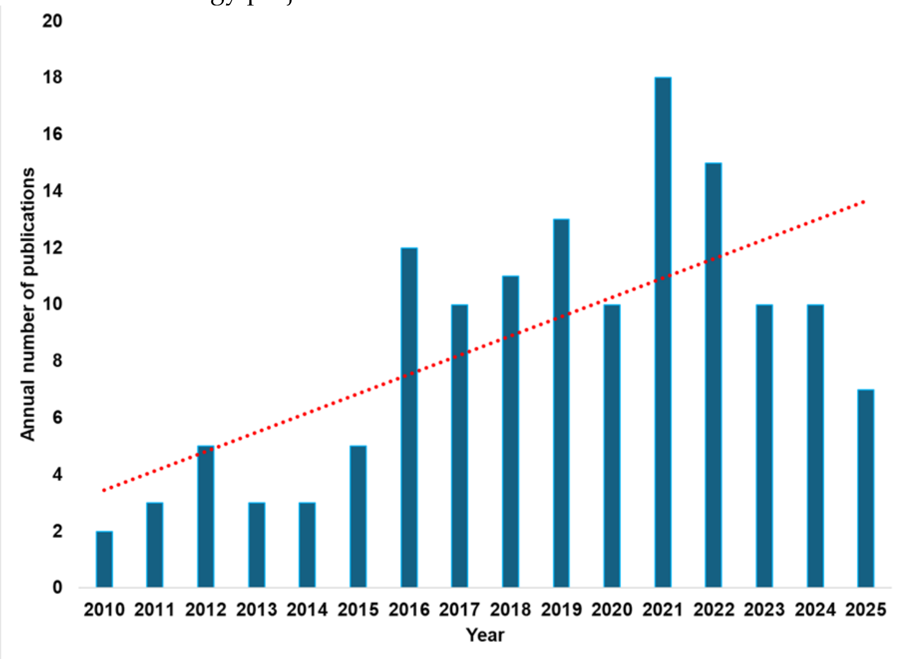

Figure 2. Annual number of publications related to renewable energy development in SIDS.

The global collaborative network map based on co-authorship between countries is presented in Figure 3. The size of a circle representing a country is positively correlated with the number of publications. The largest set of connected countries consists of 35 countries in 8 clusters based on collaborations. The USA, UK, Mauritius, Australia, and China are the countries with the highest number of publications (Figure 3).

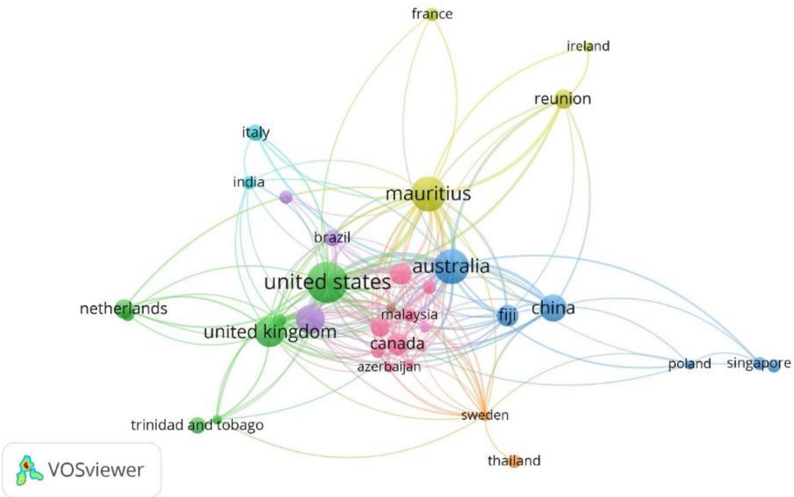

Figure 3. The global collaborative network map based on co-authorship between countries of the research on renewable energy development in SIDS.

The global collaborative network map based on co-authorship between research institutions is presented in Figure 4. The size of the circle representing an institution is positively correlated with the number of citations. Five clusters of institutions, consisting of 75 institutions, were identified. The University of Mauritius, the Beijing Institute of Technology, Beijing Normal University, the University of the West Indies, and the Australian National University showed the highest number of citations among other institutions in each cluster (Figure 4).

