Navigating Sustainable Development: A Study of Renewable Energy's Effects on SDGs in Somalia

Approach

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Declaration

DECLARATION

I, **Mr. Abdillahi Mohamed Ibrahim**, hereby declare that the thesis entitled: **"Navigating Sustainable Development: A Study of Renewable Energy's Effects on SDGs in Somalia"**

This is my original work and has not been submitted., either in part or in whole, for the award of any degree, diploma, or other qualification at this or any other institution.

This research was conducted under the supervision of **Dr. Eng. Adnan Aslam Noon** (Principal Supervisor). All sources of information, including data, literature, and intellectual contributions, have been appropriately cited and acknowledged in accordance with academic conventions.

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Approval Page

This is to certify that the thesis entitled:

"Navigating Sustainable Development: A Study of Renewable Energy's Effects on SDGs in Somalia"

submitted by

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in partial fulfillment of the requirements for the award of the degree of

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has been examined and approved by the undersigned examiners.

This thesis showcases the candidate's original research, completed under the supervision of the signatory.

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Abstract

The international shift towards sustainable and inclusive development has put renewable energy at the center of national policies seeking to realize the United Nations Sustainable Development Goals (SDGs). In post-conflict and fragile environments such as Somalia—where energy systems are disjointed, electricity access is low, and diesel generator and biomass use is high—renewable energy offers a feasible route towards economic recovery, environmental conservation, and social change. This research critically analyzes the nexus of renewable energy deployment and sustainable development in Somalia, with particular emphasis on how renewable energy supports the realization of important SDGs, especially SDG 7 (Affordable and Clean Energy), SDG 8 (Decent Work and Economic Growth), and SDG 13 (Climate Action), and indirect support for SDGs related to poverty, health, education, and water access.

A mixed-methods research design was used, integrating a standardized questionnaire sent to energy experts with in-depth interviews with main stakeholders in the public and private energy sectors. The results illustrate that renewable energy, especially solar photovoltaic (PV) systems, has enhanced electricity access in off-grid and underserved communities, reduced household and business energy expenses, and spurred local job creation. In addition, solar-powered applications are ever more powering public facilities, such as schools, health centers, and water systems, demonstrating the indirect benefits of renewable energy toward achieving multiple SDGs. Nonetheless, the study exposes a number of key impediments: excessive initial capital outlays, restricted access to funding, low public sensitization, fractured policies, and the absence of national monitoring systems of SDGs progress.

The research concludes that although renewable energy is a significant catalyst of sustainable development in Somalia, it will take coordinated action at the national level to reach its full potential. The regulatory frameworks must be fortified, financial opportunities expanded, technical capacity enhanced, and renewable energy planning incorporated into national SDGs objectives. Ultimately, the research places renewable energy not just as a way of enhancing energy access but also as a platform for inclusive, climate-resilient, and sustainable development in Somalia.

CHAPTER ONE

1.1 Introduction Background

In recent decades, billions of people in developing nations have been impacted by the energy problem and environmental deterioration. Human activity and population growth pose a potential to the availability of energy resources. The primary sources of energy for many of them are fossil fuels including coal, oil, and natural gas. The majority of energy sources are used as the primary fuel in power plants to provide the world's electricity needs. The world's energy consumption is still dominated by fossil fuels and coal, reaching 31.1% for oil and 28.9% for coal (IEA, 2015). However, given that coal and fossil fuels are expected to become extinct in the next 100 years, some nations are attempting to discover a way to address this issue. The potential answer involves transitioning to renewable energy sources or implementing energy conservation measures.

Not all nations are able to use renewable energy to meet their electricity needs. Countries all around the world have become increasingly urgent in the last few years to give sustainable development top priority, especially when it comes to tackling energy-related issues in developing regions. Somalia, a nation known for its ongoing efforts to achieve stability and economic prosperity, finds itself at a crucial point in its developmental journey. At the heart of this endeavor lies the urgent requirement for a dependable and sustainable energy infrastructure that can drive progress while adhering to international sustainability standards.

In the pursuit of global sustainable development, the energy sector emerges as a pivotal arena where transformative change can be both catalyzed and sustained. Somalia, a nation marked by its resilience in the face of multifaceted challenges, stands at the crossroads of developmental imperatives, seeking to not only meet its growing energy needs but also to harness this vital resource as a driver for broader societal advancement. Recognizing the intricacies of this juncture, this thesis endeavors to unpack the rationale underlying the assessment of renewable energy integration and its profound implications on the Sustainable Development Goals (SDGs) within the Somali context.

1.2 Problem Statement

This thesis addresses the critical issue of Somalia's limited access to contemporary energy sources, especially in rural and underserved regions, and its detrimental impact on the realization of Sustainable Development Goals (SDGs). Through an investigation into the socio-economic and policy barriers obstructing the widespread adoption of renewable energy technologies, the study aims to elucidate the intricate correlation between renewable energy integration and the advancement of two pivotal SDGs: SDG 7 (Affordable and Clean Energy) and SDG 8 (Decent Work and Economic Growth). By uncovering actionable insights, this research endeavors to inform targeted policy interventions and strategic initiatives geared towards mitigating energy poverty, fostering sustainable development, and steering Somalia towards a more resilient and prosperous trajectory. Through this endeavor, the study seeks to fill a crucial gap in understanding the nuanced interplay between renewable energy integration and the attainment of SDGs, thereby facilitating informed policy formulation and sustainable development planning in Somalia.

1.3 Research Objectives

The aim of this research is to provide a comprehensive understanding of the implications of renewable energy integration for Somalia's sustainable development goals, ultimately informing evidence-based policy formulation and planning processes. The sub objectives of this research are:

- To evaluate the current condition of energy infrastructure and its role in sustainable development in Somalia.
- To investigate the potential of renewable energy sources in addressing energy gaps and promoting sustainable development.
- To analyze the existing policy framework related to renewable energy in Somalia and its alignment with SDGs.
- To assess evaluate the socio-economic and environmental implications of integrating renewable energy into the energy mix in Somalia.

1.4 Research Questions

In light of the background, problem statement, and research aims, the research questions for this study are as follows:

- What is the current status of renewable energy integration in Somalia, and how does it impact progress towards the SDGs?
- How can renewable energy sources be leveraged to address energy deficiencies in Somalia, and what role can they play in advancing sustainable development?
- What is the alignment between existing policy frameworks related to renewable energy in Somalia and the targets outlined in the SDGs?
- What are the potential socio-economic and environmental benefits and challenges associated with the integration of renewable energy into the energy mix in Somalia?

1.5 Significance of the Study

The study "Navigating Sustainable Development: A Study of Renewable Energy's Effects on SDGs in Somalia" is highly significant for several reasons. Firstly, it addresses the contextual relevance of Somalia, which faces unique developmental challenges such as political instability, economic underdevelopment, and a lack of infrastructure. By focusing on this context, the study provides tailored solutions that consider these specific issues. Moreover, Somalia has considerable potential for renewable energy, especially in solar and wind resources. Investigating this potential offers insights into how renewable energy can be effectively harnessed in similarly challenging environments.

In terms of advancing Sustainable Development Goals (SDGs), the study demonstrates a multi-faceted impact. It examines how renewable energy influences multiple SDGs, including SDG 8 (Decent Work and Economic Growth), SDG 7 (Affordable and Clean Energy), and SDG 13 (Climate Action). By highlighting the interconnections between renewable energy and various SDGs, the study emphasizes the holistic nature of sustainable development and promotes integrated policy approaches.

The study also plays a important role in policy and strategy formulation. Its findings provide evidence-based recommendations that can inform policymakers in Somalia and similar contexts about the benefits and practicalities of investing in renewable energy. Detailed analyses within the study aid in creating targeted strategies for renewable energy deployment, ensuring that investments are both efficient and effective in achieving broader developmental goals.

Economic and social benefits are another key aspect of the study's significance. Renewable energy projects can lead to job creation, thereby contributing to economic development and poverty reduction. Additionally, reducing reliance on traditional biomass and fossil fuels can improve air quality and health outcomes. Reliable energy access facilitated by renewable sources can enhance educational facilities, creating better learning environments.

This study provides comprehensive insights into the role of renewable energy in promoting sustainable development in a challenging context like Somalia. It offers evidence-based recommendations that can help achieve multiple SDGs, supports policy formulation, highlights economic and social benefits, and contributes to global efforts in sustainable development and climate change mitigation.

CHAPTER TWO

2.0 Literature Review

The intersection of renewable energy integration and sustainable development goals (SDGs) has garnered global attention, as nations aims to strike a balance between environmental sustainability and economic growth. Within this context, Somalia, a nation navigating socio-economic challenges and energy deficiencies, stands poised to leverage renewable energy as a transformative force. This literature review examines key themes surrounding the impact of renewable energy integration on SDGs, with a focus on insights relevant to Somalia's unique context.

2.1 Renewable Energy Integration and Global Sustainable Development Goals:

The global discourse on sustainable development underscores the pivotal role of renewable energy integration in achieving SDGs. Research by UN agencies, like the United Nations Development Programme (UNDP) and the International Renewable Energy Agency (IRENA), provides foundational insights into the potential of renewable energy for addressing global challenges, emphasizing the interconnectivity between clean energy (SDG 7) and other SDGs, including poverty reduction (SDG 1) and climate action (SDG 13).

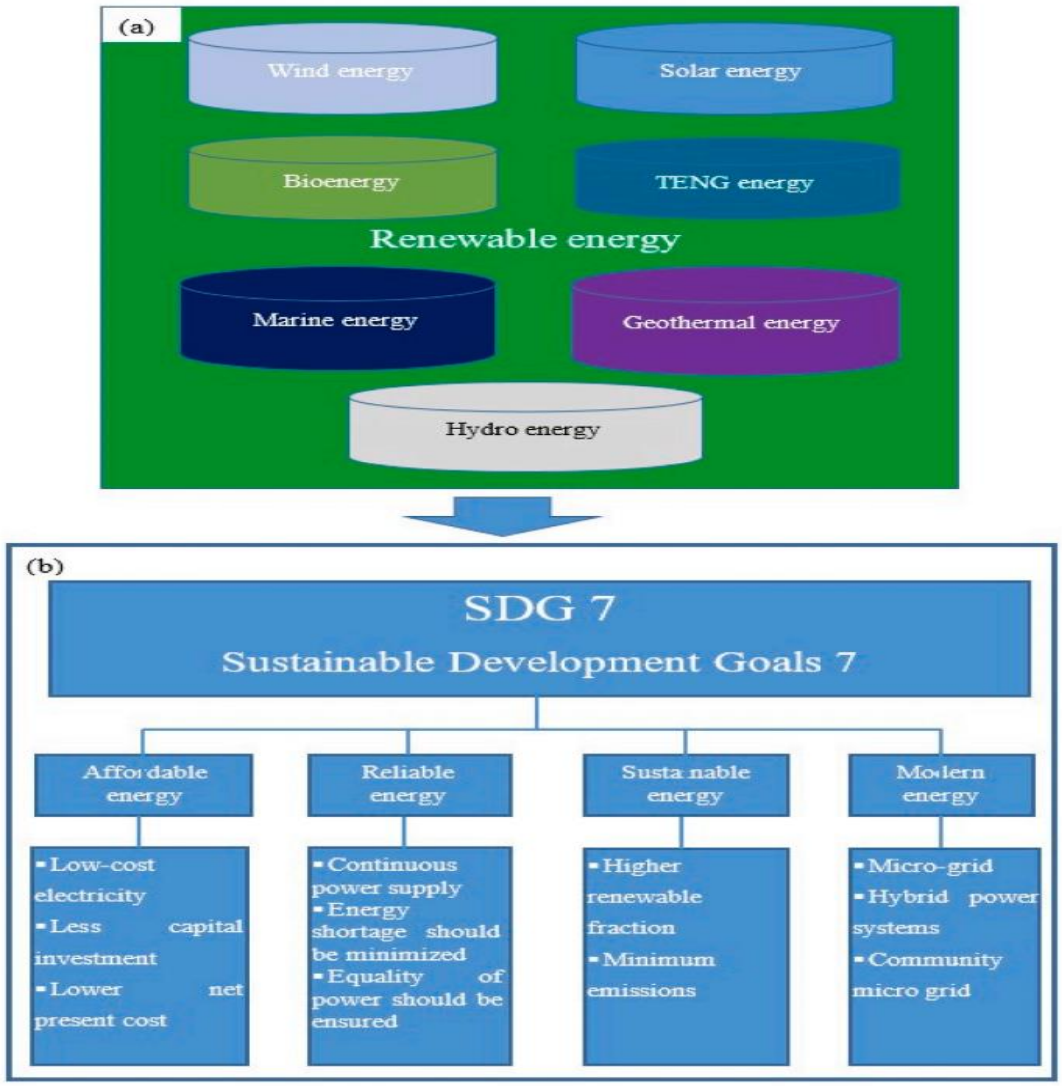


Figure 1. Renewable energy in sustainable development goals 7 targets.

2.2 Renewable Energy Initiatives in Developing Countries:

Studies on renewable energy projects in developing nations provides insightful viewpoints on obstacles and achievements. Works by scholars like Sovacool and Dworkin highlight the importance of context-specific strategies in promoting renewable energy adoption. This literature illuminates potential pitfalls and successes that can inform the design and implementation of renewable energy projects in Somalia.

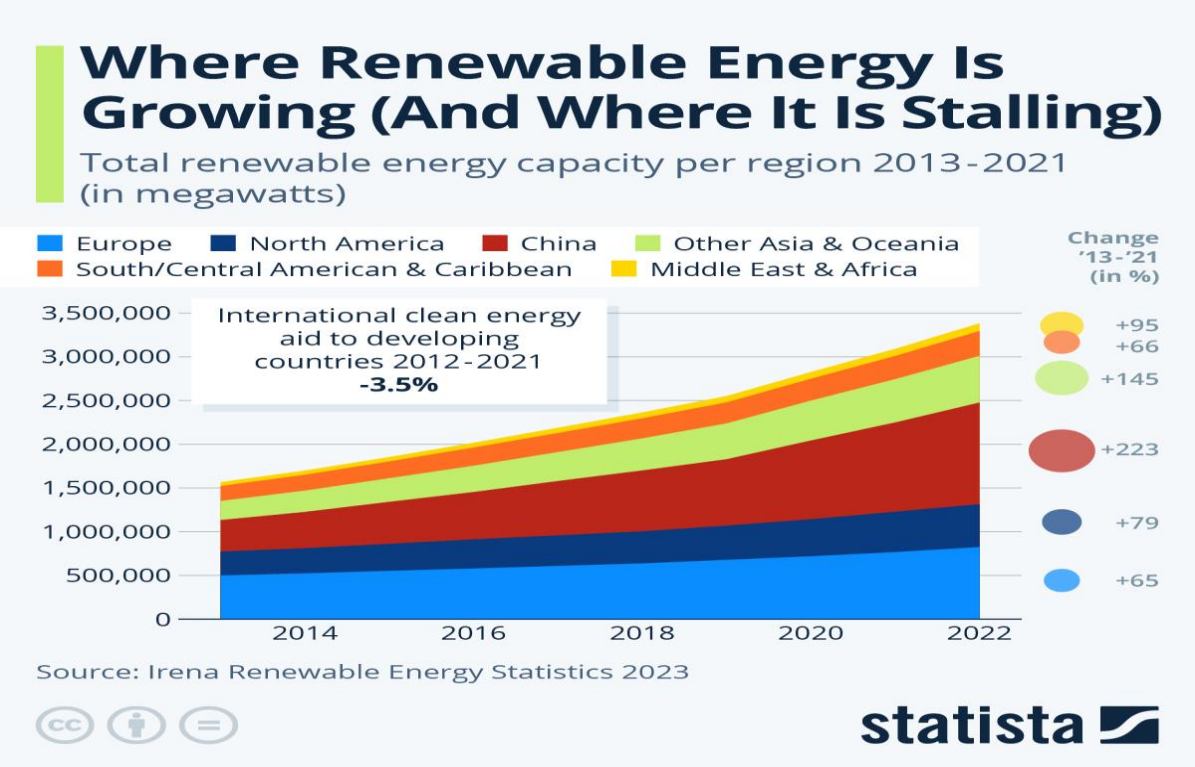


Figure 2. Where Renewable Energy Is Growing (And Where It Is Stalling)

The International Renewable Energy Agency has recently published a report revealing that the global capacity of renewable energy has more than doubled between 2013 and 2022. However, this growth has been unevenly distributed, with Europe leading in terms of large capacities and China making significant progress in the past decade.

On the other hand, regions such as South and Central America, the Middle East, and Africa have not witnessed substantial growth in renewable energy capacity during this period. This raises concerns about these regions being left behind in the global transition towards clean energy. Moreover, the reduction in international financial aid for clean energy research, development, and production in developing countries in 2021 has further exacerbated this issue.

In contrast, countries in Asia and Oceania, excluding China, have shown above-average growth in renewable energy capacity, which is now two-and-a-half times larger than it was in 2013. Although this region has surpassed North America in terms of installed megawatts of renewable energy, the slower progress outside of China can be attributed to the larger population in Asia.

Despite the significant increase in renewable energy installation, it is crucial to note that in 2021, only 27.8% of the world's electricity was generated from renewable sources. This represents a mere 0.2% increase from the previous year, as non-renewable energy production, particularly in China, gained momentum once again. When considering all energy sources globally, the share of renewables drops to just 8% in 2022. This highlights the long journey that renewable energy still has to undertake, especially in achieving a net zero emissions scenario by 2030, as emphasized by the International Energy Agency's data.

2.2.1 Socio-Economic Impact of Renewable Energy Integration:

Scholarly investigations into the socio-economic implications of renewable energy integration contribute significantly to understanding its potential in Somalia. Works by Komendantova et al. and Rai and Bhattarai provide insights into how renewable energy initiatives can alleviate poverty, create employment opportunities and enhance access to education and healthcare, aligning with specific SDGs.

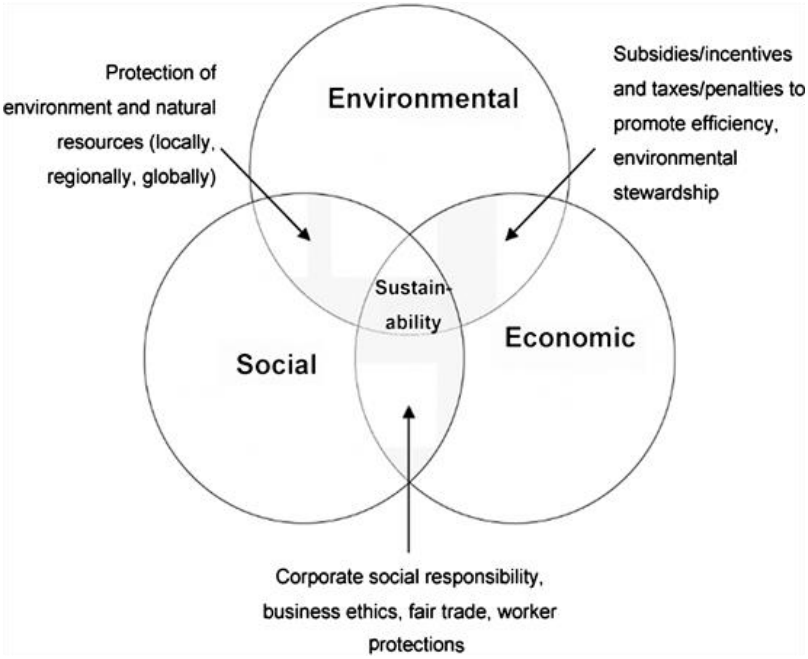


Figure 3. Sustainability as the meeting point of its three main components, and also instances of characteristics at the meeting point of any two components.

2.2.2 Environmental Sustainability and Climate Action:

The environmental sustainability of renewable energy integration is a crucial aspect explored in the literature. Studies by Lu et al. and Sovacool emphasize the role of renewable energy in mitigating climate change, underscoring the importance of SDG 13 in the pursuit of a sustainable and resilient Somalia.

2.2.3 Challenges and Opportunities in Renewable Energy Integration:

The literature recognizes challenges associated with renewable energy integration, including financing constraints, technological barriers, and institutional gaps. Works by Rai et al. and Bensch et al. shed light on strategies to overcome these challenges and emphasize the need for tailored solutions in the Somali context.

2.2.4 Regional and National Contexts:

Considering the significance of local contexts, literature specific to renewable energy initiatives in the Horn of Africa and Somalia enriches the understanding of regional dynamics. Works by Adaramola et al. and Ali and Said elucidate the particular difficulties and chances Somalia faces in pursuing sustainable energy.

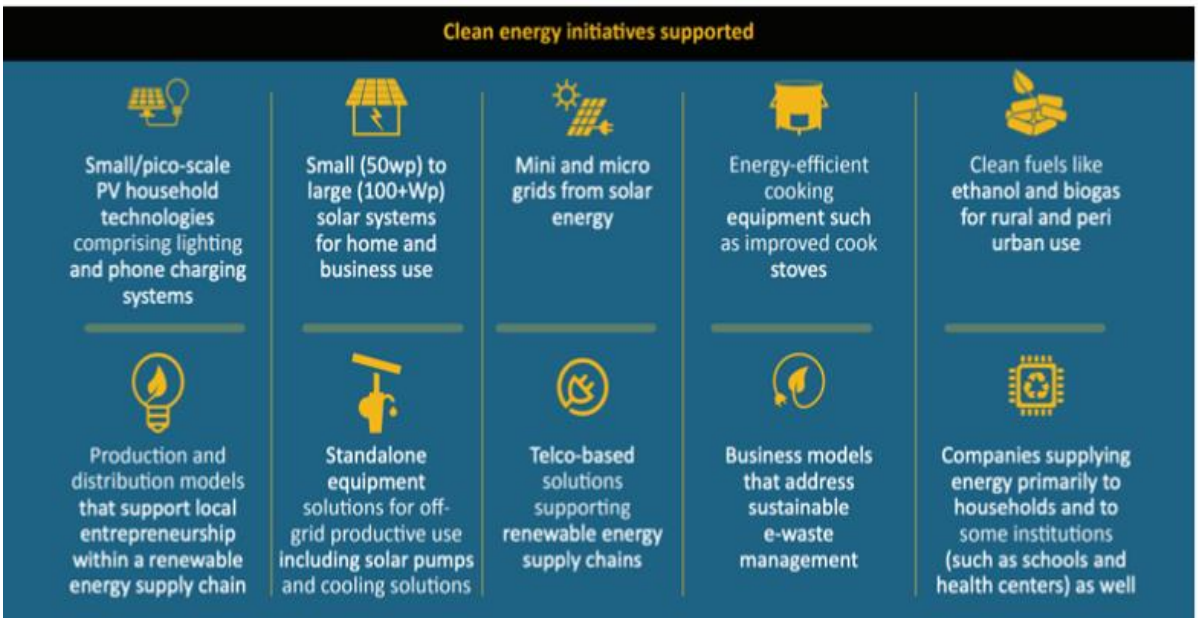


Figure 4. Clean energy initiatives supported

- AECF has launched 2nd round of REACT SSA for funding companies and microfinance institutions encouraging renewable energy deployment in Somalia
- It is open to commercially-viable and active entities, out of which 25% will be owned and managed by women.
- It encourages Somalian states of Hirshabelle, Southwest and Banadir since these were the least represented during the 1st round

Private companies in Somalia promoting the use of renewable energy can seek financial support from the Africa Enterprise Challenge Fund (AECF) and win between $100,000 and $1.5 million grants. It will be awarded once the winners achieve mutually agreed milestones (Anu Bhambhani, 2021).

To be awarded through Sub-Saharan Africa (SSA) and Renewable Energy and Climate Technologies (REACT) program, the funding is open to commercially-viable and active private sector companies out of which 25% will be owned or managed by women, and microfinance institutions commercially active in the renewable energy space of Somalia.

Managed by the AECF and funded by the Swedish International Development Agency (SIDA), REACT SSA initiative is aimed at off-grid households reducing poverty through 'transformational increase' in the use of renewable energy. It focuses on companies that can provide low-cost, reasonably priced, high-quality sustainable energy goods and services to the impoverished in rural and per urban areas..

Among other clean energy initiatives supported by REACT SSA, small/pico=scale PV household technologies, solar home systems (SHS) with capacity ranging between 50W to over 100W for both homes and businesses, mini and micro grids from solar energy, and the like.

The AECF wants to see high participation from the Somalian states of Hirshabelle, Southwest and Banadir for this 2nd call REACT SSA competition. These states were least represented during the 1st round, see $8.5 Million For RE In Somalia & Somaliland (Anu Bhambhani, 2021).

2.6 Global Energy Challenges

Access to cheap, reliable, and sustainable sources of energy is an important factor in global development; however, tremendous inequalities still exist. According to IEA, Nearly 759 million people lack access to electricity, while 2.6 billion heat and cook using traditional biomass. (IEA, 2021). All these issues most adversely affect the developing and the least-developed countries, primarily the rural and local areas that face significant degrees of energy-access inequality. A significant inadequacy in access to modern energy hampers social and economic development, traps people in poverty, and limits the prospects of educational and health improvement.

Access to electricity inequality is another concern. Despite increased electrification rates in cities, rural parts of Sub-Saharan Africa and South Asia lag behind. 77% of the population of Sub-Saharan Africa in rural areas cannot enjoy electricity. It is present in only 17% of the urban regions (World Bank, 2022). This inequality prevents economic benefits and widens disparities. For example, the Democratic Republic of Congo has one of the lowest electrification rates in the world, with 19% only of its population having access to electricity—and at the rural levels, it's even lower, at just 1% (IEA, 2021). Redress of these imbalances is an important factor towards ensuring inclusive growth.

One major cause of the world's energy challenges is the over-reliance of the world on fossil fuels. Fossil fuels comprise coal, oil, and natural gas, which constitute around 80% of the world's current energy consumption (BP Statistical Review, 2022). Moreover, this is not only unsustainable but the biggest source of greenhouse gas emissions. The energy sector accounts for more than 70% of global emissions of such pollutants (IPCC, 2022). China and India, though increasing their renewable energy, still largely depend on coal. Coal still accounts for 56% of China's energy mix (IEA, 2021). The dependence on this fuel has caused severe environmental impacts including air pollution, habitat destruction, and rapid climate change, which is a danger to global sustainability.

Renewable energy, though essential, is not without its challenges. Significant investment is required for the infrastructural development of solar farms, wind turbines, and energy storage systems; most countries are not financially capable enough to invest in such projects. Some other hindrances to these transitions are the policy gaps and regulatory hurdles faced by many places.

Despite all this, there is a silver lining: 29% of the world's electricity was generated in 2022 using renewable energy sources like wind and solar.. That is up from 19% in 2017 (REN21, 2023). With the right policies, huge de carbonization strides are within reach.

Another critical challenge is access to energy: in many developing countries, the cost of energy is high enough to consume more than half the average household's income. It remains too expensive to afford electricity, and millions remain without electricity. For instance, in Liberia, the price for electricity is one of the worlds highest: $0.35 per kWh, whereas, the world's average stands at $0.13 per kWh (World Bank, 2021). Even more profound implications on the economy are created due to high energy prices: increasing the prices of products, transport, and all basic services. Subsidies and innovative financing models are required for affordability and, therefore, to be able to equitably close the gap.

Climate change further makes the energy sector more vulnerable to global energy challenges. Increasingly, extreme weather events like hurricanes, floods, and droughts cause destruction to energy infrastructure, which causes disruptions in supply. The risks are more heightened for developing nations that are the most affected by climate-related disasters, which face increased pressures from growing energy demands. Energy and climate change highlight the need to transition to resilient, low-carbon energy systems.

2.3 Sustainable Development Goals and Energy

Energy is a critical enabler of sustainable development and is directly linked to many of the United Nations' Sustainable Development Goals (SDGs). Among these, SDG 7: Affordable and Clean Energy emphasizes the need to "ensure access to affordable, reliable, sustainable, and modern energy for all" by 2030 (United Nations, 2015). Energy access underpins several other SDGs, highlighting its cross-cutting role in fostering socio-economic development, improving health and education outcomes, and mitigating climate change.

Despite progress in renewable energy adoption, achieving SDG 7 remains a significant challenge, particularly in regions with limited infrastructure and investment (IEA, 2022).

The interconnection between energy and other SDGs is profound. For example, the pursuit of SDG 3: Good Health and Well-being needs energy supply with a high degree of reliability for healthcare facilities to be powered up, vaccines to be refrigerated, and medical equipment that can save lives. In sub-Saharan Africa and south Asia, where there is little light, the absence of electricity in hospitals and clinics leads to increased maternal mortality rates (WHO, 2021). According to a 2021 report by the World Health Organization (WHO), nearly 60% of healthcare facilities in low-income countries lack access to electricity, which undermines healthcare delivery and outcomes.

Similarly, energy access plays a very important role in advancing SDG 4: Quality Education. Electrified schools can provide better learning environments through lighting, enabling evening study, and powering digital tools for learning. For instance, in Kenya, solar electrification projects have been proven to enhance student performance and attendance rates. According to the United Nations Development Programme, schools with electricity had 20% higher enrollment rates than non-electrified schools (UNDP, 2020). Energy access is, therefore, a basic building block for creating equitable and inclusive education systems.

Energy is also central to SDG 8: Decent Work and Economic Growth. Industrialization through cheap, reliable energy, supports small and medium-sized businesses to increase job possibilities in the renewable energy sector. According to IRENA, 2021, the renewable energy sector provided jobs for over 12 million workers globally in 2020. In fact, some of the prospects were for the solar, wind and biomass areas. Renewable energy can stimulate job creation along with green jobs in areas of emerging economies.

In addition, the connection of energy to SDG 13: Climate Action emphasizes the need for a transition to sustainable energy systems to mitigate climate change. The energy sector is responsible for more than 70% of global greenhouse gas emissions (IPCC, 2022), and thus, the transition to renewables is critical to achieving SDGs for climate.

Transitioning to clean energy sources such as solar, wind, and hydropower not only reduces emissions but also strengthens resilience against climate-related risks. For example, decentralized renewable energy systems, such as microgrids, have proved to be efficient in providing reliable energy during extreme weather events, especially in disaster-prone areas (IEA, 2022).

Achieving SDG 7 requires meeting three primary targets: enhancing energy efficiency, expanding the proportion of renewable energy in the world's energy mix, and guaranteeing that everyone has access to reasonably priced and dependable energy. As noted by the International Energy Agency (IEA, 2022), access to electricity has been increasing globally; however, such growth has been uneven. The statistics indicate that about 759 million people live without electricity and mainly in Sub-Saharan Africa and Asia. Second, clean cooking solutions, one of the major parts of SDG 7, are also not accessible for 2.6 billion people, resulting in health issues associated with indoor air pollution. The World Bank estimates that indoor air pollution from traditional biomass fuels contributes to more than 4 million premature deaths annually, especially among women and children (World Bank, 2021).

Renewable energy is important in achieving SDG 7 and related goals. Bangladesh and Ethiopia are just two examples of countries that have implemented successful renewable energy programs that tackle energy access in support of economic and social development. For instance, Bangladesh's SHS has so far installed over 6 million solar systems and provided electricity to nearly 20 million people in rural areas (IRENA, 2021). Ethiopia has also set out a National Electrification Program that targets universal access by 2030 and will rely on off-grid solar and mini-grid solutions to power remote areas (UNDP, 2020).

2.7 Energy Challenges in Somalia

Somalia faces a multifaceted energy crisis that significantly hampers its socio-economic development and the achievement of Sustainable Development Goals (SDGs). The country's electrification rate is among the lowest globally, with only about 17% of the population having access to electricity. This limited access severely restricts economic activities, healthcare services, and educational opportunities, particularly in rural areas (IEA, 2022).

The energy infrastructure in Somalia is predominantly decentralized, characterized by small, isolated mini-grids operated by private electricity service providers. These mini-grids primarily rely on diesel generators, leading to high electricity costs and environmental concerns due to greenhouse gas emissions. The absence of a unified national grid results in inconsistent power supply and limited reach, especially in remote regions (Africa, Unlocking Somalia’s Clean Energy Potential 2024)

A significant portion of Somalia's energy consumption—approximately 90%—is derived from traditional biomass sources such as wood and charcoal. This heavy reliance contributes to environmental deterioration and deforestation, exacerbating the country's vulnerability to climate change impacts. The unsustainable harvesting of forest resources threatens long-term ecological balance and the livelihoods of communities dependent on these resources (worldbank.org, 2010)

Several systemic challenges impede the development of Somalia's energy sector. Among these are the absence of thorough rules, guidelines, and quality assurance measures; weak governmental enforcement; limited technical skills within the workforce; and insufficient financial investment in electricity generation, transmission, and distribution infrastructure. Collectively, these issues hinder the establishment of a robust and reliable energy system (2017-2020.usaid.gov).

Climate change further compounds these challenges, with increasing frequency of droughts and extreme weather events disrupting energy production and distribution. The recent severe droughts have not only strained water resources but also impacted hydroelectric potential and the overall resilience of the energy infrastructure.

Despite these obstacles Somalia has considerable renewable energy potential, especially in solar and wind energy. The nation possesses the greatest onshore wind power potential among all African countries, offering a promising avenue for sustainable energy development. However, the advancement of renewable energy faces challenges such as a lack of trained specialists, ongoing instability, and inadequate energy infrastructure, which deter private sector investment (Marriott, Renewable Energy in Somalia 2024)

Addressing Somalia's energy challenges necessitates a multifaceted approach that includes strengthening regulatory frameworks, investing in infrastructure development, enhancing technical capacity, and promoting private sector engagement. Leveraging the country's renewable energy potential could play a pivotal role in overcoming these challenges and fostering sustainable development.

2.8 Global Perspective on Renewable Energy and Sustainable Development

Renewable energy is crucial in achieving sustainable development across the globe by providing solutions to environmental challenges, economic growth, and social equity. The transition from fossil fuels to renewable energy sources is fundamental in mitigating climate change, promoting economic growth, and ensuring environmental sustainability. This section focuses on the global perspective on renewable energy and its integral connection to sustainable development, highlighting key trends, challenges, and case studies.

2.8.1 The Role of Renewable Energy in Sustainable Development

Solar, wind, hydro, and geothermal sources of renewable energy are essential aspects of the United Nations' Sustainable Development Goals (SDGs). In detail, SDG 7 is aimed to be achieved by 2030, wherein "ensure access to affordable, reliable, sustainable, and modern energy for all." The International Renewable Energy Agency (IRENA) insists that having renewables in the world's energy mix is vital, which alone would help in reducing emissions of greenhouse gases and promoting economic growth (nation n.d.).

2.8.2 Global Trends in Renewable Energy Adoption

Renewable energy capacity has been rapidly increasing globally in the last few years. The International Energy Agency reports that global renewable electricity generation is expected to rise to more than 17,000 TWh by 2030. This is nearly a 90% increase from the 2023 level. This growth is due to the improvement of technologies, reduced costs, and positive policies (iea.org).

For instance, Denmark leads in the integration of renewable energy. North Sea is already referred to as the "green power plant of Europe" since more than 80% of Europe's installed offshore wind capacity is connected here. Plans are further in place to enhance this capacity to 120 GW by 2030 and to 300 GW by 2050, contributing significantly to the EU's climate-neutral goals (Pozniak 2025).

2.8.3 Challenges in renewable energy implementation

Despite the positive trends, several challenges hinder the widespread adoption of renewable energy. Financial constraints, technological barriers, and policy inconsistencies are significant obstacles. For instance, Denmark's Ørsted has announced a 25% reduction in its 2030 investment program due to rising costs and supply chain disruptions in the offshore wind industry (Reuters 2025).

For one, some companies in the energy sector are retracting their investment in renewable. Norwegian oil group Equinor cut its investments in renewable and raised its output of fossil fuel as the challenge deepens across the industry (Powell 2025).

2.8.4 Case Studies: Renewable Energy Programs

Renewable energy drive in India

India's ambitious renewable energy initiatives offer valuable lessons for the global community. The country has set a target of achieving 500 GW of renewable capacity by 2030. Innovations in battery energy storage systems (BESS) have been pivotal, with projects providing electricity to low-income communities in Delhi. This progress underscores The significance of cooperation among governments, enterprises, and philanthropic organizations in promoting renewable energy.

Europe's Battery Storage Boom

Europe's battery storage capacity is growing at a higher rate due to the increasing renewable energy market. Capacity in Europe will, by 2030, expand by five times to over 50 GW, with investments of around €80 billion. This is critical for balancing the grid and, especially with the likelihood of an increase in renewables, ensuring that energy supply remains stable (Twidale 2025)

The shift towards renewable energy is integral to sustainable development. Although much has been achieved, there are still challenges that require continued innovation, investment, and policy support. By learning from successful case studies and addressing existing barriers, the international community can work towards a sustainable energy future that aligns with global development goals.

2.9 Renewable Energy in Somalia: Opportunities and Challenges

Somalia possesses significant renewable energy potential, especially in solar and wind energy, owing to its geographical location and favorable climate. However, despite these abundant resources, the country remains heavily reliant on costly and unsustainable diesel-powered electricity. The lack of adequate infrastructure, weak regulatory frameworks, and financial constraints have hindered the widespread adoption of renewable energy. With increasing global interest in sustainable energy solutions, Somalia has the opportunity to transform its energy sector by investing in renewable resources to improve electricity access, enhance economic development, and contribute to environmental sustainability.

2.9.1 Solar Energy Potential in Somalia

Somalia enjoys some of the world's highest levels of solar irradiation, thus making it a very good country for the development of solar power. The average solar irradiation in the country is 5 to 7 kilowatt-hours per square meter per day, with over 310 sunny days per year (IRENA, 2021). This is very suitable for solar photovoltaic (PV) systems and solar thermal applications, including electricity generation, water heating, and agricultural processing.

Despite the high potential, solar energy remains underutilized in Somalia. Currently, most solar energy projects are small-scale installations, primarily used for household electrification, water pumping, and street lighting. Several independent power producers (IPPs) have begun incorporating solar hybrid solutions into their existing diesel-based systems. For example, Benadir Electric Company (BECO), one of Somalia's largest electricity providers, installed a 10-megawatt (MW) solar farm in Mogadishu to supplement diesel generation (Trade.gov, 2022).

The main challenges for the adoption of large-scale solar energy in Somalia include:

- Initial investment costs are high: Despite the long-term cost savings, solar PV systems require a large amount of initial capital, which most Somali businesses and households cannot afford.
- Technical expertise is lacking: There is a shortage of trained engineers and technicians to install, maintain, and operate the solar systems.

- ❖ Lack of government incentives: Unlike other countries that offer subsidies and tax breaks for solar investments, Somalia does not yet have a clear policy framework to support large-scale solar deployment.
- ❖ To fully harness its solar potential, Somalia needs to attract investment in utility-scale solar farms, develop a skilled workforce, and implement government policies that promote renewable energy adoption through tax incentives and financial support programs.

2.9.2 Wind Energy Potential in Somalia

Somalia has one of the highest wind energy potentials in Africa due to its long coastline along the Indian Ocean. Studies indicate that wind speeds in certain regions, particularly Puntland, Somaliland, and the central-southern coastal areas, range between 7 to 11 meters per second (m/s) at 50 meters height, making wind energy a viable source for electricity generation (USAID, 2020).

Currently, several small-scale wind farms operate in Somalia, with the most notable being the NECSOM wind power project in Puntland, which produces 3.5 MW of electricity (Trade.gov, 2022). Many energy companies in Somalia are exploring hybrid renewable energy systems, integrating wind power with solar and diesel generators to ensure a more stable and reliable electricity supply.

Despite this potential, the growth of wind energy in Somalia is constrained by:

- ❖ Weak grid infrastructure: Most parts of Somalia lack an integrated national grid, making large-scale wind projects difficult to implement.
- ❖ Land ownership disputes: In some areas, unclear land tenure laws hinder the development of wind farms.
- ❖ Limited financial investment: The high initial capital required for wind farms discourages private investors.

To overcome these challenges, Somalia must develop policies that encourage wind energy investments, improve grid infrastructure, and strengthen land ownership regulations to attract both domestic and foreign investors in wind energy projects.

2.9.3 The Role of Hydropower in Somalia

Although Somalia has many rivers, especially the Juba and Shabelle Rivers, hydropower accounts for a minor share of the country's energy mix. In the past, hydropower plants in Somalia accounted for a large share of the country's electricity, but years of conflict and neglect have left most of these facilities in disrepair. The Jowhar Hydroelectric Dam, once a major source of electricity for central Somalia, is no longer operational (UNDP, 2022).

Hydropower faces several challenges in Somalia, including:

- Climate change and droughts: Somalia experiences frequent droughts, reducing river water levels and limiting hydropower generation.
- Infrastructure damage: Many existing hydroelectric facilities require rehabilitation due to damage from years of conflict.
- High costs of new hydropower projects: The construction of new dams requires significant funding, which remains a challenge given Somalia's economic constraints.

Despite these challenges, small-scale hydropower projects could provide localized electricity solutions in rural areas, particularly through run-of-river hydro plants, which do not require large dams.

2.9.4 Biomass and Biogas Energy

Biomass remains the primary source of energy for the majority of Somalis, particularly in rural areas. More than 80% of the population depends on traditional biomass (firewood and charcoal) for cooking and heating. (UNEP, 2021). The widespread use of biomass contributes to deforestation, desertification, and environmental degradation, worsening the impacts of climate change.

To address this, biogas energy solutions have been introduced in Somalia. Some pilot projects have shown that the biogas digesters can convert animal and agricultural waste into clean cooking gas and electricity. These systems are very effective in rural communities and livestock farming areas. The main reasons why the adoption of biogas remains low are high initial costs and a lack of awareness about the benefits of biogas technology.

2.9.5 Barriers to Renewable Energy Development in Somalia

Despite the vast potential for renewable energy, Somalia faces several challenges in scaling up its clean energy sector:

- Lack of a national energy policy: The absence of a clear legal and regulatory framework hinders investment in renewable energy.
- Limited access to financing: Most Somali businesses and households lack access to credit and financial resources needed to invest in renewable technologies.
- Political instability and security-related issues: The persistent insecurity reduces massive investment in energy structures.
- Appreciable lack of infrastructures in grids: Such a state does not have a unified central national grid; thus, it is hard to connect large-scale renewable energy projects.