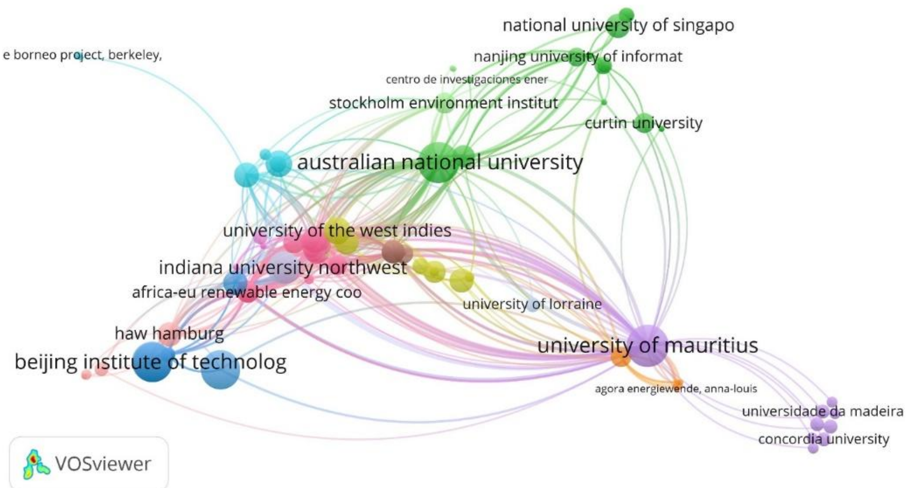

Figure 4. The global collaborative network map based on co-authorship between institutions of the research on renewable energy development in SIDS.

The overlay visualization map of institutions is presented in Figure 5. This map provides a visualization of research productivity at different institutions over the 2010–2025 period. The University of Mauritius and the University of the West Indies have significantly contributed to research on renewable energy development during the 2019-2021 period, while the Beijing Institute of Technology, Purdue University, Kyoto University and Delft University of Technology can be identified as the leading institutions that have made a significant contribution to this research area in the past three years (Figure 5).

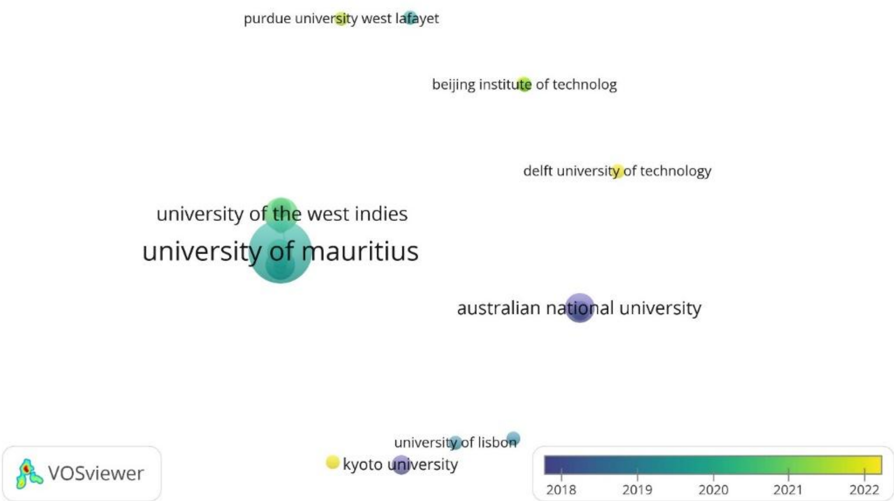

Figure 5. The overlay visualization map of the institutions according to the number of publications in each year.

4. Renewable Energy Resources in SIDS and Status of Usage

The data from the International Renewable Energy Agency shows that SIDS rely mostly on fossil fuels for electricity generation, despite the abundance of renewable energy resources [15]. Expanding electricity access and decarbonizing existing supplies are essential to increase access to clean energy and reduce local reliance on imports of fossil fuels.

The geographical location, unique climatic and environmental conditions support abundant renewable energy resources in SIDS, which could be utilized for sustainable energy production. Table 1 summarizes the growth in renewable energy capacity across major renewable energy sources between 2015 and 2024 for SIDS that have set a 100% renewable energy target for 2030.