2.9.6 The Potential for Renewable Energy in Somalia

These notwithstanding, Somalia has considerably remarkable prospects for expansion in terms of renewable energy, especially:

- Public-Private Partnership: The promulgation of cooperation between the government, private sectors, and international investors will hasten the development of renewable energy projects.
- Off-Grid Solutions: Decentralized renewable energy systems, including solar household systems and mini-grids, can supply electricity to rural and marginalized areas.
- International Funding and Development Aid: Organizations such as the World Bank, African Development Bank (AfDB), and the United Nations Development Programme (UNDP) have expressed interest in funding renewable energy projects in Somalia.

Somalia has enormous potential to move to a renewable energy-based economy, leveraging its solar, wind, and hydro resources to meet its growing energy demands. However, achieving this transition requires strong policy support, increased investment, and capacity building in the energy sector.

By addressing the existing challenges and capitalizing on available opportunities, Somalia can achieve energy security, reduce electricity costs, and contribute to global climate action. Investing in renewable energy will not only enhance economic growth but also improve the quality of life for millions of Somalis.

2.10 Impact of Renewable Energy on Somalia's Sustainable Development Goals (SDGs)

The integration of renewable energy in Somalia plays a crucial role in advancing the United Nations Sustainable Development Goals (SDGs). With 17 SDGs designed to eradicate poverty, promote economic growth, and ensure environmental sustainability by 2030, Somalia's transition to renewable energy can significantly contribute to achieving multiple objectives. Given the country's limited access to modern energy, high dependency on imported fossil fuels, and widespread energy poverty, the deployment of solar, wind, hydro, and biomass energy presents a transformative opportunity for sustainable development. This section explores how renewable energy impacts Somalia's progress toward key SDGs, particularly in economic, social, and environmental dimensions.

2.10.1 Renewable Energy and SDG 7: Affordable and Clean Energy

Ensuring Universal Access to Modern Energy

The most direct impact of renewable energy is on SDG 7: Affordable and Clean Energy, which aims to ensure universal availability of modern, sustainable, and reliable energy by 2030.. Currently, only about 30% of Somalia's urban population and less than 10% of rural communities have access to electricity (World Bank, 2021).

The deployment of solar mini-grids, wind farms, and off-grid solutions can provide cost-effective and sustainable electricity to millions of people who currently rely on expensive diesel generators or traditional biomass fuels.

Reducing Electricity Costs

Somalia has one of the most expensive electricity tariffs in the world, with prices ranging from $0.50 to $1.00 per kWh, compared to the global average of $0.10 to $0.20 per kWh (African Development Bank, 2020).

The widespread adoption of solar and wind energy can significantly reduce electricity prices by decreasing reliance on costly imported diesel fuel. Lowering electricity costs will enhance economic productivity, support business growth, and improve household affordability.

Expanding Renewable Energy Infrastructure

Investments in renewable energy infrastructure, such as solar photovoltaic (PV) farms, wind power plants, and hybrid mini-grids, will expand energy access in rural and off-grid communities. International organizations like the International Renewable Energy Agency (IRENA) and the United Nations Development Programme (UNDP) are actively supporting solar mini-grid projects to provide affordable energy in Somalia's underserved regions (IRENA, 2021).

2.10.2 Renewable Energy and SDG 1: No Poverty

Promoting Economic Opportunities

Energy access is essential for poverty reduction. Reliable electricity from renewable sources enables economic activities, particularly in agriculture, small businesses, and industrial sectors. Farmers can irrigate crops using solar-powered water pumps, fishermen can refrigerate seafood, and small businesses can extend operating hours through affordable solar-powered lighting. These opportunities enhance productivity and income levels, lifting communities out of poverty.

Reducing Household Energy Costs

Many Somali households rely on expensive kerosene lamps and charcoal for lighting and cooking, which consume up to 30-50% of their monthly income (UNEP, 2021). Renewable energy solutions, such as solar home systems and biogas stoves, provide cheaper and more sustainable alternatives, allowing families to save money for education, healthcare, and investments in income-generating activities.

2.10.3 Renewable Energy and SDG 3: Good Health and Well-being

Reducing Indoor Air Pollution

A major health challenge in Somalia is indoor air pollution, caused by the widespread use of charcoal, firewood, and kerosene for cooking and lighting. These traditional energy sources release harmful pollutants that lead to respiratory diseases, lung infections, and eye problems, particularly among women and children.

According to the World Health Organization (WHO), more than 4 million premature deaths annually are linked to household air pollution globally (WHO, 2021). The promotion of clean cooking solutions, such as biogas and solar cookers, can significantly improve public health by reducing exposure to toxic emissions.

Enhancing Healthcare Services

Access to electricity is vital to healthcare facilities, especially in rural Somalia. Many hospitals and clinics operate with a lack of consistent or no electricity, causing the medical services to be disrupted several times (UNDP, 2022). The installation of solar-powered refrigerators for vaccine storage, solar lighting for emergency treatments, and wind-powered water purification systems can significantly enhance the delivery of healthcare services and patients' outcomes.

2.10.4 Renewable Energy and SDG 4: Quality Education

Supplying Electricity to Schools

Many schools in Somalia, particularly in rural and conflict-affected regions, lack access to electricity, limiting students' ability to study after dark. Solar-powered lighting and computer labs can improve learning conditions, enhance digital education, and increase school attendance rates.

Supporting Vocational Training in Renewable Energy

The renewable energy sector presents a growing demand for skilled technicians, engineers, and project managers.

Investing in vocational training programs for solar panel installation, wind turbine maintenance, and biogas system operations will create employment opportunities for Somali youth and strengthen local capacity to sustain the renewable energy industry (IRENA, 2021).

2.10.5 Renewable Energy and SDG 8: Decent Work and Economic Growth

Job Creation in the Renewable Energy Sector

The expansion of renewable energy projects in Somalia can generate thousands of jobs in construction, engineering, sales, and maintenance. According to IRENA (2021), the renewable energy sector employs over 11 million people worldwide, with significant job opportunities in solar PV, wind energy, and bioenergy. Encouraging investment in local renewable energy industries will drive employment, reduce dependency on foreign imports, and boost economic development.

Enhancing Agricultural Productivity

Agriculture is Somalia's largest economic sector, employing over 65% of the population (World Bank, 2021). The integration of solar irrigation systems, wind-powered grain mills, and biogas-fueled processing plants can improve food security, increase crop yields, and reduce post-harvest losses, contributing to economic stability.

2.10.6 Renewable Energy and SDG 13: Climate Action

Reducing Greenhouse Gas Emissions

Somalia's heavy reliance on diesel generators and charcoal significantly contributes to carbon emissions and deforestation. The transition to solar, wind, and hydropower can drastically cut Somalia's carbon footprint and align with global climate commitments under the Paris Agreement (UNEP, 2021).

Combatting Deforestation

Approximately 80% of Somalia's population relies on charcoal and firewood for cooking and heating, leading to severe deforestation and land degradation (FAO, 2022). Biogas and solar cooking solutions can reduce dependence on unsustainable biomass energy, helping to preserve forests and mitigate desertification.

The integration of renewable energy in Somalia has profound implications for achieving multiple Sustainable Development Goals (SDGs). It will improve energy access (SDG 7), reduce poverty (SDG 1), enhance health (SDG 3), provide education (SDG 4), boost economic growth (SDG 8), and foster climate action (SDG 13). Even though there are challenges, like financial barriers, regulatory gaps, and political instability, Somalia can capitalize on the solar and wind resources to achieve a sustainable, resilient, and inclusive energy future. By attracting investment, developing supportive policies, and strengthening institutional capacity, Somalia can harness renewable energy to drive national development and enhance the quality of life for its citizens.

2.11 Strategies for Boosting Renewable Energy Intake in Somalia

Somalia has a enormous renewable energy potential in solar, wind, and biomass energy. There is, thus, a huge opportunity for adopting renewable energy in Somalia, but it is constrained by factors such as financial constraints, weak policies, poor infrastructure, and political instability. Integration of renewables would be accelerated if Somalia adopted a combination of policy reforms, financial incentives, capacity building, and infrastructure development. This section provides an overview of key strategies for improving the integration of renewable energy in Somalia, with a focus on governance, investment, technological advancements, and community engagement.

2.11.1 Strengthening Energy Policies and Regulatory Frameworks

Developing a National Renewable Energy Policy

One of the major reasons Somalia cannot have successful renewable energy is that the country lacks a national energy policy and regulatory framework.

Unlike most other countries with policies on renewable energy, Somalia's energy market is fragmented and lacks regulation with dominance by private electricity providers. There is a disincentive to large-scale investment in renewable energy due to a lack of oversight and direction by the government.

To enhance renewable energy integration, the Somali government should:

- Establish a clear national renewable energy policy with specific targets for solar, wind, and biomass energy development.
- Implement feed-in tariffs (FiTs) to encourage private sector investment in renewable energy.
- Develop regulations for net metering so that users can sell extra electricity to the grid (IRENA, 2021).
- Strengthen the Ministry of Energy and Water Resources to oversee and regulate the energy sector.

This will ensure a stable investment environment with the aim of transparency and long-term growth in Somalia's renewable energy sector, according to World Bank, 2021.

Promote Public-Private Partnerships (PPPs)

Public-private partnerships (PPPs) are essential for expanding renewable energy infrastructure. Given Somalia's limited public funding, collaborations between the government, private sector, and international donors can accelerate the deployment of solar and wind projects. Successful examples of PPPs in Africa have demonstrated that shared investment models reduce financial risks and improve project sustainability (AfDB, 2022).

2.11.2 Improving Access to Renewable Energy Financing

Attracting Foreign Direct Investment (FDI)

Probably one of the significant challenges is that the up-front capital required to put solar farms, wind turbines, or mini-grids together is huge. To tackle this, Somalia should attract as much foreign direct investment (FDI) by adopting policies in order to invite investors, like investment-friendly tax incentives and exemption on duties from imports of renewable energy equipment.

Cooperating with such international financial institutes as World Bank, African Development Bank (AfDB), and UNDP in raising finance for large-scale projects (World Bank, 2022). Establishing a renewable energy investment fund. This investment fund has been created to facilitate credit access for local entrepreneurs and small businesses dealing with the energy sector.

Microfinance and Subsidies for Small-Scale Renewables

Most Somali households and small businesses lack access to financing for solar home systems and biogas solutions. Expansion of the microfinance programs and provision of some subsidies for solar and wind technologies can increase adoption, especially in rural areas.

Successful examples include PAYGO (Pay-as-you-go) solar systems in Kenya and Tanzania, where households pay in small installments rather than making large upfront investments (UNEP, 2021). Introducing similar financing models in Somalia can boost renewable energy adoption among low-income communities.

2.11.3 Expanding Renewable Energy Infrastructure

Developing Off-Grid and Mini-Grid Systems

Somalia doesn't have a national electricity grid, and it is challenging to integrate large-scale renewable energy projects. Off-grid solar and mini-grid solutions are more practical alternatives for rural and peri-urban communities.

- Mini-grids powered by solar and wind energy can power entire villages, reducing dependence on expensive diesel generators.
- Off-grid solar home systems provide households with affordable lighting, phone charging, and small-scale appliance use.
- Hybrid renewable-diesel mini-grids will ensure a steady power supply to areas where renewable energy availability varies (IRENA, 2021).

Modernizing Energy Storage Solutions

The major drawback of renewable energy integration is that the generation of solar and wind energy depends on the weather conditions. Investment in battery storage technology can store extra electricity generated to ensure a reliable supply of energy.

Advanced battery technologies, including flow and lithium-ion batteries, are successfully deployed for solar mini-grids in Kenya and Ethiopia. Somalia should therefore collaborate with global donors to similarly develop energy storage solutions (IRENA, 2022).

2.11.4 Improvement of Local Capability and Technical Skill

Training renewable energy technicians

A significant constraint to the deployment of renewable energy in Somalia is the lack of trained personnel in the field. Many solar and wind projects collapse due to poor maintenance and lack of proper expertise.

To address this challenge, Somalia should:

- Establish training centers for renewable energy engineers, technicians, and entrepreneurs.
- Develop vocational programs in solar panel installation, wind turbine maintenance, and biogas system operations.
- Partner with international universities and technical institutions to provide certified renewable energy training (UNDP, 2022).

Building local capacity will ensure sustainable growth in Somalia's renewable energy sector, avoiding foreign engineers and imported technology.

2.11.5 Grid Integration and Energy Planning

National Grid Expansion Strategy

Somalia currently lacks a centralized national electricity grid, making energy distribution highly fragmented and inefficient. Expanding grid infrastructure will:

- Improve connectivity between renewable sources and consumers.
- Allow excess electricity generated from wind or solar farms to be distributed over several regions.
- Improve the reliability of energy by integrating multiple renewable sources into the grid (World Bank, 2021).

Smart Grid Technologies

Smart grid technologies such as digital monitoring systems and automated grid management can be applied to increase the efficiency of distribution. They help in getting a balanced energy demand supply curve, less electricity wastage, and optimal usage of renewable energy sources IRENA, 2022.

2.11.6 Public Awareness and Community Mobilization

Civic Education on Renewable Energy Advantages

Most Somalis are uninformed about the economic and environmental benefits of renewable energy. Public awareness can:

- Encourage the use of solar and wind energy in homes and industries.
- Advocate for energy-efficient use and waste-to-energy generation.
- Eliminate the misconception of the high cost of renewable energy and its unreliability (UNEP, 2021).

Involving Local Communities in Energy Projects

Community-led renewable energy initiatives have worked in other African countries like Kenya's decentralized solar power programs. Increasing acceptance and the sustainability of a project is realized by involving local people in decision-making in the energy sector.

A multi-faceted approach is required to end the scourge of shortages of reliable renewable energy in Somalia, includes capacity building, infrastructural development, financial incentives, and policy reforms, and community participation. The government can begin by building a strong regulatory framework, attracting foreign investments, off-grid solutions, and modernizing the energy storage system; moreover, it can educate the workforce to have needed technical skills. Investing in renewable energy will not only reduce electricity costs and enhance economic growth but also contribute significantly to climate resilience and sustainable development.

2.12 Energy companies and high-potential regions in Somalia

Somalia's renewable energy landscape is driven primarily by a mix of private electricity service providers, telecom-led corporate adopters, and a growing set of local solar installers and EPC contractors. Prominent operators include **Benadir Energy Company (BECO)**, the largest utility serving Mogadishu and south-central Somalia, which has begun supplementing diesel generation with utility-scale solar installations to reduce fuel costs and improve supply reliability; BECO's activity illustrates how established local utilities can anchor larger PV projects in urban load centers. **NECSOM (National Energy Corporation of Somalia)** and similar regional utilities are pursuing hybridization and grid-efficiency measures in Puntland and other states, signaling a shift toward integrating renewables with digital grid management. Independent mini-grid developers such as **Cabudwaaq Electric Company (CECO)** demonstrate the feasibility of town-scale solar investments — CECO inaugurated a 500 kWp solar system in Abudwak that is delivering power for homes, businesses and public lighting — while large private actors (notably **Hormuud Telecom**) have converted the majority of their cell-site and data-center energy needs to solar, creating important demand-side examples for corporate procurement of renewables. These companies together form the practical backbone for deployment models (utility PV, mini-grids, rooftop/commercial PV and corporate offtake) that are most realistic in Somalia's decentralised energy context. (beco.so)

Geographically, Somalia's resource endowment points to **solar** as a national priority and **wind** as regionally strategic. Multiple resource assessments show that most of Somalia receives very high solar irradiation (average Global Horizontal Irradiance [GHI] commonly reported in the **~5–7 kWh/m²/day** range), making PV economically attractive across the country and suitable for widespread applications such as solar home systems, commercial rooftops, water-pumping, and utility or mini-grid farms. The national suitability of PV supports a policy focus on solar-first electrification for rural and peri-urban communities. In contrast, wind potential is concentrated along the **northern coastal corridor (Puntland and Somaliland; ports such as Bossaso and Berbera)** where onshore wind speeds at turbine heights are among the highest on the mainland, creating the best locations for utility-scale onshore (and potential near-shore/offshore) wind projects. The **southern coastal strip** (including Kismayo and parts of Lower Shabelle) shows moderate wind but excellent solar, which favors hybrid solar-plus-storage or solar-diesel-hybrid

mini-grids for coastal towns. Historical river corridors (Juba and Shabelle) offer limited but locally useful small run-of-river hydro opportunities and irrigation-linked hybrid systems where hydrology permits, though these require careful climate and drought risk assessment. (Samatar 2023)

For thesis discussion and policy implications, two practical conclusions follow. First, **scale solar deployment nationally** (utility PV, distributed rooftop, SHS, and mini-grids) because of uniformly high irradiance and the rapid cost declines and modularity of PV systems; second, **target northern coastal zones for wind-farm development** while prioritizing storage and hybrid systems (battery energy storage, demand management) to manage intermittency and ensure reliable supply. Local company case studies (BECO, CECO, NECSOM, Hormuud) provide observable business models and institutional partners for scaling these approaches, and their early successes can be used to justify pilot projects, PPP arrangements, and targeted financial incentives in your policy recommendations.(beco.so)

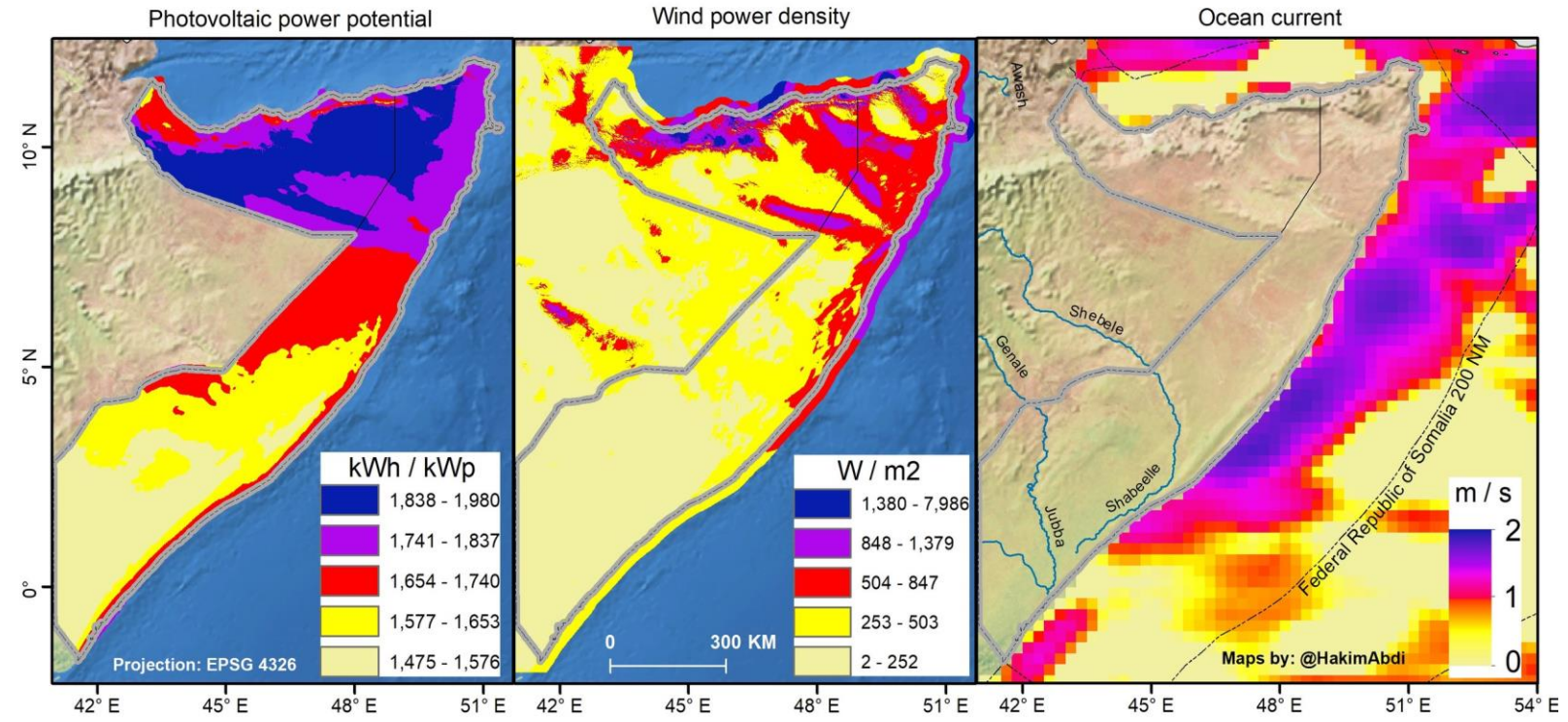


Figure 5. Somalia is geographically well-positioned to take advantage of different forms of renewable energy.
(Data source: hakimabdi.com/blog/oil-and-opportunities-for-development-in-somalia)

CHAPTER THREE

3.0. RESEARCH METHODOLOGY

3.1 Research Design and Methods

This study combined qualitative and quantitative methods in a mixed-methods, less-dominant design (Cresswell, 2010). The main position in this study design is held by the quantitative approach, whereas the less prominent position is held by the qualitative approach. This study's use of a problem-analysis research viewpoint makes it non-experimental. According to (Verschuren and Dooreward 2010), this kind of research frames research issues from a conceptual standpoint. Cross-checking using the triangulation method was done in order to prevent bias in the research findings. This relates to gathering data by observation, interviews, and document analysis (Cresswell, 2010).

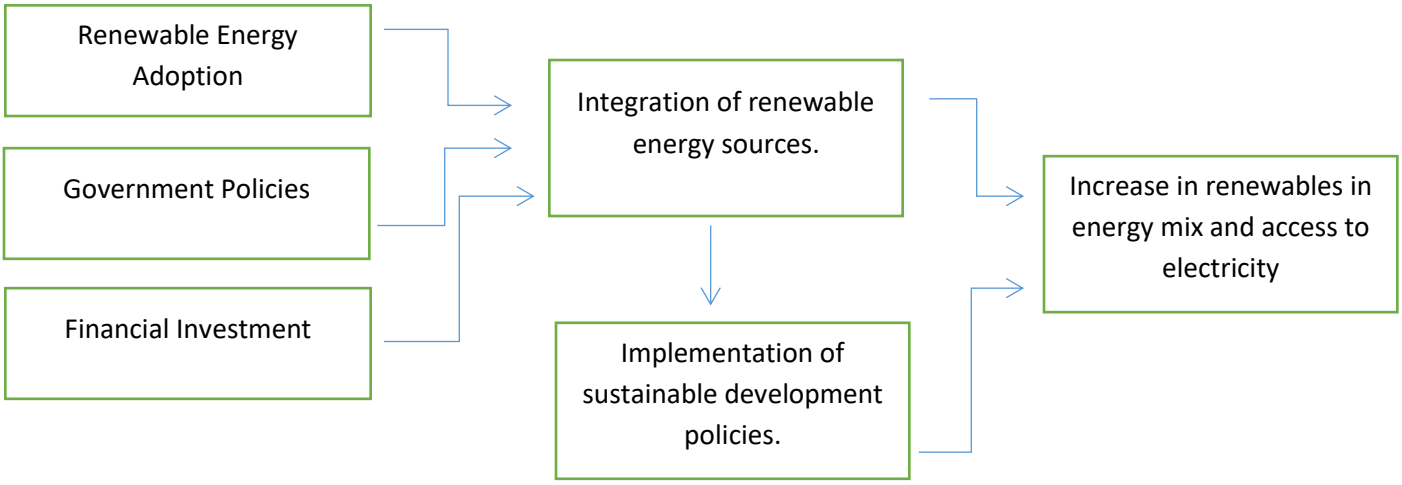
3.2 Establishing the nature of the Research Perspective

A review of applicable theories and literature led to the development of a conceptual model. Establishing limits for the research topic and illustrating the relationships between the key ideas of the study are two benefits of using a conceptual model. (Verschuren et al., 2010). The research perspective for the thesis "Navigating Sustainable Development: A Study of Renewable Energy's Effects on SDGs in Somalia" is grounded in an interdisciplinary approach that integrates sustainability science, energy studies, and development theory. This perspective is essential to comprehensively understand the multifaceted impacts of renewable energy on Somalia's sustainable development goals (SDGs). By combining the principles of these fields, the study aims to provide a holistic analysis of how renewable energy can drive sustainable development in Somalia, addressing economic growth, environmental protection, and social equity.

Adopting a pragmatic paradigm, The study uses a mixed-approaches strategy that blends qualitative and quantitative research techniques to achieve a nuanced understanding of renewable energy's impact on SDGs. The research objectives focus on analyzing contributions to economic growth, environmental benefits, access to clean energy, and identifying barriers and enablers to renewable energy implementation.

By considering Somalia's unique socio-economic and political context, The study interacts with important parties, such as local communities, business companies, government agencies, and international organizations. To guarantee the integrity and dependability of the results, ethical principles including informed consent, confidentiality, and transparency are upheld at every stage of the study process.

Figure 5. Conceptual model



3.3 Data Collection

Researchers used a number of data collection techniques with the following details:

a. Structured interview

This interview is being conducted using the in-depth interview technique using pre-prepared interview guides. Qualitative methods were employed to analyze the interview results. Purposive sampling is used to select key informants for interviews, with consideration given to actors who are aware of the issues and capable of formulating strategies and policies to address them (Renosori, 2012).

Ten managers from electric power companies, specializing in planning, resources, and infrastructure management of renewable energy, were key informants in the interview.

b. Questionnaires

Researchers gather information from respondents by using a questionnaire technique. Quantitative methods are obtained through the use of questionnaire results. Respondents, who are electric power companies' employees, will carry out the policy's objective as the target group. This questionnaire's model of questions has been broken down into their individual options.

Proposed Sub Question	New Sub Question
What programs and initiatives are available from the government to encourage PV-based self-generation of electricity? How well-informed are people about the benefits and potential of using photovoltaics to generate electricity on their own?	What significance are awareness-raising and information-sharing for SDGs' implementation of RET?
What financial mechanisms can be used by the power companies to finance PV system installation?	How can solar equipment changed the socio-economic of the population and what are the advantages and disadvantages?

3.4 Data analysis

3.4.1 Qualitative Analysis

The three stages of the qualitative analysis—data reduction, data presentation, and conclusion- or verification-drawing—are based on a model developed by Miles, Huberman, and Saldana (2014).

The following is a description of the interactive model's data analysis components:

1. Data Reduction

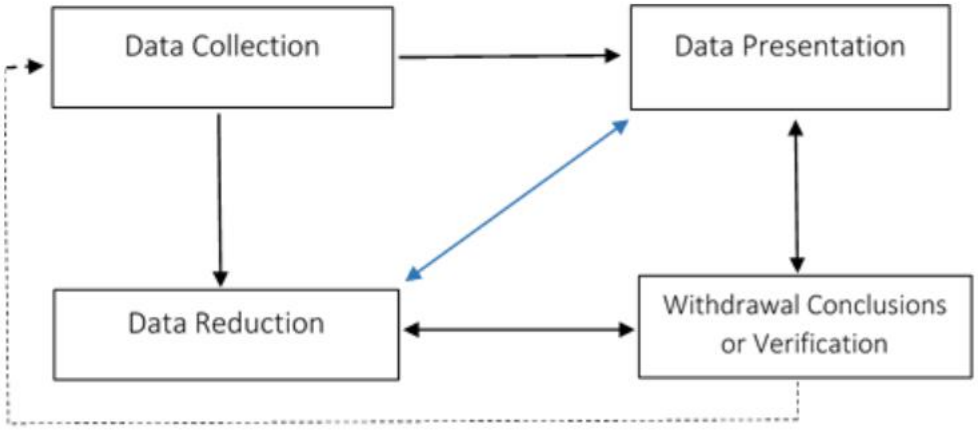
Data obtained by researchers through observations, interviews, and documentation. By condensing, picking, and concentrating data on the goals of the research, they are minimized. In order to reduce the amount of data at this point, the researcher categorized, sorted, and abstracted the notes, interviews, and documentation.

2. Data Presentation

Data reduction or summarization is followed by data presentation. Transcripts of interviews, observation notes, and documentation notes are the results of data analysis from observation, interviews, and documentation. The text will include all of the data that was gathered.

3. Withdrawal Conclusions or Verification

Making inferences or conducting verification is the last stage of the qualitative data analysis process. At the time of data collection, the researcher reached a conclusion that is strongly supported by evidence based on data reduction and data presentation. The diagram of interaction model can be seen on Figure 6:



(Source: Miles, Huberman and Saldana, 2014)

Figure 6. Interactive model on qualitative analysis

3.4.2 Quantitative Analysis

a. SPSS

Utilize statistical tools (e.g., SPSS) to analyze survey data, providing quantitative insights into the current state of renewable energy integration and its correlation with SDGs.

b. Correlation Analysis:

Conduct correlation analyses to examine relationships between variables, exploring whether there are statistically significant associations between renewable energy integration and specific Sustainable Development Goals in Somalia.

CHAPTER FOUR: DATA FINDINGS, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presents the findings of the study in relation to the research objectives outlined in Chapter One. It provides a detailed analysis and interpretation of the data collected through the research instruments, focusing on the impact of renewable energy development on the achievement of selected Sustainable Development Goals (SDGs) in Somalia. the analysis is structured around key thematic areas derived from the study's objectives, including access to affordable and clean energy (SDG 7), economic growth and employment (SDG 8), and partnerships for development (SDG 17). Data were gathered from a variety of stakeholders, including government agencies, renewable energy companies, and local communities, to ensure a comprehensive understanding of the subject.

The findings are presented using descriptive statistics, tables, and charts to enhance clarity and support interpretation. Each section draws a connection between the empirical data and the study's conceptual framework, allowing for a meaningful discussion of how renewable energy influences sustainable development in the Somali context.

4.2 Response Rate

30 questionnaires were issued, and all were returned, resulting in a response rate of 100%.

4.3 Section 1: Respondent Profile

1.1. Gender of the Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	23	71.9	76.7	76.7
	Female	7	21.9	23.3	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 1: Classifications of the Respondents by Gender

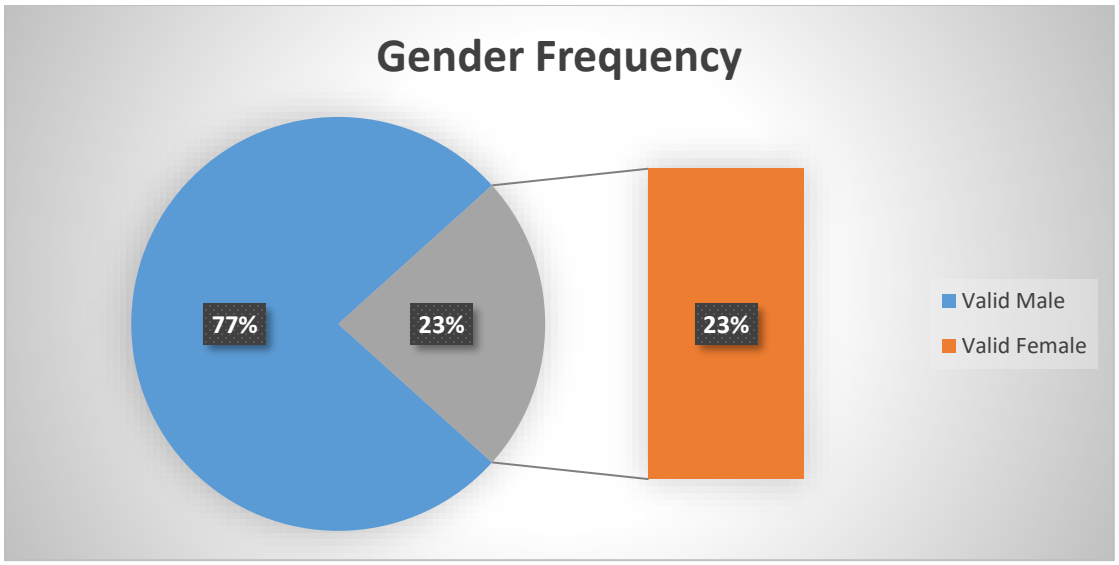


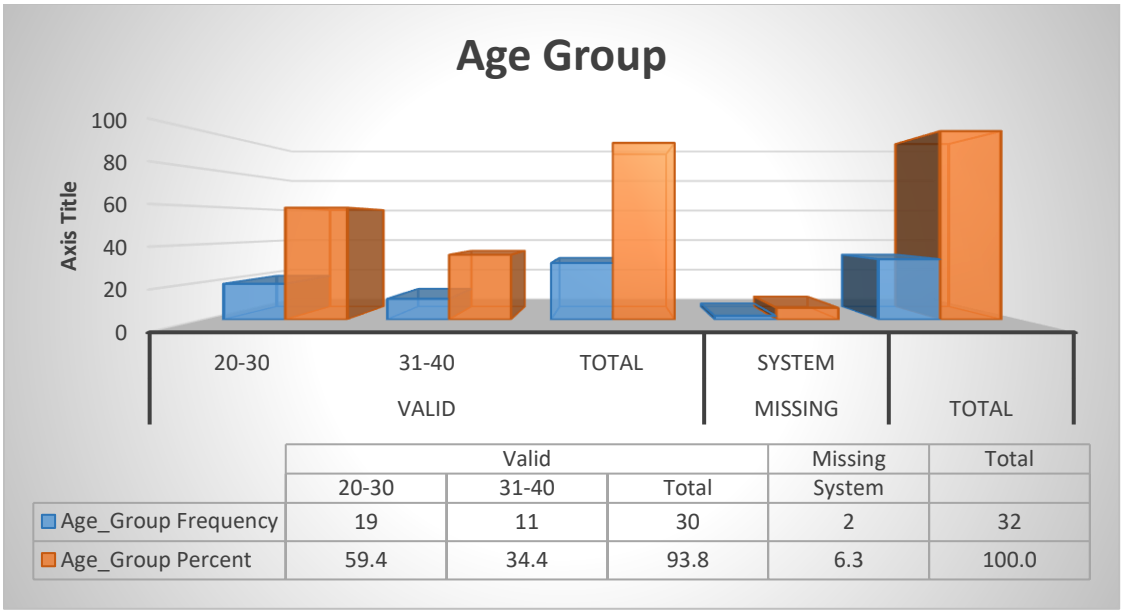
Figure 7: Classifications of the Respondents by Gender

As the above pie chart indicates, the 77% of the respondents were male and only 23% were female. This indicates that Somalia's energy sector workforce is predominantly male, reflecting cultural factors that limit female participation.

1.2. Age of the Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-30	19	59.4	63.3	63.3
	31-40	11	34.4	36.7	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 2: Classification of the respondents by Age levels



	Valid			Missing	Total
	20-30	31-40	Total	System	
Age_Group Frequency	19	11	30	2	32
Age_Group Percent	59.4	34.4	93.8	6.3	100.0

Figure 8: Classification of the respondents by age

As the above Histogram chart shows, the respondents were in two categories in relation to age: The age range of the respondents was 20–30 years old for 59.4% of them and 31–40 years old for 34.4%. According to this, the majority of employees in Somalia's energy sectors are younger and more active.

1.3. Educational level of the respondents

Educational level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor	15	46.9	50.0	50.0
	post graduate	9	28.1	30.0	80.0
	Masters & above	6	18.8	20.0	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 3: Classification of the respondents by Educational

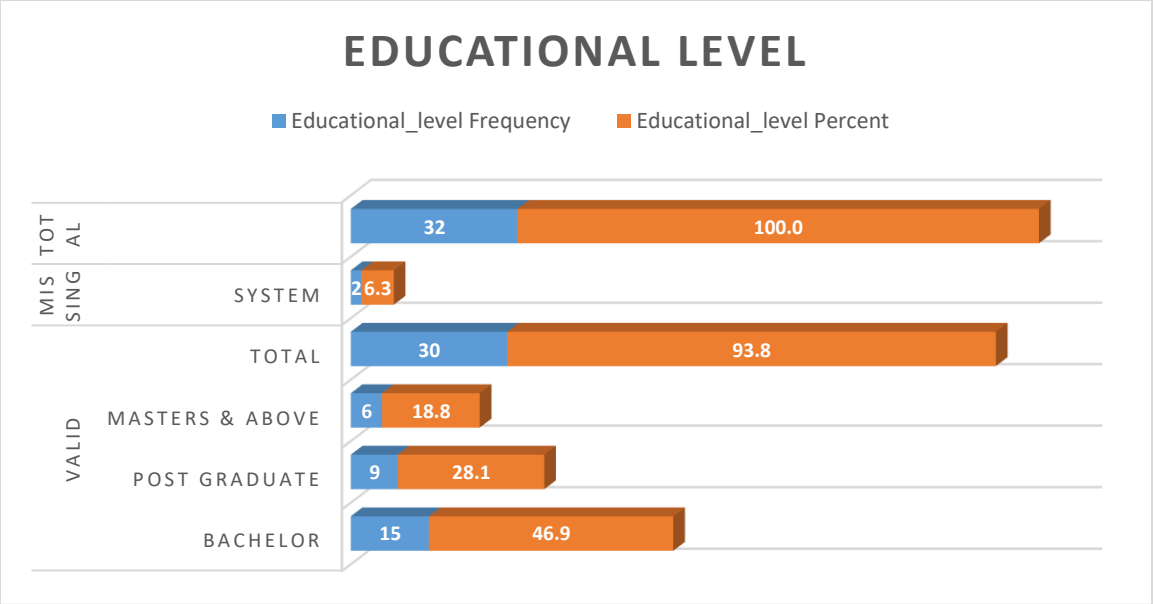


Figure 9: Classification of the respondents by Educational level

As the figure 9 above shows, 46.9% had a Bachelor's degree, 28.1% had postgraduate qualifications, and 18.8% held a Master's degree or higher. The educational level of the respondents with bachelor's degrees and postgraduate degrees is 24 people, while 6 respondents had master's degrees and above. This implies that the majority of the respondents have a first degree in the level of education.

1.4. Type of the company

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	private	19	59.4	63.3	63.3
	public	11	34.4	36.7	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 4: Classification of the respondents by type of company

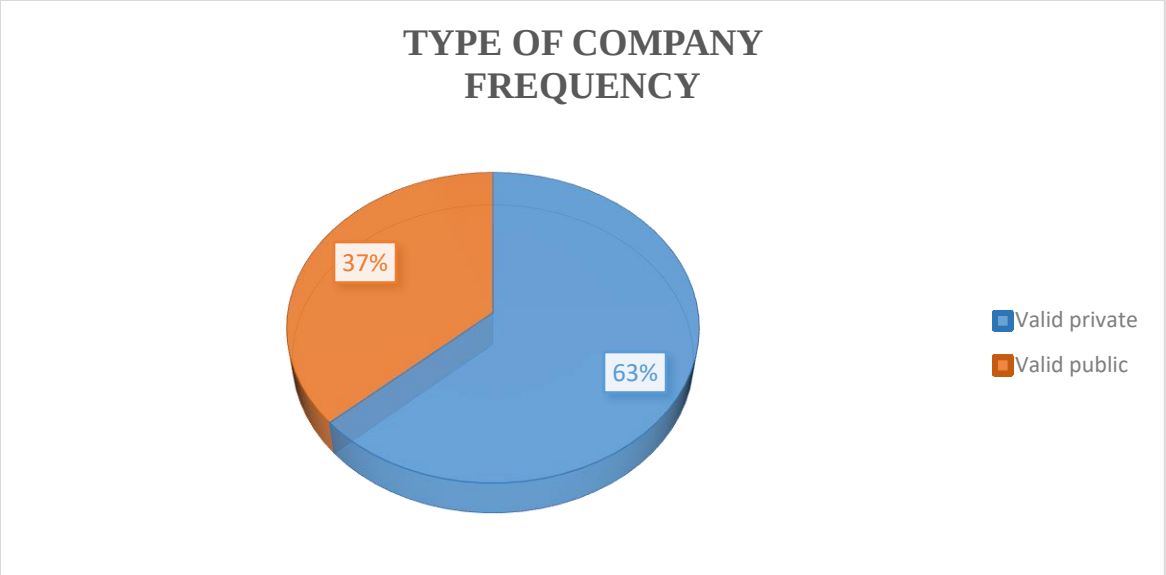


Figure 10: Classification of the respondents by type of company

1.5. Occupation Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Junior Expert	12	37.5	40.0	40.0
	Senior Expert	7	21.9	23.3	63.3
	Head of Department	9	28.1	30.0	93.3
	Others	2	6.3	6.7	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 5: Classification of the respondents by Occupation Status

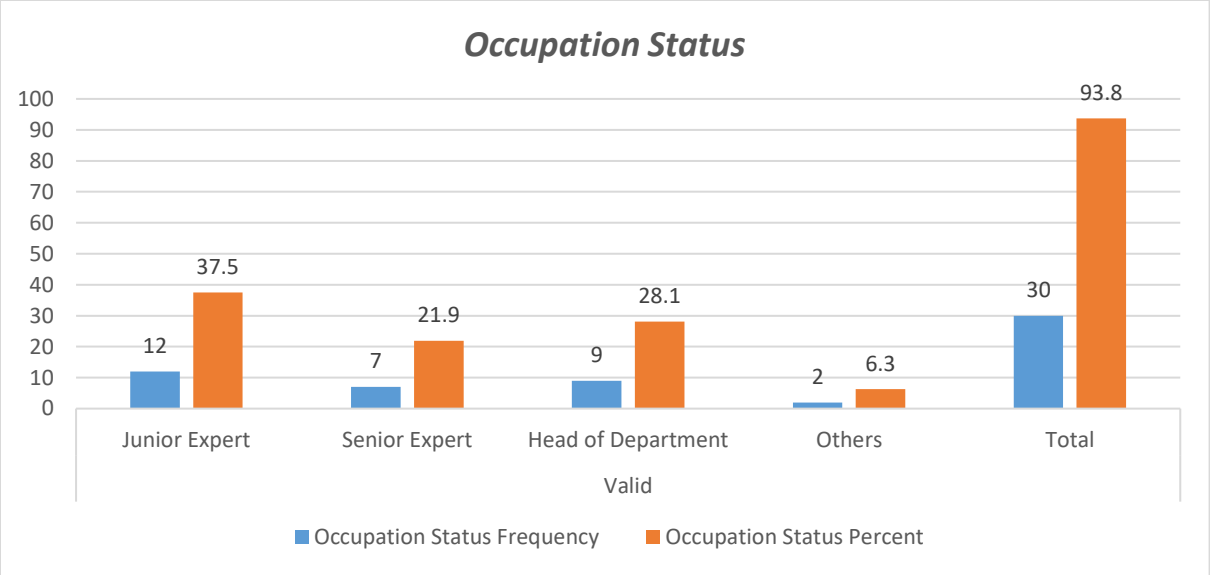


Figure 11: Classification of the respondents by Occupation Status

As the above table indicating, the 37.5% of the respondents were junior expert whereas 21.9% were senior experts and 28.1% were Head of departments. This indicates that the majority of employees in Somalia's energy companies hold junior positions.