Table 1. The increase in renewable electricity capacity from 2015-2024 in SIDS with 100% renewable energy targets by 2030 (Source: International Renewable Energy Agency (IRENA) 2025 [16]).

Country	Increase in renewable electricity capacity from 2015-2024 (MW)					Renewable energy share of electricity capacity (%)	Percentage increase of renewable energy share of electricity capacity from 2015-2024 (%)
	Solar	Wind	Hydropower	Bioenergy	Total		
Antigua and Barbuda	13	-	-	-	13	13.1	10.30
Barbados	67	1	-	-	68	19.2	18.00
Bahamas	19	-	-	1	20	2.5	1.900
Belize	6	-	-	9	15	39.9	0.84
Cuba	273	-	2	-	275	12.2	3.60
Dominica	-	-	1	-	1	30.2	4.100
Dominican Republic	1399	347	12	64	1822	37.4	19.00
Fiji	7	-	-	20	27	48.8	4.39
Grenada	3	-	-	-	3	5.5	3.40
Guyana	16	-	-	-	16	17.0	1.20
Haiti	2	-	20	-	22	17.0	3.80
Marshall Islands	2	-	-	-	2	7.9	4.400
Mauritius	120	10	1	-	131	32.6	10.40
Nauru	3	-	-	-	3	11.8	10.00
Palau	19	-	-	-	19	39.7	36.30

Papua New Guinea	4	-	68	-	72	34.6	-0.57
Saint Kitts and Nevis	4	-	-	-	4	7.7	2.50
Saint Lucia	4	-	-	-	4	5.5	4.60
Saint Vincent and the Grenadines	3	-	-	-	3	18.3	3.00
Solomon Islands	5	-	-	-	5	11.4	6.70
Vanuatu	6	-	-	-	6	37.0	11.10
Tokelau			Achieved the target by 2012/2013			87.8	1.20
Tuvalu	1	-	-	-	1	59.2	18.50
Niue	2	-	-	-	2	43.5	29.40
Cook Islands	3	-	-	-	3	23.1	5.50

The data reveal substantial differences associated with the trends of transition and expansion of renewable energy across SIDS. Several countries have demonstrated significant capacity additions and notable increases in renewable energy shares. However, some SIDS showed limited progress despite having ambitious policy targets. Solar energy can be identified as the dominant technology driving capacity expansion, particularly in the Caribbean and Indian Ocean SIDS. Wind and hydropower contributions are comparatively limited, except in specific countries with favorable resource endowments. Most SIDS that are targeting 100% renewable energy transition in 2030 are relying primarily on solar power-based renewable energy projects, whereas Haiti and Papua New Guinea are primarily relying on hydropower-based renewable energy projects (Table 1). The Dominican Republic (1822 MW) showed the highest increase in renewable energy generation capacity, followed by Cuba (275 MW) and Mauritius (131 MW) during the period from 2015 to 2024. Tokelau (87.8%) and Tuvalu (59.2%) had the highest share of renewable energy-based electricity in 2024.

The most significant increases in total renewable energy capacity were observed in the Dominican Republic (1822 MW), Cuba (275 MW) and Mauritius (131 MW). The main contributors to increased renewable energy in the Dominican Republic are solar (1399 MW) and wind (347 MW) power sectors, with a 19% renewable energy share increase, reaching 37.4% of total electricity capacity. This suggests strong policy implementation and investment mobilization compared to smaller island states. However, despite large capacity additions, Cuba’s renewable share increased by only 3.6%, indicating that fossil-fuel capacity expansion may also have occurred during the same period or that renewable additions remain proportionally small relative to the total system capacity (Table 1). In addition, in some SIDS small capacity additions of renewable energy have resulted in moderate absolute capacity increases and substantial percentage growth in renewable share. For example, Palau’s 19 MW increase resulted in renewable energy accounting for 39.7% of total capacity, reflecting structural vulnerability but also rapid transition potential in microgrid systems (Table 1). Similar trends were observed in Niue (+29.4% renewable share), Tuvalu (+18.5% renewable share) and Barbados (+18% renewable share). Several Pacific SIDS are comparatively advanced in renewable integration, mostly due to high diesel import dependence, strong international donor support, and distributed solar deployment. For example, Tokelau has achieved 100% renewable electricity as early as 2012/2013 and SIDS such as Tuvalu (59.2%), Fiji (48.8%) and Niue (43.5%) achieved more than 40% renewable energy integration (Table 1).