4.4. Section 2. The Various Sources of Renewable Energy Technology in Somalia

2.1. Which of the following renewable sources are you using?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Solar energy	26	81.3	86.7	86.7
	Hydroelectric energy	3	9.4	10.0	96.7
	Mini-grids and Off-grid solutions	1	3.1	3.3	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 6: Sources of renewable energy

The figure and table illustrate the types of renewable energy sources currently utilized by respondents. Out of 30 valid responses, a significant majority—**86.7%**—reported using **solar energy**, highlighting its dominant role in Somalia's renewable energy landscape.

Other sources include **mini-grids and off-grid solutions** (16.7%), **hydroelectric energy** (13.3%), **wind energy** (6.7%), and **biomass energy** (3.3%).

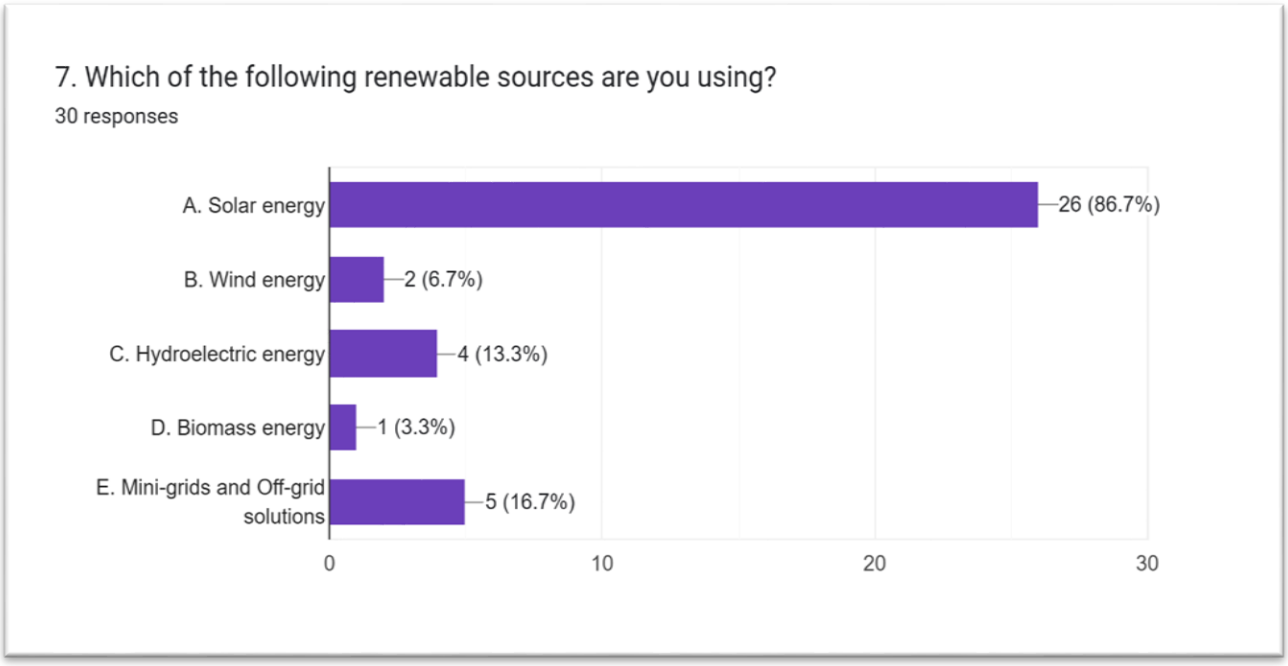


Figure 12: Sources of renewable energy

2.2. Have you noticed the changes in the electricity bill before and after using the renewable energy?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	22	68.8	73.3	73.3
	No	8	25.0	26.7	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 7: Changes in the electricity bill before and after using the renewable energy

The figure and table present respondents' experiences regarding changes in electricity bills after adopting renewable energy solutions. According to the results, **73.3%** of respondents noticed a **reduction** in their electricity costs after transitioning to renewable energy, while **26.7%** reported no significant change.

This data highlights that for the majority of users, renewable energy has resulted in **meaningful financial savings**, validating one of the key advantages of clean energy adoption—**cost-effectiveness over time**. The fact that over a quarter of respondents did not perceive a change suggests that some installations may have been less optimized or that initial investment costs still impact user perceptions of affordability.

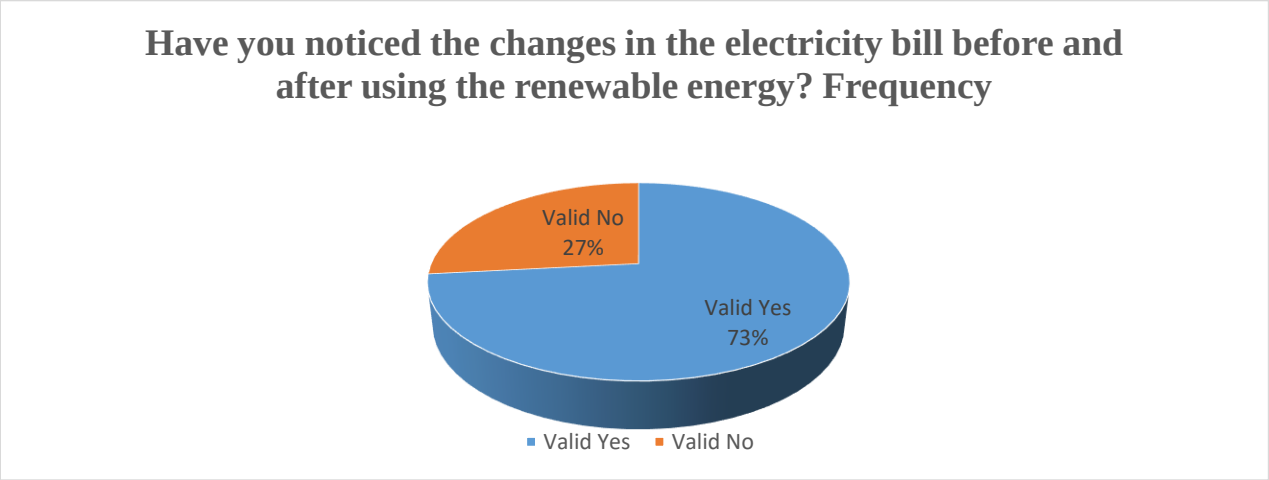


Figure 13: Changes in the electricity bill before and after using the renewable energy

2.3. How important do you think renewable energy is for Somalia's development?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	16	50.0	53.3	53.3
	Agree	9	28.1	30.0	83.3
	Neutral	2	6.3	6.7	90.0
	Disagree	2	6.3	6.7	96.7
	Strongly disagree	1	3.1	3.3	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 8: Renewable energy important for Somalia's development

The table presents respondents' opinions on the importance of renewable energy for Somalia's development. The results show that **83.3%** of participants either **strongly agreed** (53.3%) or **agreed** (30.0%) that renewable energy is crucial for Somalia's progress. Meanwhile, a small proportion remained **neutral (6.7%)**, and only **10.0%** either **disagreed** or **strongly disagreed**.

These findings clearly indicate a **strong consensus** among respondents that renewable energy plays a **vital role in advancing Somalia's sustainable development**, supporting areas such as economic growth, energy security, environmental protection, and improved living standards.

The few neutral or negative responses suggest minor skepticism or lack of full awareness among some individuals.

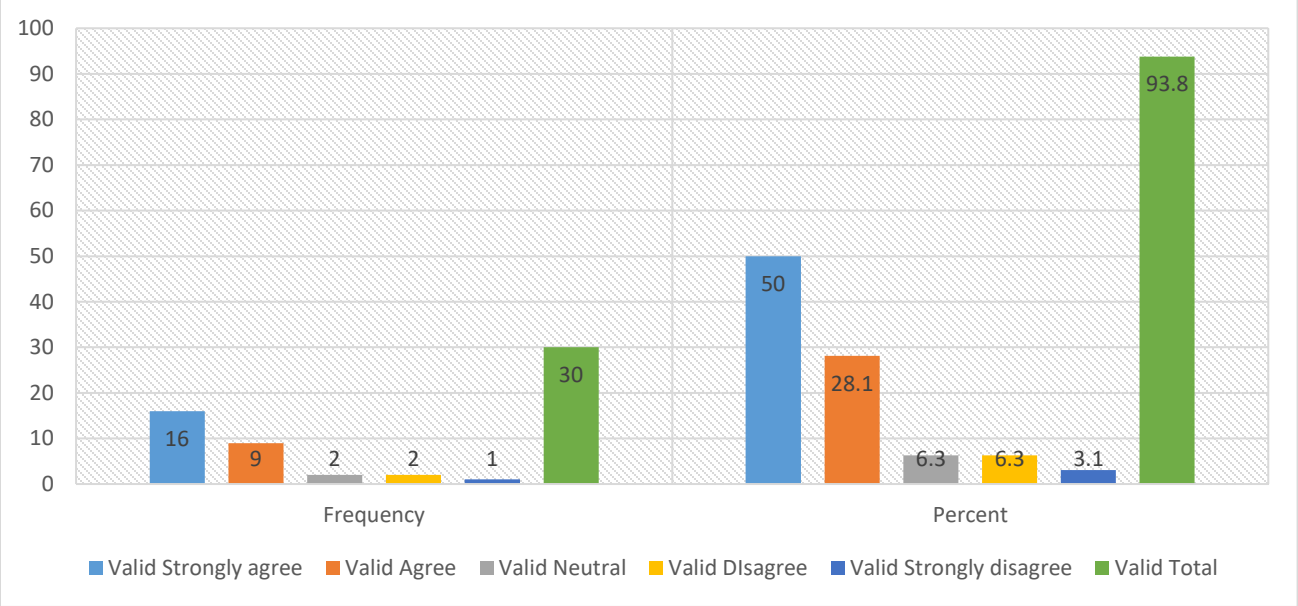


Figure 14: Renewable energy important for Somalia's development

2.4. How much do the following points influence your decision to switch to renewable energy?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Cost of purchasing	20	62.5	66.7	66.7
	Maintenance cost	1	3.1	3.3	70.0
	Ease of implementation	1	3.1	3.3	73.3
	Social opinions	1	3.1	3.3	76.7
	F. All of them	7	21.9	23.3	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 9: Points influence your decision to switch to renewable energy

The table illustrates the factors that influenced respondents' decisions to adopt renewable energy. The majority of participants (**66.7%**) identified the **cost of purchasing** renewable energy systems as the most significant factor affecting their decision. Meanwhile, smaller proportions cited **maintenance cost** (3.3%), **ease of implementation** (3.3%), and **social opinions** (3.3%) as important considerations. Additionally, **23.3%** of respondents indicated that **all of these factors combined** influenced their decision.

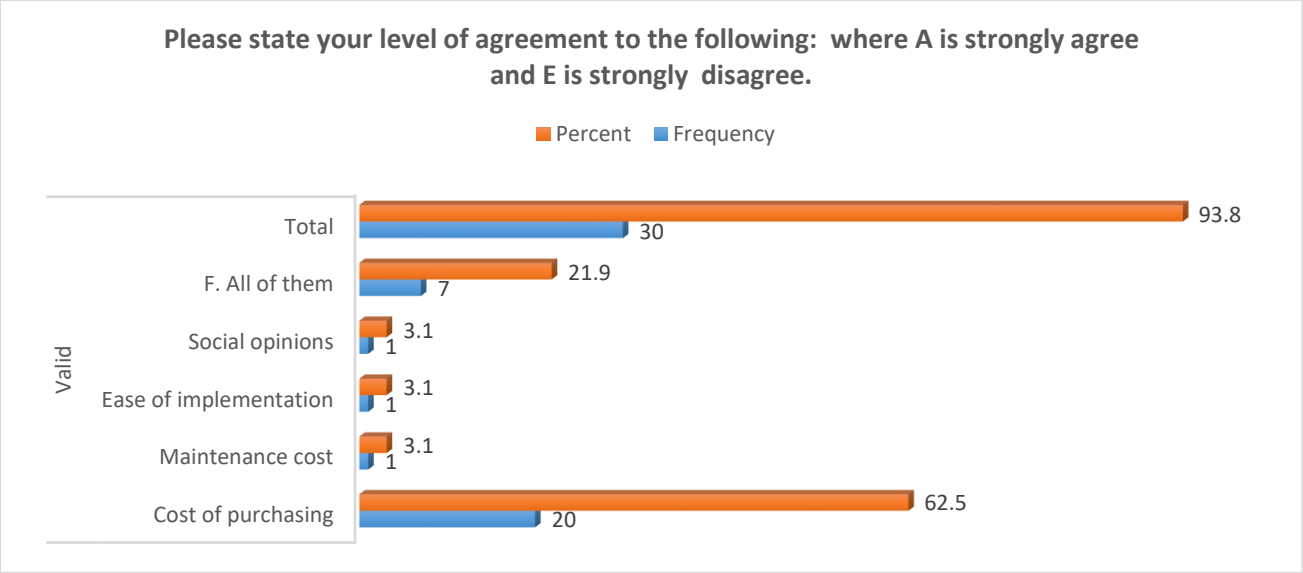


Figure 15: Points influence your decision to switch to renewable energy

2.5. Do you believe that the integration of renewable energy will create more job opportunities in Somalia?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	16	50.0	53.3	53.3
	Agree	8	25.0	26.7	80.0
	Neutral	4	12.5	13.3	93.3
	Disagree	2	6.3	6.7	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 10: Believes of integration of renewable energy will create more job opportunities in Somalia

The table presents respondents' perceptions regarding the potential of renewable energy to create new job opportunities in Somalia. The results show that a strong majority—**80.0%**—either **strongly agreed (53.3%)** or **agreed (26.7%)** that integrating renewable energy will lead to increased employment. Meanwhile, **13.3%** remained **neutral**, and only **6.7%** disagreed with the idea. These findings indicate a **widespread belief** among respondents that renewable energy development not only addresses energy access challenges but also offers a **significant opportunity for economic growth and job creation**. The optimism around employment opportunities suggests strong public support for expanding the renewable energy sector as part of Somalia's broader sustainable development strategy.

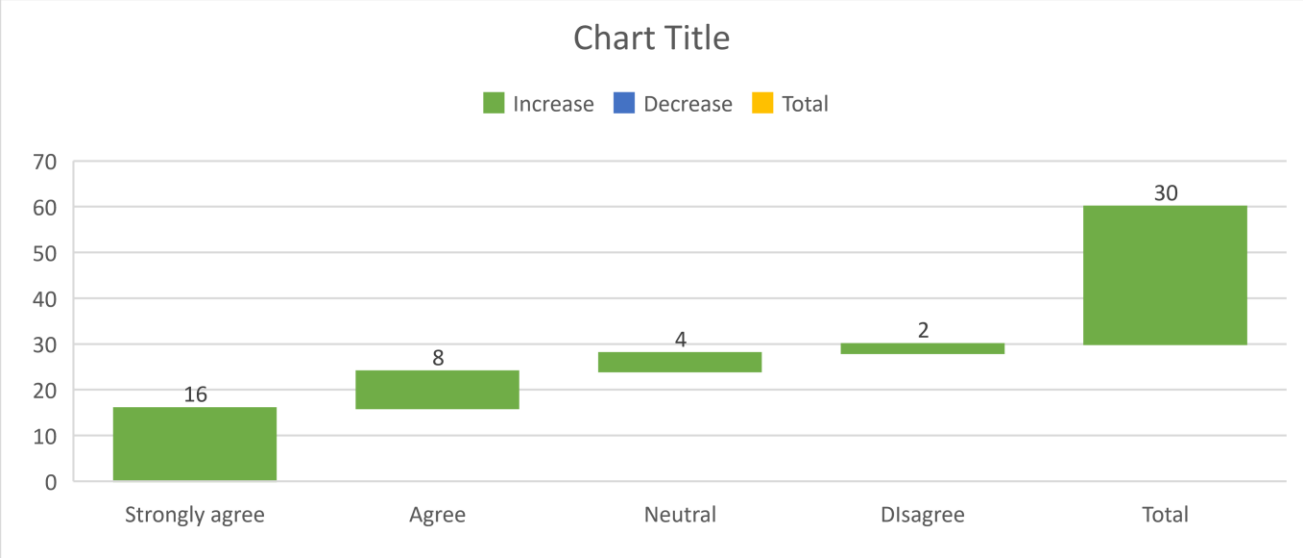


Figure 16: Believes of integration of renewable energy will create more job opportunities in Somalia

4.5. Section 3 Perceptions of Renewable Energy's Impact on SDGs

3.1. In your opinion, How important do you think renewable energy is for achieving the (SDGs) in Somalia?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Important	24	75.0	80.0	80.0
	Important	6	18.8	20.0	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 11: Important of renewable energy for achieving the (SDGs) in Somalia

The table shows respondents' views on the importance of renewable energy for achieving the Sustainable Development Goals (SDGs) in Somalia. A large majority—**80.0%**—considered renewable energy to be **very important**, while **20.0%** described it as **important**.

These results demonstrate a **strong consensus** among respondents that renewable energy is **critical** for Somalia's sustainable development. It reflects a widespread understanding that expanding renewable energy access directly supports key SDGs, including affordable energy, climate action, economic growth, and poverty reduction.