The minimal percentage growth of renewable energy capacity was observed in Belize (+0.84%), Guyana (+1.2%) and Bahamas (+1.9%). However, among these countries, Belize already contains a relatively high renewable share (39.9%), and therefore may have a limited percentage increase. In contrast, the Bahamas shows both a low renewable share (2.5%) and limited growth, whereas Guyana shows limited growth (+1.2%) despite a higher renewable share (17%) (Table 1). Moreover, Papua New Guinea recorded a slight negative change (-0.57%) despite a 68 MW hydropower increase. This may be attributed to the expansion of overall electricity capacity at a higher rate compared to renewable additions, thereby reducing the proportional share of renewables (Table 1).

4.1. Solar Power

The geographical location of most SIDS in the equatorial region has given access to abundant solar energy throughout the year, which can successfully be used as a clean, reliable and sustainable alternative to fossil fuels. Furthermore, the low cloud cover over many SIDS increases the efficiency and possibility of using solar power as a sustainable energy source [17]. The limitations on the available land area to install an adequate number of solar panels are a challenging topographic circumstance in SIDS. Therefore, alternative approaches such as using floating offshore solar installations and domestic rooftop solar installations are implemented to ensure efficient capturing and energy conversion [18].

Installation of solar panels on the roofs of new buildings or retrofitting them into existing buildings is identified as a feasible option in many SIDS when the available land area is limited. Moreover, the rooftop-mounted solar panels support the household self-supply and reduce the need for additional power generation for the domestic use [19]. Mega projects focusing on generating electricity using roof-mounted solar panels have been implemented in many SIDS, including Maldives [19], Barbados [20], Curaçao [21], Antigua and Barbuda [22], which are successfully contributing to increase the energy generation via the renewable energy sector.

Floating offshore solar panels represent a major technological advancement in the renewable energy sector; studies indicate they generate roughly 13% more power than onshore facilities across several SIDS [23]. Floating solar panel-based electricity generation is successfully practiced in the Maldives [18], Singapore [24] and Malta [25]. However, it is essential that the offshore installations be mounted on rigid structures to provide adequate support against the mechanical pressures caused by seawater and the wave action [25].

4.2. Wind Power

Wind power is one of the most promising options for renewable energy in the coastal areas of SIDS. The energy systems in SIDS can be sustainably planned by understanding the wind energy potential of a country. The maximum possible wind energy generation capacity and expected annual energy production are vital information in designing the national renewable energy strategies in SIDS. The wind energy yield of a country is highly dependent on the steady flow patterns, strength and speed of wind [26]. SIDS make use of both offshore and inshore installations of wind turbines to capture wind energy. The bathymetric features of SIDS and the shallow continental shelves provide high potential for harnessing the offshore wind energy [26]. Mauritius is actively promoting offshore wind energy-based electricity generation to achieve its renewable energy targets with an objective to generate 60% of its electricity from renewable sources by 2030 [23]. Furthermore, onshore wind-based electricity generation is successfully practiced in Cape Verde. The Cape Verde Wind Power project contains 32 onshore wind turbines installed on four islands and contributes to more than 25% of the total energy generated from renewable resources [27]. However, among other SIDS, the contribution of wind energy to total electricity generation is comparatively small (Table 1). The percentage of electricity generated by wind energy in African, Pacific and Caribbean SIDS are approximately 4.2%, 1.0% and 0.8% respectively [5,20].

4.3. Hydropower

Hydropower is a significant and steady source of renewable energy for mountainous SIDS that receive abundant rainfall. The availability of abundant inland water resources also facilitates the cultivation of biofuel crops such as coconut and palm trees which aids in supporting local economies and reducing dependence on imported fossil fuels. Large-scale hydropower electricity generation has been practiced in Fiji for nearly four decades, and the country is currently observing the potential to expand the hydropower generation capacity with the objective of achieving 100% renewable electricity by 2030 [28,29].

Recent research has identified the possibility of establishing Seawater Pump Storage hydropower systems in some SIDS, including Trinidad and Tobago [30], and Curaçao [31] to support grid stability and reliability and to store excess energy generated from intermittently available renewable sources such as solar and wind power.

4.4. Geothermal Power

Many SIDS are exploring the potential of using geothermal power as a renewable energy source, due to the low carbon emissions, its reliability during the extreme weather events and the ability to generate large capacity of energy with fewer resources. The ability to use geothermal power as a renewable energy source is dependent on the geological setting, abundance and status of geothermal features, presence of recent or active volcanism and availability of any chemical geothermometric features. The high-enthalpy geothermal sources have a temperature higher than 150 ℃ and can be used for power generation and heat. These sources are present in the tectonically active geographic regions on Earth [32]. Among SIDS, Papua New Guinea, which is located on the Pacific Ring of Fire, at the junction of several tectonic plates has a high geothermal energy generation capacity and has constructed a 55 MWe geothermal power plant, which meets to 11% of the electricity needs of the country [33]. The potential for utilization of geothermal energy in Vanuatu, Samoa, Tonga and the Northern Mariana Islands have also been analyzed based on their geographical settings and the geothermal activities

[32]. Moreover, recent studies have identified a chain of geographically young volcanic islands in the Eastern Caribbean with thermal gradients that have the potential to be utilized for the geothermal power generation to meet the energy requirements in the Caribbean community [34].

4.5. Ocean Energy Resources (Wave and Tidal Power)

The oceans have considerable potential for utilization of mechanical, thermal, and chemical energy associated with tidal currents, thermal gradients, salinity gradients and wave action as renewable energy sources [35,36]. Ocean current-based renewable energy, mainly tidal and wave energy, holds significant potential for SIDS to diversify their energy sources and enhance energy security. The ocean currents that are generated due to tidal action can be harvested using marine current turbines installed in the coastal headlands and estuaries. The shoreline, offshore and near-shore wave power turbines can be installed along the coastlines of SIDS to utilize the energy in the waves for power generation. Recent research has assessed the availability of wave and tidal energy ranges and the potential for utilizing them as sustainable renewable energy sources in the Caribbean SIDS [37–39].

4.6. Biomass Energy Resources

Biomass energy derived from agricultural and forestry waste and manure is identified as a promising pathway for renewable energy generation in SIDS. The additional benefits of utilizing biomass for energy production include the reduction of solid waste, emissions and local pollution. The abundantly available biomass resources in SIDS are mostly used for domestic cooking purposes while only four countries - Mauritius, Papua New Guinea, Fiji, and Samoa - use biomass for sustainable power generation. Five biomass power plants with a total capacity of 102 MW are established in Mauritius, which significantly contribute to the renewable energy load in the country. Bagasse (sugarcane waste) is the main source of biomass for these power plants. However, the shifting of sugarcane growing practices to other agricultural and non-agricultural activities and discontinuation of traditional crop cultivation in the past decades have led to a reduction in the availability of bagasse for energy production. Therefore, recent studies are exploring the potential for using bamboo biomass as a source for biomass energy production in Mauritius [40,41]. Diverse biomass resources, such as crop residues, livestock manure, municipal solid waste, sewage sludge, logging residues, and sawmill residues, contribute to biomass energy generation in Fiji, Samoa and Papua New Guinea [28,42]. In addition, the potential of using invasive plant species for biomass energy generation has been extensively researched through pilot projects and small-scale biomass generation plants. However, soil degradation, infertility and erosion and unaffordability of efficient technologies are among the major challenges for utilizing biomass as a viable energy resource in most SIDS.

5. Challenges in Utilizing Renewable Energy Resources in SIDS

The challenges associated with the utilization and development of renewable energy resources can be discussed based on poor data availability, non-strategic policy and regulatory frameworks, financial, technological and infrastructure constraints and socio-cultural aspects [3].