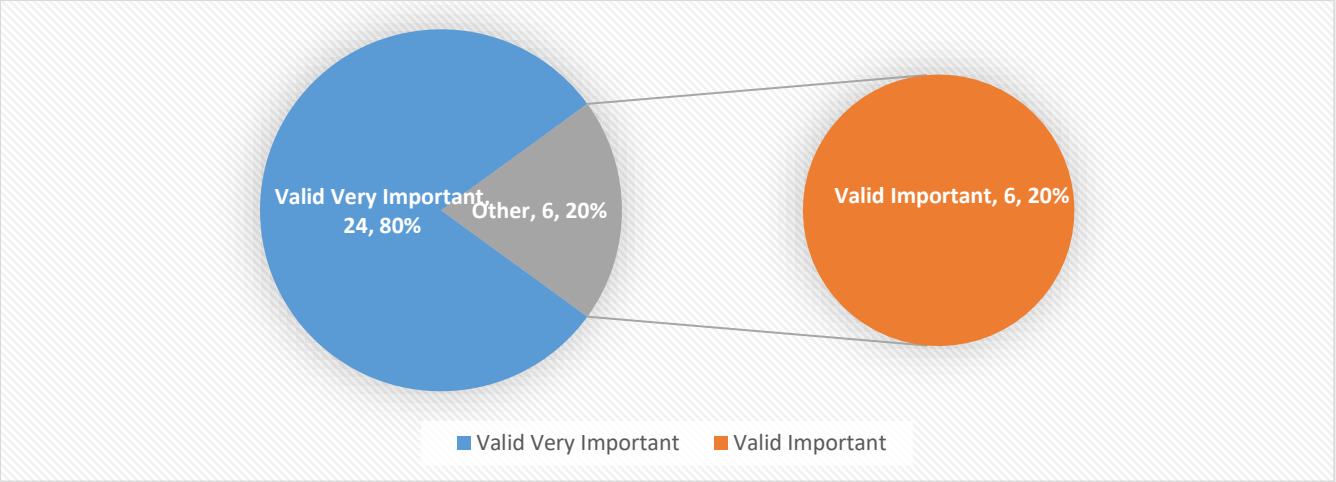


Figure 17: Important of renewable energy for achieving the (SDGs) in Somalia

3.2. Please rate each statement on a scale of A-E, where A is strongly agree and E is strongly disagree .

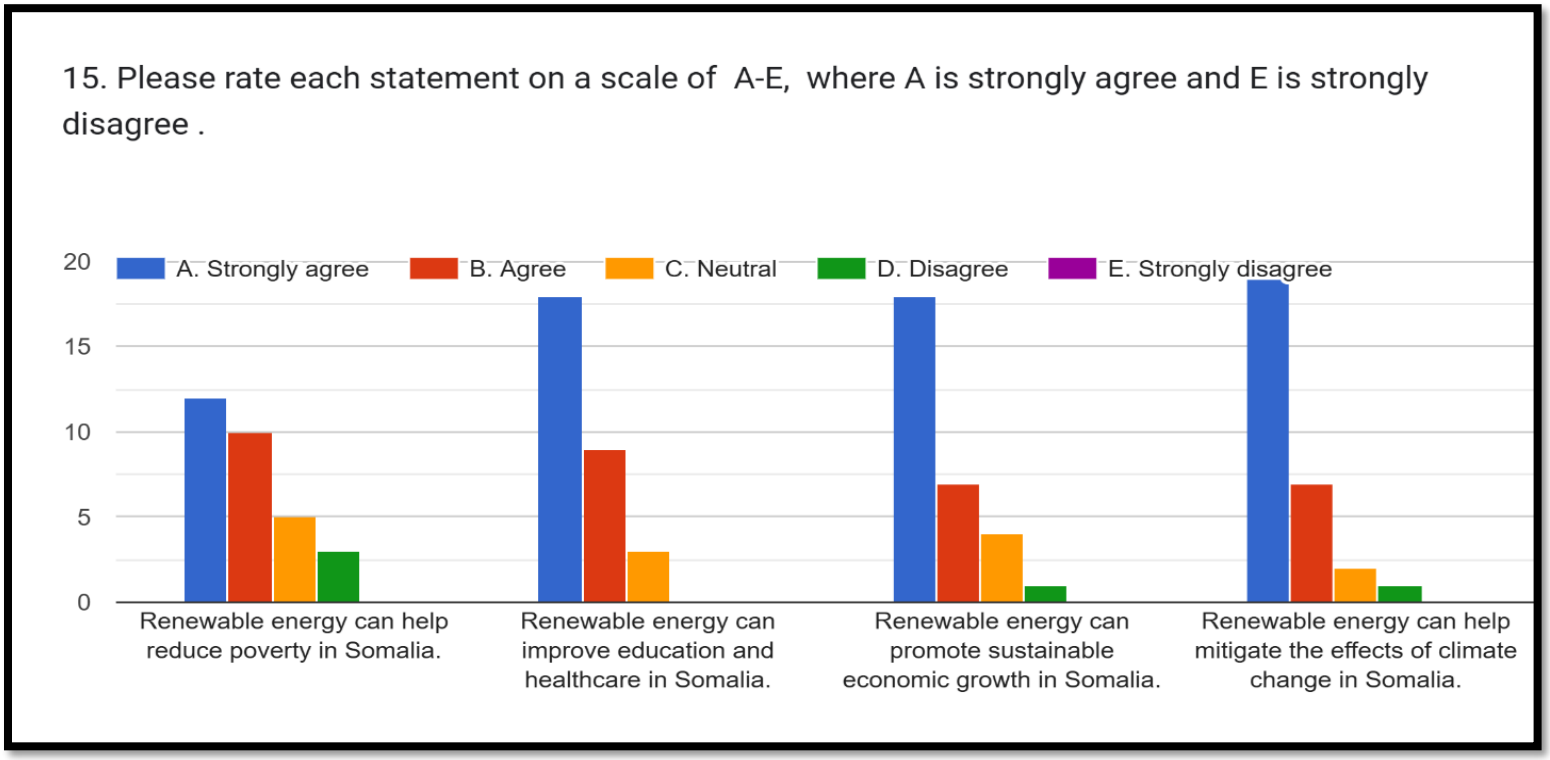


Figure 18: State your level of agreement to the following statements

3.3. Which SDGs do you think renewable energy can significantly contribute to in Somalia? (Select all that apply)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SDG 1: No Poverty	1	3.1	3.3	3.3
	SDG 7: Affordable and Clean Energy	20	62.5	66.7	70.0
	SDG 8: Decent Work and Economic Growth	3	9.4	10.0	80.0
	SDG 9: Industry, Innovation, and Infrastructure	4	12.5	13.3	93.3
	SDG 11: Sustainable Cities and Communities	2	6.3	6.7	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 12: SDGs can significantly contribute to the renewable energy in Somalia

The table illustrates respondents' views on which Sustainable Development Goals (SDGs) renewable energy can significantly impact in Somalia. A substantial majority—**66.7%**—identified **SDG 7: Affordable and Clean Energy** as the primary area where renewable energy can make a significant contribution. Other SDGs mentioned include **SDG 9: Industry, Innovation, and Infrastructure** (13.3%), **SDG 8: Decent Work and Economic Growth** (10.0%), **SDG 11: Sustainable Cities and Communities** (6.7%), and **SDG 1: No Poverty** (3.3%).

These findings suggest that respondents predominantly associate renewable energy with the goal of providing affordable and clean energy, which is directly aligned with SDG 7. The recognition of its potential impact on other goals, such as economic growth and infrastructure development, indicates an awareness of the broader benefits of renewable energy in advancing Somalia's sustainable development agenda.

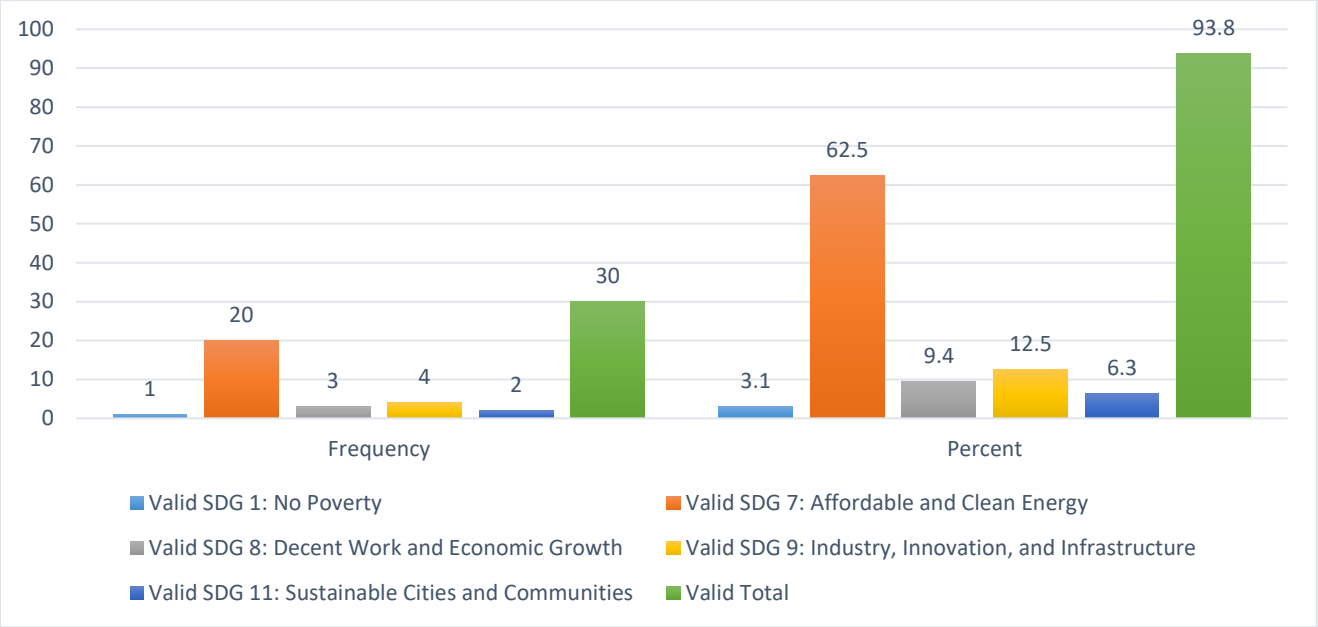


Figure 19: SDGs can significantly contribute to the renewable energy in Somalia

3.4. What role do you think the government should play in promoting renewable energy?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Provide Subsidies for Renewable Energy Projects	11	34.4	36.7	36.7
	Develop Policies and Regulations Favoring Renewable Energy	10	31.3	33.3	70.0
	Encourage Foreign Investment in Renewable Energy	6	18.8	20.0	90.0
	Create Public Awareness Campaigns	3	9.4	10.0	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 13: Role of Somalia's government in promoting renewable energy

The table presents respondents' views on the government's role in promoting renewable energy in Somalia. The majority of participants highlighted two primary actions: **providing subsidies for renewable energy projects (36.7%)** and **developing policies and regulations favoring renewable energy (33.3%)**. Other suggestions included **encouraging foreign investment in renewable energy (20.0%)** and **creating public awareness campaigns (10.0%)**.

These findings indicate that respondents believe the government should play a multifaceted role in advancing renewable energy. Financial incentives, such as subsidies, can lower the entry barriers for both consumers and investors. Simultaneously, establishing supportive policies and regulations can create a conducive environment for renewable energy development. Encouraging foreign investment can bring in necessary capital and expertise, while public awareness campaigns can educate the populace on the benefits and usage of renewable energy.

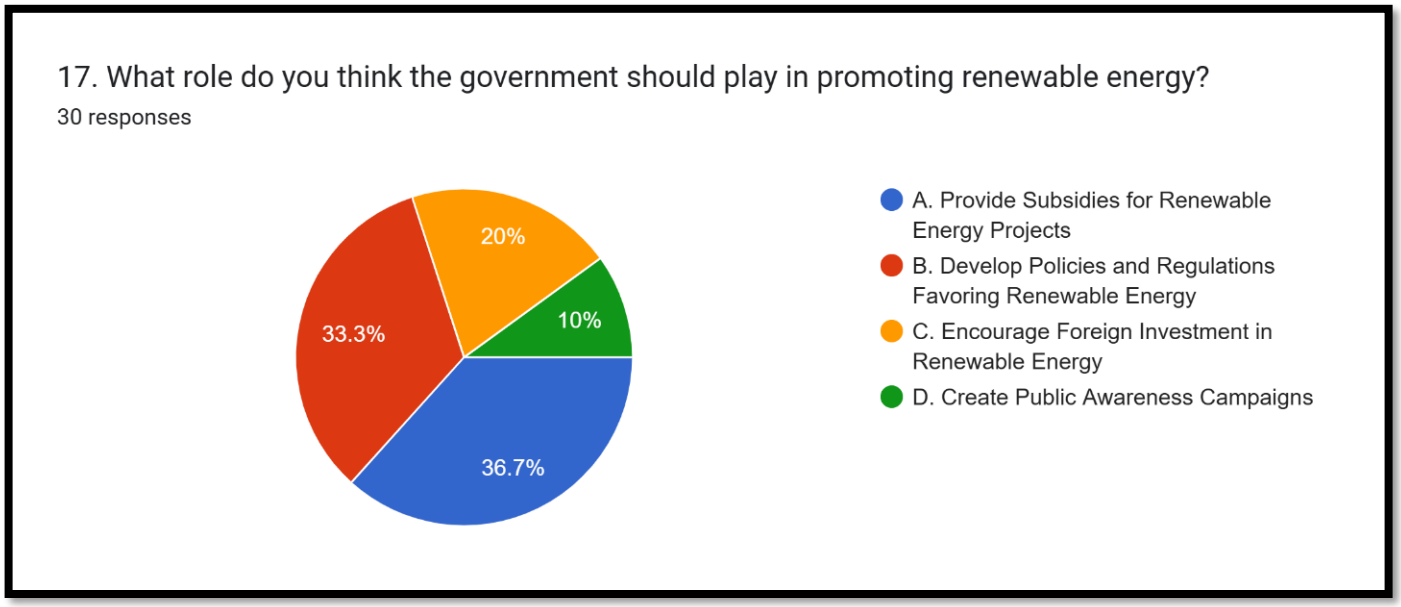


Figure 20: Role of Somalia's government in promoting renewable energy

4.6. Section 4 Renewable Energy Development Policy Implementation Strategies in Somalia

4.1. Does the government of Somalia have policies or strategies in place for renewable energy?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	21	65.6	70.0	70.0
	No	9	28.1	30.0	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 14: The government of Somalia has policies or strategies in place for renewable energy.

The table presents respondents' awareness of the Somali government's policies or strategies regarding renewable energy. The results indicate that **70.0%** of participants believe that such policies or strategies exist, while **30.0%** are unaware of any.

This majority awareness suggests that the government's efforts to promote renewable energy—such as the enactment of the Electricity Act of 2023, which established the National Electricity Authority and provided a legal framework for electricity development , and the implementation of the Somalia Power Master Plan —are reaching a significant portion of the population. However, the fact that nearly a third of respondents are unaware of these initiatives highlights the need for increased public engagement and information dissemination to ensure broader awareness and support for renewable energy policies.

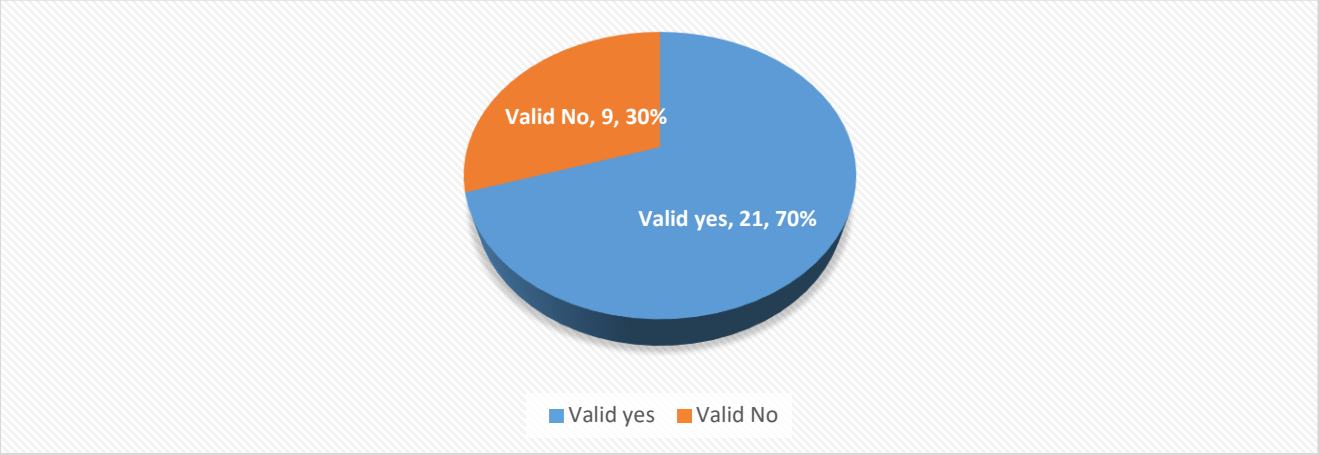


Figure 21: The government of Somalia has policies or strategies in place for renewable energy.

4.2. If such policies and strategies for renewable energy exist, how is the Somalia's Renewable Energy Policies' effectiveness?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very effective	12	37.5	40.0	40.0
	Somewhat effective	10	31.3	33.3	73.3
	Neutral	5	15.6	16.7	90.0
	Ineffective	3	9.4	10.0	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 15: Somalia's Renewable Energy Policies' effectiveness

The table shows how respondents view the effectiveness of Somalia's renewable energy policies and strategies. From the results, **40.0%** of the participants find the policies to be **very effective**, and **33.3%** think that they are **somewhat effective**. Another **16.7%** do not have an opinion on this matter **(neutral)**, and **10.0%** think that the policies are **ineffective.**

These results indicate a generally positive public attitude toward the government's initiative in developing renewable energy. The passage of the Electricity Act of 2023, which created the National Electricity Authority and gave a legal framework to electricity development, might have helped instill this impression.

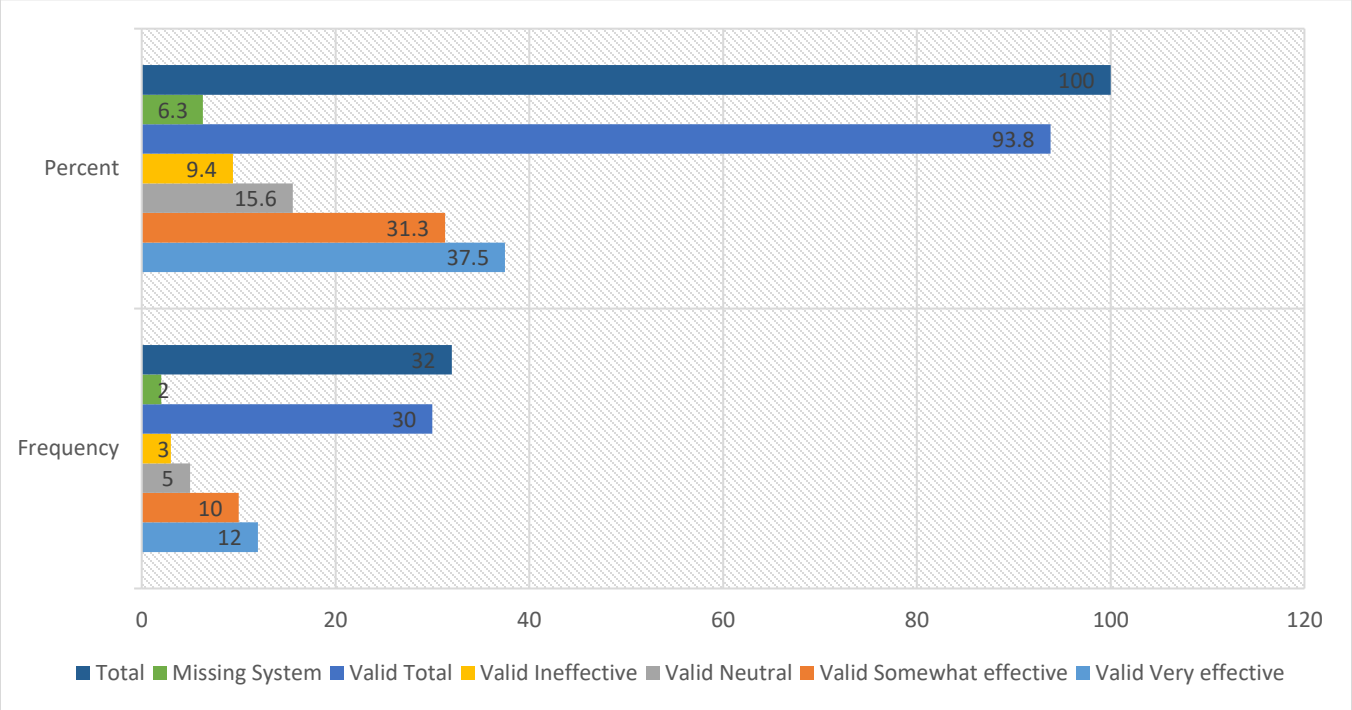


Figure 22: Somalia's Renewable Energy Policies' effectiveness

4.3. The Effectiveness of Renewable Energy Policies in Somalia / Positive impacts of renewable energy Policies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Job creation	6	18.8	20.0	20.0
	Access to energy	16	50.0	53.3	73.3
	Rural electrification	6	18.8	20.0	93.3
	Technological advancement	1	3.1	3.3	96.7
	Energy security	1	3.1	3.3	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 16: Effectiveness of Renewable Energy Policies in Somalia / Positive impacts of renewable energy Policies

The table shows how respondents viewed the positive effects stemming from renewable energy policies in Somalia. Most, **53.3%,** pointed out **access to energy** as the most important advantage**. Job creation** and **rural electrification** were also pointed out by **20.0%** each, while **technological development** and **energy security** were cited by **3.3%** respectively.

These results indicate that renewable energy policy is best known for increasing accessibility of energy, important in Somalia due to historically low rates of electrification, particularly in the countryside. Both rural electrification and job creation highlight the needs of the country to spur economic growth and lift standards of living in remote areas. While less frequent mentions, technology development and energy security emphasize knowledge of other positive impacts from renewable energy policies.