Uneven distribution of renewable energy sources across SIDS makes it challenging for shifting from traditional fossil fuel-based energy to clean technologies. While SIDS may have high potential for solar and wind energy, the distribution of these resources can be uneven across different islands within a nation or even within a single island. According to the Gini index based on the Lorenz curve, the hydropower and solar resources are the most evenly distributed types of renewable energy. Wind power is the most unevenly distributed renewable energy resource [43]. Uneven distribution of renewable energy sources can result in financial constraints to fund the small-scale clean energy projects. Moreover, the energy crisis and the updated status of renewable energy usage in SIDS are underrepresented within the scientific literature, whereas the data regarding fossil fuel usage and associated costs are readily available. Poor documentation and limited research on the extent and availability of renewable energy resources in SIDS make it challenging to assess the viability of renewable energy projects. Therefore, the policy makers, investors and funding agencies lack access to relevant information to invest in sustainable renewable energy projects in SIDS.

Furthermore, the initial costs associated with the establishment of renewable energy infrastructure such as wind farms, solar PV systems, tidal turbines, and wave energy converters may not be affordable by the developing economies of SIDS. According to the IRENA, some SIDS need to allocate approximately US$5.9 billion annually to achieve their renewable energy targets by 2030. Therefore, public-private partnerships and international investors can play a key role in overcoming these financial constraints. However, the restrictions on foreign investment and small project sizes can be less attractive for foreign investors and can negatively impact investor perception. Therefore, mechanisms to attract donors and foreign investors should focus on appropriate financial mechanisms such as Feed-in tariff (FiT), tax incentives, and public-private partnerships [7].

Moreover, the limited awareness of the local communities on the advantages of renewable energy transitions may cause significant impacts on the implementation of renewable energy projects in SIDS. The long-term reliance on established and traditional fossil fuel power generation may prevent the general public from readily accepting new technologies [2]. Furthermore, the small population sizes of the communities in the marginal areas can further limit the size of the energy markets and thereby restrain investments in large-scale renewable energy projects [44].

SIDS often lack robust policy frameworks and regulatory mechanisms to support renewable energy utilization. Therefore, the renewable energy projects in SIDS are identified as high-risk investments by potential international investors and project developers [45]. Demonstration of a strong political relationship and a financial commitment between SIDS and the developed nations is pivotal to achieving the renewable energy targets in the next decade. Furthermore, international development partners can play a crucial role in leveraging investments, providing technical assistance, and supporting the development of SIDS-specific policies and regulations to establish a strong legal framework for investment in carbon offsetting projects in SIDS [45,46].

6. Policy Implications on Renewable Energy Projects in SIDS

SIDS are increasingly focusing on renewable energy policies and regulations to address energy security, reduce reliance on fossil fuels, and mitigate climate change. Many SIDS have set national targets for developing their renewable energy resources with many committed to achieving 100% renewable electricity generation by 2030 or 2050 [45]. These policy commitments reflect the strategic importance of renewable energy in addressing structural vulnerabilities in SIDS energy systems, including exposure to volatile fuel prices and high electricity generation costs.

Furthermore, some SIDS have implemented FiT, tax incentives, and regulatory frameworks to encourage investment in renewable energy infrastructure. The Renewable Energy Policy Network for the 21st Century (REN21) defines FiT as a renewables promotion policy that pays a guaranteed price for power generated from a renewable energy source, most commonly for each unit of electricity fed into the grid by a producer, and usually over a fixed long-term period. These schemes guarantee a fixed price for electricity generated from renewable sources, ensuring investment security and supporting the development of renewable energy projects [47]. The government of Jamaica has introduced a FiT system as an encouragement for investment in solar energy technologies and to reduce reliance on fossil fuels, with a target of achieving 20% of the energy needs from solar power by 2030. This has resulted in the launch of several small- scale and medium-scale solar projects across the island [48]. FiT, tax credits for renewable energy investments, carbon pricing, and subsidy reforms have proven effective in redirecting capital away from fossil fuel industries. The government of Mauritius uses FiT systems to promote the establishment of solar, wind and biomass energy projects to achieve its renewable energy targets. FiT can also allow policymakers to monitor and review the performance and effectiveness of the tariff policies and to incorporate feedback and lessons learned for improvement and adaptation of renewable energy technologies [49]. In addition, most SIDS use generic tax incentives and subsidies for the infrastructure associated with the renewable energy projects. Furthermore, levies on greenhouse gas emissions are considered as a cost-effective regulatory approach to reduce the reliance on fossil fuels. These levies can be significant contributors to government revenue, which in turn can be utilized to fund renewable energy projects [50].

However, despite the availability of these policy instruments, the implementation of renewable energy transitions in many SIDS remains constrained by limited financial resources and high levels of public debt. Many island economies face debt-to-GDP ratios that restrict their ability to invest in large-scale energy infrastructure, making renewable energy deployment heavily dependent on concessional financing, international climate funds, and multilateral development assistance.

Access to international climate finance mechanisms, therefore, plays a critical role in supporting renewable energy transitions in SIDS. Institutions such as the Green Climate Fund and the World Bank provide concessional financing and technical assistance for renewable energy projects, grid modernization, and energy efficiency improvements in vulnerable economies. Innovative financing mechanisms, including blended finance models and debt-for-climate swaps, have also been proposed as policy tools to alleviate debt burdens while enabling investment in sustainable energy infrastructure.

Furthermore, most of the existing legal frameworks related to energy security and sustainable energy utilization in SIDS operate as “soft law”, which serves as guidelines that encourage action rather than binding obligations. The UNFCCC (1992), the Kyoto Protocol (1997), and the Paris Agreement (2015) have established a legal framework that contributes to the development of international legal mechanisms to combat climate change by imposing specific commitments on states and providing the foundation for the implementation of renewable energy policies at national, regional and global levels [51]. Moreover, these international agreements establish mechanisms for international cooperation in climate mitigation and sustainable energy development. Aligning national renewable energy policies with these agreements can strengthen institutional coordination, facilitate access to climate finance, and support long-term strategies for achieving sustainable and equitable energy transitions in SIDS.

Overall, while policy instruments such as FiT and fiscal incentives have helped stimulate renewable energy development, achieving the long-term renewable energy targets of SIDS will require stronger financial support mechanisms, enhanced policy implementation capacity, and deeper integration with international climate governance frameworks. Therefore, the national energy targets and the national energy policies of SIDS need to be aligned with these international agreements and conventions to implement effective strategies for an equitable and accessible renewable energy transition.

7. Conclusion

This study examined the current status of the renewable energy capacity in SIDS and evaluated the policy and institutional frameworks supporting the transition toward sustainable energy systems. The analysis demonstrates that while many SIDS have established ambitious renewable energy targets, the pace and scale of implementation vary significantly across countries. Solar energy has emerged as the dominant driver of renewable capacity expansion, while wind, hydropower, and bioenergy play complementary roles depending on local resource availability and infrastructure capacity.

The findings highlight that several SIDS, including Mauritius, Barbados, and the Dominican Republic, have demonstrated notable progress in increasing renewable energy capacity through supportive policy frameworks such as FiT, fiscal incentives, and renewable energy investment programs. However, most other island states continue to experience slower progress due to financial constraints, limited grid infrastructure, and institutional capacity challenges.

The literature review on policy impacts emphasizes the importance of strengthening financing mechanisms for renewable energy development in SIDS. Access to concessional climate finance, blended finance instruments, and international development support is critical for overcoming investment barriers in small island economies with limited fiscal space. Partnerships with international institutions such as the Green Climate Fund, the World Bank, and the International Renewable Energy Agency can play a key role in mobilizing resources and technical expertise for renewable energy deployment.

The study also highlights the broader climate justice dimension of renewable energy transitions in SIDS. Although these countries contribute minimally to global greenhouse gas emissions, they face disproportionate climate risks and economic vulnerabilities. Therefore, international cooperation and financial support remain crucial to ensuring equitable and sustainable energy transitions in these regions. Aligning national renewable energy strategies with global climate agreements, including the Paris Agreement, can enhance policy coherence and facilitate access to international climate finance mechanisms.

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