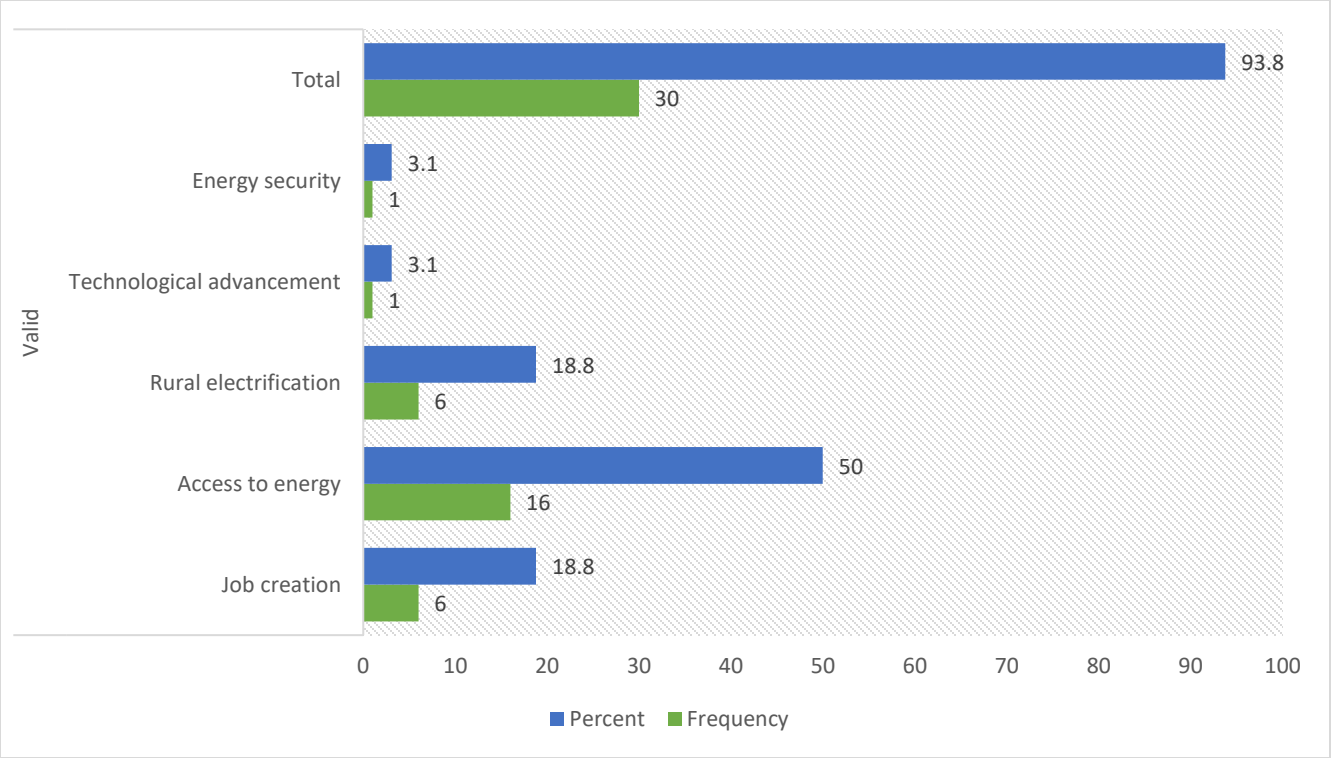


Figure 23: Positive impacts of renewable energy Policies* effectiveness *in Somalia

4.4. The Effectiveness of Renewable Energy Policies in Somalia/ Challenges or areas where these policies have fallen short

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Infrastructure gaps	7	21.9	23.3	23.3
	Financing constraints	6	18.8	20.0	43.3
	Political instability	7	21.9	23.3	66.7
	Lack of public awareness	9	28.1	30.0	96.7
	Energy access disparities	1	3.1	3.3	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 17: *Challenges of renewable energy policies effectiveness in Somalia have fallen short*

The table presents respondents' perceptions regarding the challenges and areas where Somalia's renewable energy policies have fallen short. The most frequently identified issue is a **lack of public awareness** (30.0%), followed by **infrastructure gaps** and **political instability** (each at 23.3%), **financing constraints** (20.0%), and **energy access disparities** (3.3%).

These findings highlight several critical barriers to the effective implementation of renewable energy initiatives in Somalia. The prominence of public awareness as a challenge suggests that many citizens may not be adequately informed about renewable energy options or the benefits of transitioning to sustainable energy sources. This gap can hinder community engagement and the adoption of renewable technologies.

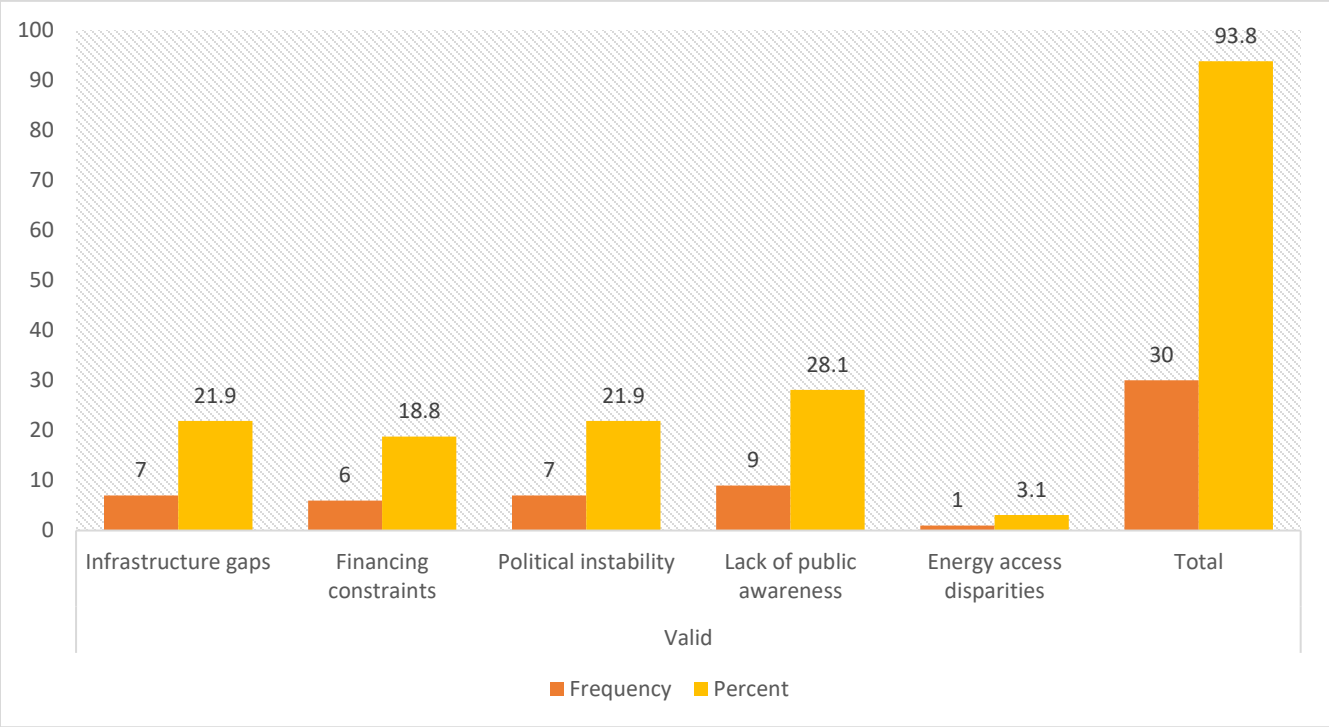


Figure 24: Challenges of renewable energy policies effectiveness in Somalia have fallen short.

4.7. Section 5. Challenges/Barriers of Renewable Energy Technologies in Somalia

5.1. Which of the following challenges /barriers you faced during the implementation of RETs in Somalia

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Financial barriers	12	37.5	40.0	40.0
	Policy and regulatory challenges	4	12.5	13.3	53.3
	Infrastructure gaps	2	6.3	6.7	60.0
	Technological capacity	3	9.4	10.0	70.0
	Public awareness and acceptance	4	12.5	13.3	83.3
	Politics and economic stability	1	3.1	3.3	86.7
	All of them	4	12.5	13.3	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 18: Barriers you faced during the implementation of RETs in Somalia

The table presents respondents' experiences regarding the challenges faced during the implementation of Renewable Energy Technologies (RETs) in Somalia. The most frequently reported barrier is **financial constraints**, cited by **40.0%** of participants. Other notable challenges include **policy and regulatory issues** and **public awareness and acceptance**, each identified by **13.3%** of respondents. **Technological capacity** was mentioned by **10.0%**, while **infrastructure gaps** accounted for **6.7%**. Additionally, **3.3%** of participants highlighted **political and economic instability** as a hindrance, and another **13.3%** indicated that they faced all the listed challenges.

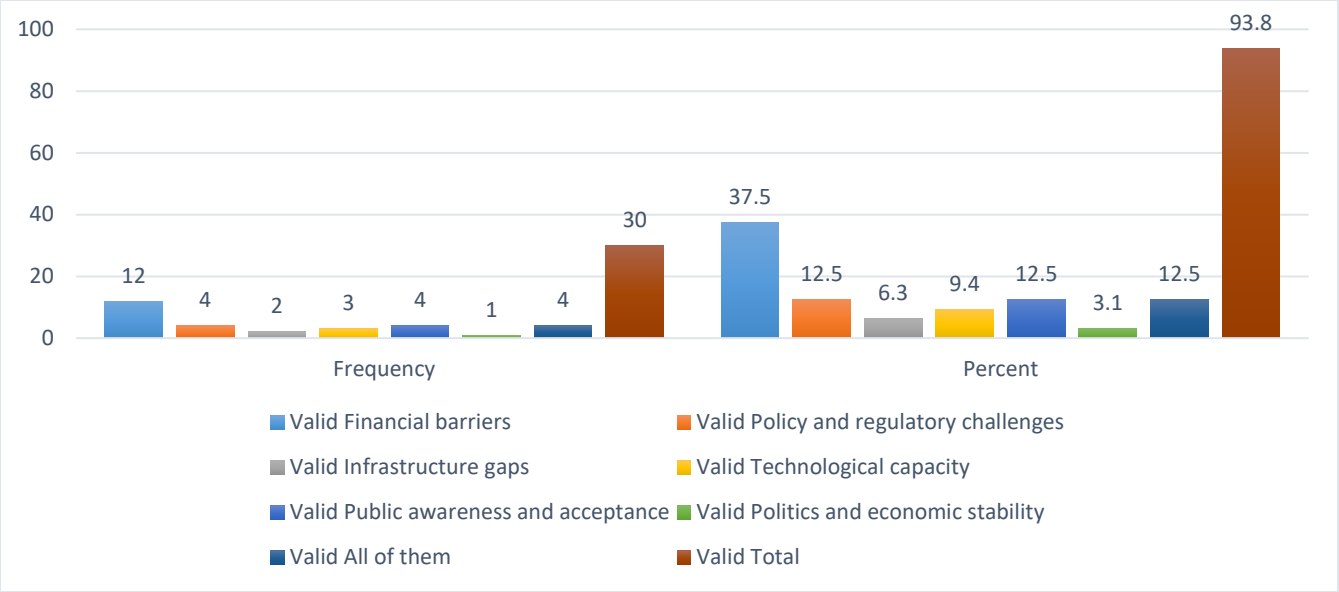


Figure 25: Barriers you faced during the implementation of RETs in Somalia

5.2. Specific economic challenges that hinder the widespread use of renewable energy technologies in Somalia

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High initial cost	25	78.1	83.3	83.3
	Energy price dynamics	2	6.3	6.7	90.0
	Return on investment (ROI) concerns	2	6.3	6.7	96.7
	Economic stability	1	3.1	3.3	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 19: Specific economic challenges that hinder the widespread use of renewable energy technologies in Somalia

The table presents respondents' perceptions of the specific economic challenges hindering the widespread adoption of renewable energy technologies in Somalia. A significant majority—**83.3%**—identified the **high initial cost** as the primary barrier. Other challenges mentioned include **energy price dynamics** and **return on investment (ROI) concerns**, each cited by **6.7%** of participants, and **economic stability**, noted by **3.3%**.

These findings underscore the financial hurdles that impede the transition to renewable energy in Somalia. The substantial upfront costs associated with renewable energy installations, such as solar panels, are often prohibitive for households and small businesses. Additionally, the lack of affordable financing options exacerbates this issue, making it challenging for many to invest in renewable energy solutions.

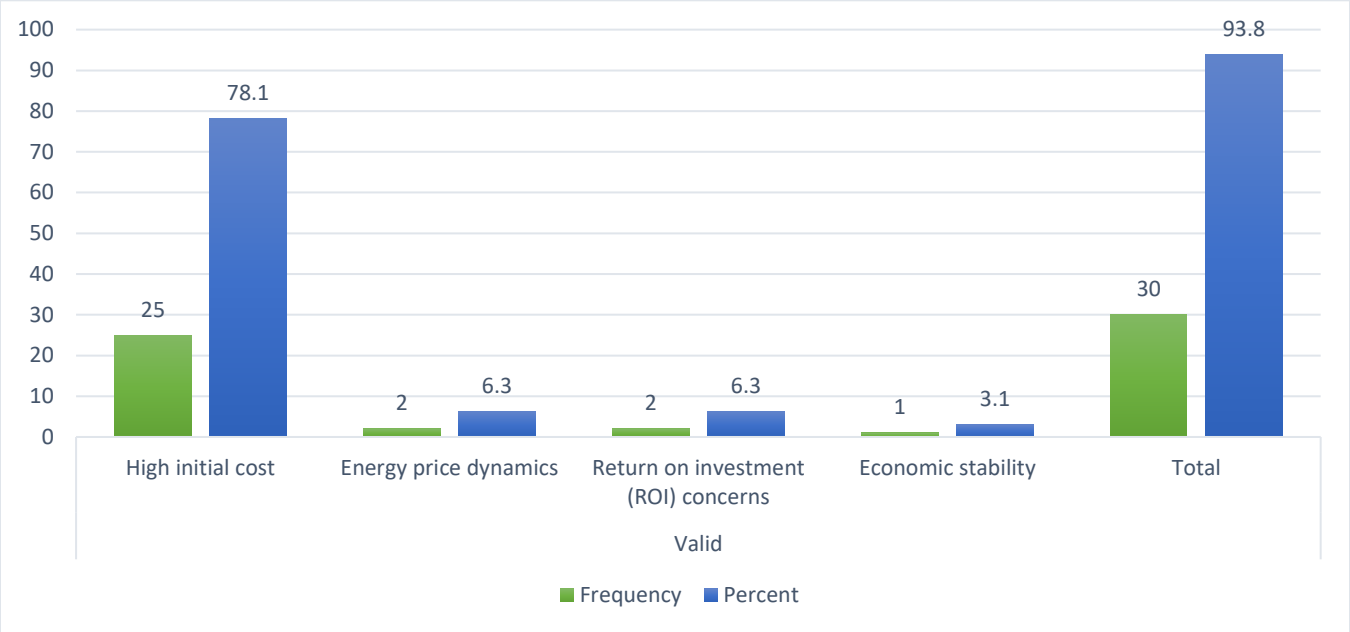


Figure 26: Specific economic challenges that hinder the widespread use of renewable energy technologies in Somalia

5.3. Do you believe there are regulatory or policy-related barriers affecting the renewable energy sector in Somalia?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	24	75.0	80.0	80.0
	No	6	18.8	20.0	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 20: There are regulatory or policy-related barriers affecting the renewable energy sector in Somalia

The table presents respondents' perceptions regarding the existence of regulatory or policy-related barriers affecting the renewable energy sector in Somalia. A significant majority—**80.0%**—affirmed the presence of such barriers, while **20.0%** did not perceive them as impediments.

These findings underscore the challenges within Somalia's policy and regulatory frameworks that hinder the advancement of renewable energy initiatives. Despite the Federal Government of Somalia (FGS) developing the Somalia Energy Policy in 2019 and the Electricity Bill in 2020, the implementation and enforcement of these policies remain limited.

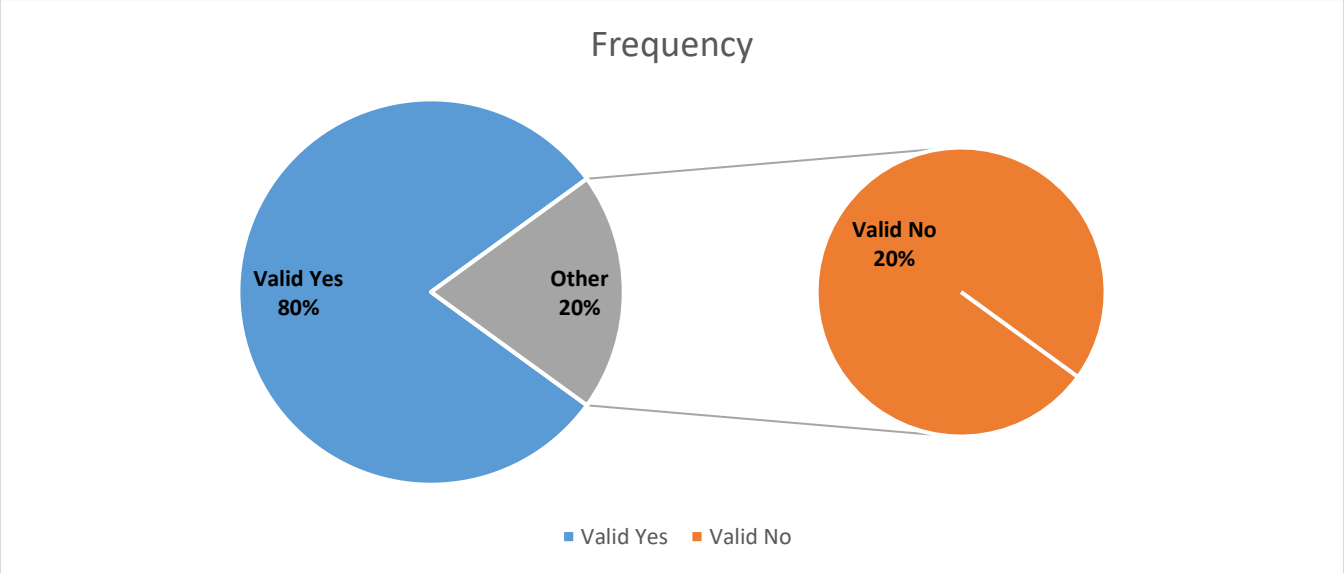


Figure 27: There are regulatory or policy-related barriers affecting the renewable energy sector in Somalia

5.4. Regulatory or policy-related barriers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Policy instability	12	37.5	40.0	40.0
	Inconsistent regulatory frameworks	9	28.1	30.0	70.0
	Lack of enforcement	6	18.8	20.0	90.0
	Permitting and licensing processes	1	3.1	3.3	93.3
	Access to finance	2	6.3	6.7	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 21: Regulatory or policy-related barriers

The table presents respondents' perceptions regarding specific regulatory and policy-related barriers impacting the renewable energy sector in Somalia. The most frequently cited challenge is **policy instability**, identified by **40.0%** of participants. This is followed by **inconsistent regulatory frameworks** at **30.0%**, and a **lack of enforcement** at **20.0%**. Other barriers include **permitting and licensing processes** (**3.3%**) and **access to finance** (**6.7%**).

These findings underscore the multifaceted regulatory challenges hindering the advancement of renewable energy initiatives in Somalia. Despite the Federal Government of Somalia (FGS) developing the Somalia Energy Policy in 2019 and the Electricity Bill in 2020, the implementation and enforcement of these policies remain limited.

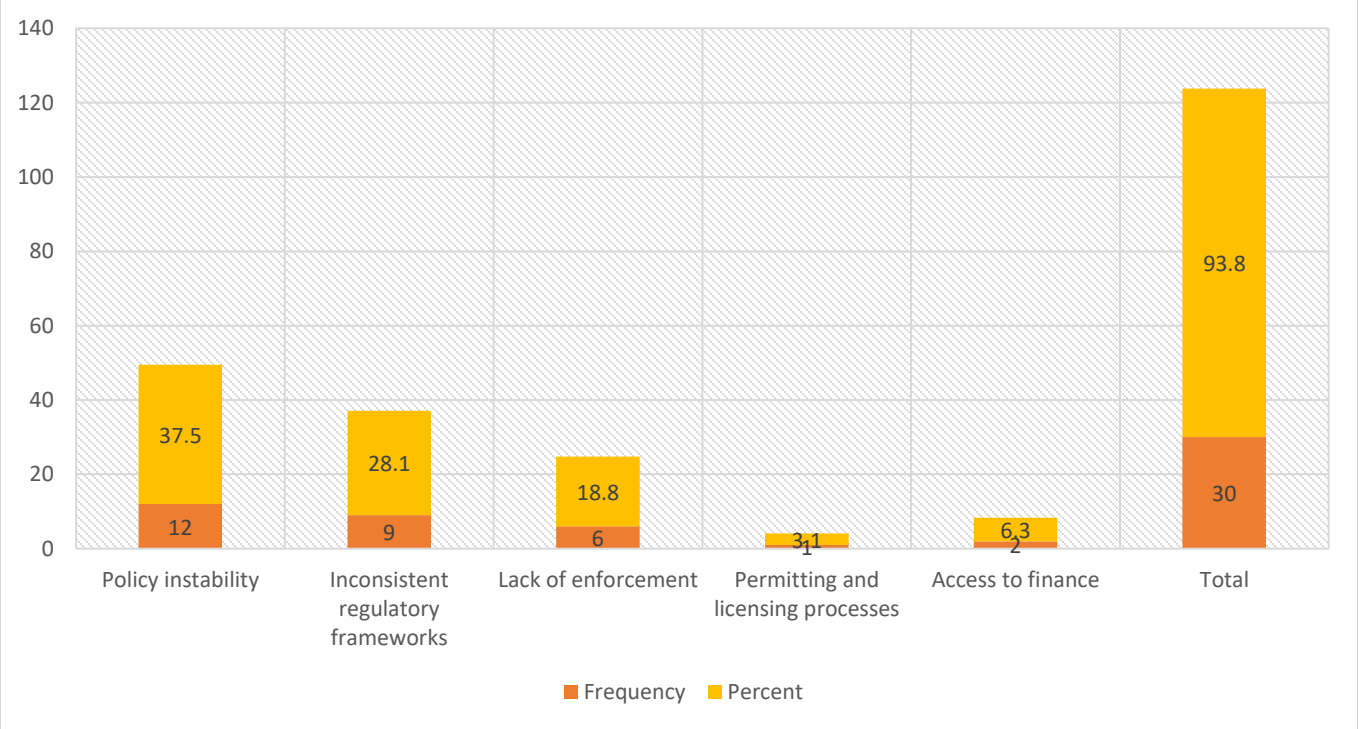


Figure 28: Regulatory or policy-related barriers

4.8. Section 6: Impact of Renewable Energy on Local Communities

6.1. Do you believe that renewable energy can improve the livelihoods of local communities in Somalia?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	20	62.5	66.7	66.7
	Agree	7	21.9	23.3	90.0
	Neutral	2	6.3	6.7	96.7
	Disagree	1	3.1	3.3	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 22: Renewable energy can improve the livelihoods of local communities in Somalia

The table presents respondents' perceptions regarding the potential of renewable energy to improve the livelihoods of local communities in Somalia. A significant majority—**66.7%**—**strongly agree**, and an additional **23.3% agree**, indicating a broad consensus on the positive impact of renewable energy. A smaller proportion remains neutral (**6.7%**) or disagrees (**3.3%**).

These findings align with broader research highlighting the transformative effects of renewable energy on community livelihoods. For instance, initiatives like the Africa Minigrids Program (AMP), led by the United Nations Development Programme (UNDP), aim to increase access to sustainable and affordable energy across Sub-Saharan Africa, including Somalia. Such programs not only provide reliable electricity but also support climate action and economic development .

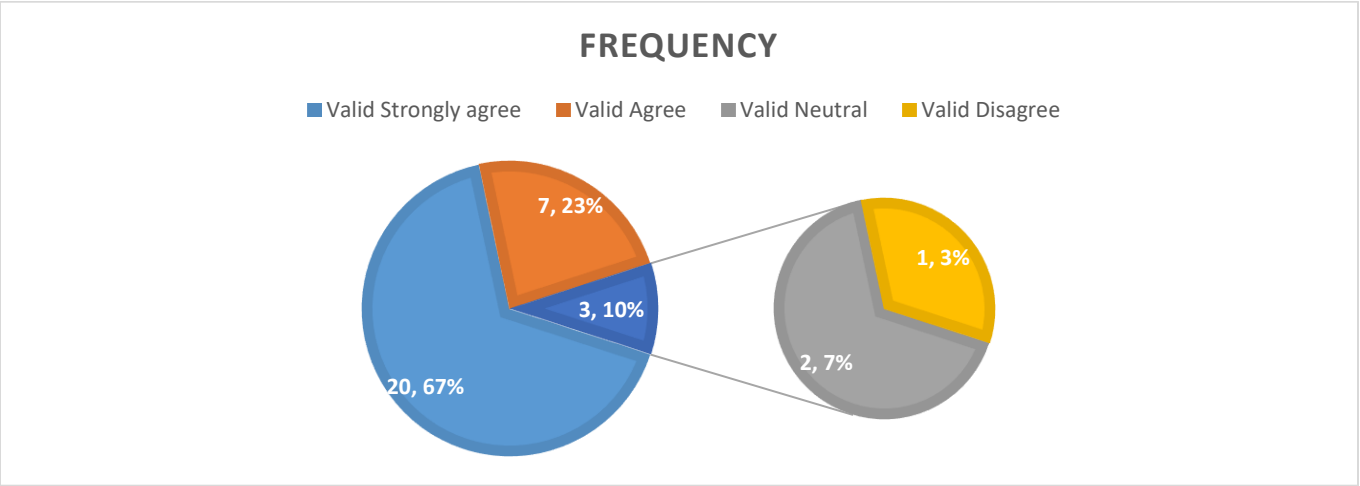


Figure 29: Renewable energy can improve the livelihoods of local communities in Somalia

6.2. In your opinion, how has the availability of renewable energy affected your local community?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Significantly Improved	16	50.0	53.3	53.3
	Slightly Improved	9	28.1	30.0	83.3
	No Impact	4	12.5	13.3	96.7
	Worsened	1	3.1	3.3	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 23. The availability of renewable energy affected the local community

The table presents respondents' perceptions regarding the impact of renewable energy availability on their local communities in Somalia. A significant majority—**53.3%**—reported that renewable energy has **significantly improved** their communities, while **30.0%** noted **slight improvements**. A smaller proportion indicated **no impact** (**13.3%**) or felt that conditions had **worsened** (**3.3%**).

These findings align with broader research highlighting the transformative effects of renewable energy on community livelihoods. For instance, initiatives like the Somalia Electricity Sector Recovery Project (SESRP), supported by the World Bank, aim to expand access to electricity through renewable sources, particularly in rural areas. Such projects are designed to power public institutions like schools and hospitals, thereby enhancing essential services and contributing to community development. (Marriott, Renewable Energy in Somalia 2024)

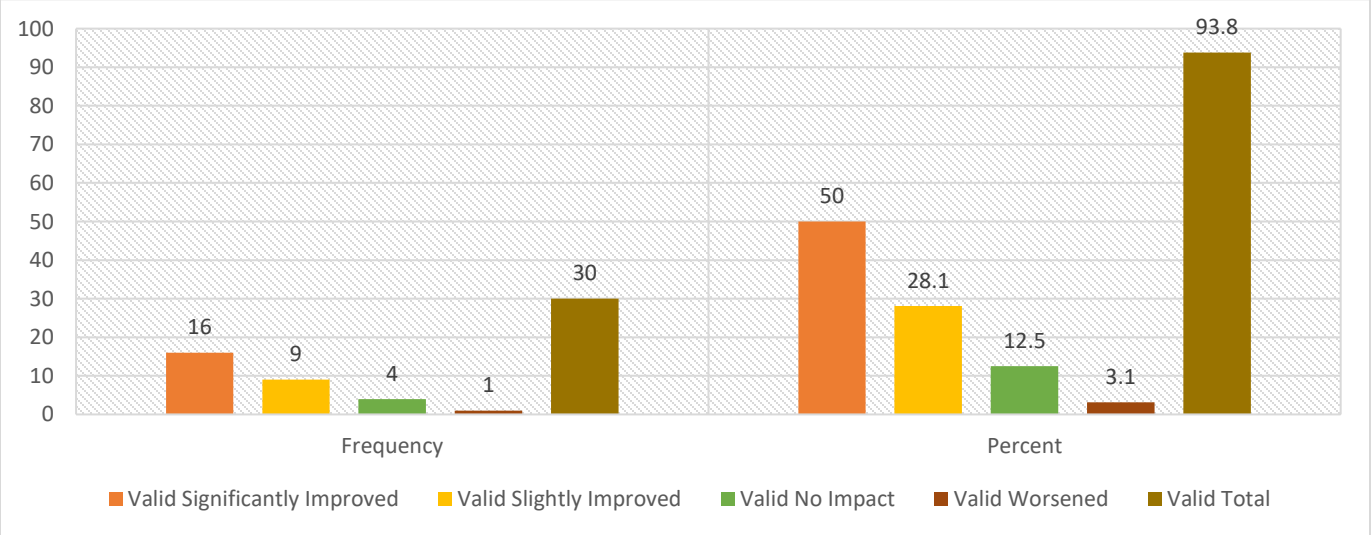


Figure 30: The availability of renewable energy affected the local community

6.3. Which areas in your community have benefited most from renewable energy? (Select all that apply)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Electricity	10	31.3	33.3	33.3
	Agriculture	2	6.3	6.7	40.0
	Education	1	3.1	3.3	43.3
	All of them	17	53.1	56.7	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 24. Areas in Somali community have benefited most from renewable energy

The table presents respondents' perceptions regarding which areas in their communities have benefited most from renewable energy initiatives. A significant majority—**56.7%**—indicated that **all sectors**, including electricity, agriculture, and education, have experienced improvements. Specifically, **33.3%** highlighted **electricity**, **6.7%** pointed to **agriculture**, and **3.3%** noted **education** as the primary beneficiaries.

These findings align with broader developments in Somalia's renewable energy sector. For instance, the Federal Government of Somalia has started installing independent solar photovoltaic systems in Banadir's educational institutions. This initiative aims to increase access to cleaner and more reasonably priced electrical services more accessible, thereby enhancing the quality of education (Chandak 2024)

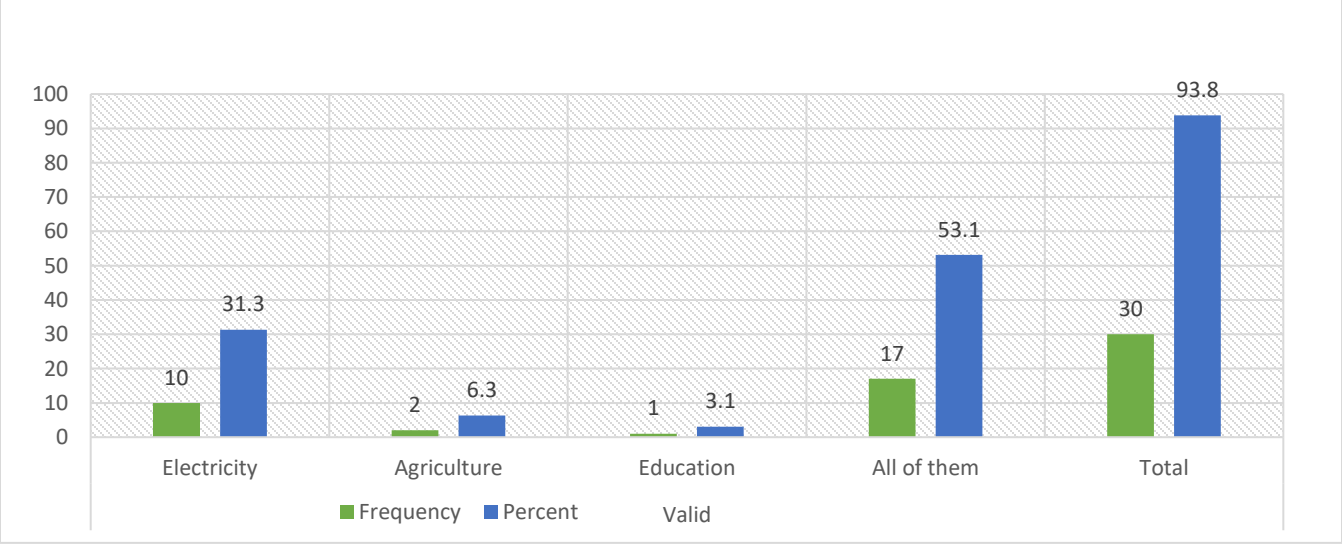


Figure 31: The availability of renewable energy affected the local community

4.9. Section 7: Recommendations

7.1. What strategies do you recommend to enhance the use of renewable energy in Somalia? (Select all that apply)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Increased Government Investment	5	15.6	16.7	16.7
	Public-Private Partnerships	5	15.6	16.7	33.3
	International Collaboration	4	12.5	13.3	46.7
	Strengthening Local Expertise	3	9.4	10.0	56.7
	Reducing Costs of Renewable Energy Technology	2	6.3	6.7	63.3
	All of them	11	34.4	36.7	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

Table 25. Strategies you recommend to enhance the use of renewable energy in Somalia

The table presents respondents' recommendations on strategies to bolster the adoption of renewable energy in Somalia. A significant majority—**36.7%**—advocated for a comprehensive approach encompassing all listed strategies. Among individual strategies, **increased government investment** and **public-private partnerships** each garnered **16.7%** support, followed by **international collaboration** (**13.3%**), **strengthening local expertise** (**10.0%**), and **reducing costs of renewable energy technology** (**6.7%**).

These findings align with broader initiatives and studies emphasizing the multifaceted approach required to advance renewable energy in Somalia. For instance, the Somalia Power Master Plan and the National Development Plan highlight the importance of integrating renewable energy solutions to enhance energy access and reliability. International collaborations, such as those facilitated by Power Africa, provide technical assistance and support to electricity service providers, aiming to improve operational efficiency and service delivery (Africa, Unlocking Somalia's Clean Energy Potential 2024).

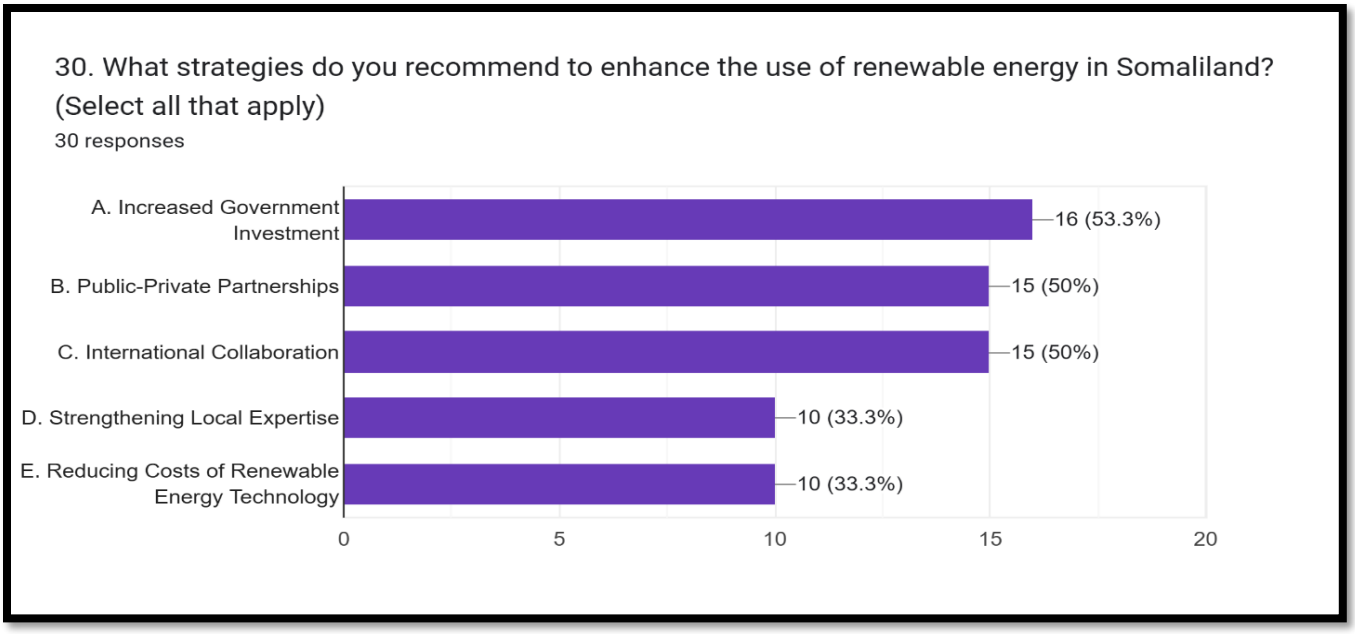


Figure 32: Strategies you recommend to enhance the use of renewable energy in Somalia

4.10. Finding from interview

4.10.1 Question one:

Analysis of Government Policies on Renewable Energy in Somaliland

"*Do you have any government policies or strategies that promote renewable energy in Somaliland?"*

The three energy sector managers' responses contain different levels of information about the current government policies and strategies encouraging renewable energy in Somalia. Examining these responses unveils specific themes on policy implementation, regulatory systems, investment promotion incentives, and strategic planning.

Comparative Analysis of Somaliland and Somalia's Renewable Energy Policies

Renewable energy is a significant stimulus for sustainable development, especially in energy-scarce nations such as Somaliland and Somalia. Whereas Somaliland has developed far enough to build a formalized policy framework regulating and supporting renewable energy, Somalia is mostly unregulated, and private sector and donor-initiated efforts fill the policy void.

This comparative examination considers government policy in the two countries, noting differences in policy implementation, regulatory frameworks, and investment incentives, and evaluating implications for sustainable development.

1. Policy and Regulatory Frameworks

Somaliland: A Structured Approach to Renewable Energy Policies

The Somaliland Government has developed a formal legislative and regulatory framework to encourage renewable energy, as indicated through comments from managers in the energy sector:

- Electricity Act (2016, effective 2018) – Declares the Ministry of Energy and Minerals (MOEM) as the main energy policymaker and Somaliland Energy Regulatory Commission (SERC) as the regulator.
- Somaliland Investment Act (2021) – Offers investors legal safeguards to ensure equal treatment for foreign and domestic energy investors.

- Energy Security and Resource Efficiency in Somaliland (ESRES) Program – A UK-sponsored programmed encouraging hybrid mini-grids utilizing solar PV and diesel genets to contain costs.
- Somaliland Electricity Sector Recovery Project (SESRP) – A $50m World Bank-supported project working on integrating the use of renewable energy and developing the electricity grid.

These measures exhibit a structured state response towards renewable energy by promoting regulatory continuity, protection for investors, and donor-supported ventures.

Somalia: Absence of a Unified Renewable Energy Policy

In contrast, Somalia lacks a national regulatory framework governing renewable energy. The energy sector is highly privatized, with no single regulatory authority overseeing electricity generation, transmission, and pricing.

Key characteristics of Somalia's policy landscape:

- No national energy policy – Unlike Somaliland, Somalia has not enacted an electricity act or investment policy for the energy sector.
- Absence of a centralized regulator – The Federal Government of Somalia (FGS) has not yet formed a separate energy regulatory commission like Somaliland's SERC.
- Private sector energy development – Electricity suppliers are independent entities that determine their tariffs and sources of energy.
- Donor-initiated energy developments – Renewable energy projects are more funded by foreign agencies (World Bank, UNDP, EU) than being government-initiated.

These variations point to the fact that although Somaliland has created a systematic energy governance structure, Somalia's renewable energy growth is occurring in the absence of official government intervention.

2. Government-Supported Renewable Energy Projects

Somaliland: Donor-Supported, Policy-Backed Development

The ESRES and SESRP initiatives in Somaliland demonstrate how government policies influence renewable energy development. These initiatives:

- Enhance the affordability of energy through hybrid solar mini-grids.
- Decrease reliance on fossil fuels and imported diesel.
- Increase access to electricity for underserved populations.

As such projects are consistent with government policies, they serve to form an integrated national energy policy.

Somalia: Project-Based, Ad-Hoc Renewable Energy Development

There are some renewable energy projects in Somalia but without a central government:

- Somalia Energy Access Project (SEAP) – A World Bank project promoting solar power solutions.
- Solar projects supported by UNDP and the EU – Emphasize small-scale solar electrification in rural locations.
- Privately owned mini-grids – Independent operation in Mogadishu and other towns.

But the projects are not policy-coordinated, leading to variable pricing, quality of services, and grid connection. In contrast to Somaliland, Somalia's renewable energy industry is guided by market forces rather than government policy.

3. Investment Climate and Policy Incentives

Somaliland: Organized Investment Environment

- The Somaliland Investment Act (2021) guarantees legal safeguards for investors and a secure business climate.
- Feed-in Tariffs (FiTs), Renewable Portfolio Standards (RPS), and Transmission Access Policies are under development to attract investment.

- ❖ Long-term funding stability is guaranteed by international donor partnerships (World Bank, UKAID).

Somalia: High-Risk Investment Environment

- ❖ Lack of investment protection legislation deters large-scale renewable energy investments.
- ❖ High and unstable tariffs are the outcome of unregulated electricity markets.

Security threats and political instability raise uncertainty for local and foreign investors.

They make Somalia less attractive to renewable energy investment than Somaliland.

4. Policy Implementation and Effectiveness

Somaliland: Policy Awareness vs. Implementation Challenges

Replies from Somaliland energy managers reflect knowledge of policies in place, but gaps in implementation and enforcement:

- ❖ The respondents elaborated on several policies, reflecting organized policymaking.
- ❖ The respondents recognized policies but was not specific, reflecting potential gaps in policy communication.
- ❖ The respondents mentioned mechanisms such as FiTs and RPS, which are not yet fully implemented, reflecting that Somaliland is still in the initial stages of policy implementation.

Somalia: Absence of Official Policies Deters Renewable Energy Development

Lacking a national regulatory system, Somalia's renewable energy industry is plagued by:

- ❖ Unstable prices and quality of service due to a dispersed market.
- ❖ No standard for incorporating renewable energy into the grid.
- ❖ Little government involvement, with private companies creating their own rules.

Somalia does not have policies as there are policies in Somaliland but they suffer from lack of enforcement.

Final Comparison: Key Differences in Approach

Factor	Somaliland	Somalia
Legislative Framework	Electricity Act, Investment Act	No unified national energy policy
Regulatory Body	Somaliland Energy Regulatory Commission (SERC)	No centralized regulatory authority
Government Role	Actively involved in energy planning	Minimal involvement, private-sector led
Investment Climate	Legal protections for investors	High-risk investment environment
Renewable Energy Projects	Government-backed, donor-supported (ESRES, SESRP)	Private-sector and NGO-driven
Challenges	Policy enforcement, donor dependency	Policy absence, market fragmentation

4.10.2 Question two

Analysis of Government Policy Effectiveness in Somaliland

"How effective are these policies in supporting renewable energy use?"

Comparative Analysis of Policy Effectiveness in Somaliland and Somalia

Assessing the efficacy of renewable energy policies in Somaliland and Somalia entails looking at their success, setbacks, and overall contribution to the renewable energy industry, investment environment, and sustainable development. Somaliland has organized policies that have resulted in concrete achievements, although scaling renewable energy is still a challenge. In Somalia, there is no formalized energy policy, and therefore, it is challenging to determine effectiveness beyond some private-sector efforts.

This part examines the interview answers on policy effectiveness in Somaliland and contrasts them with the case of Somalia.

1. Policy Effectiveness in Somaliland

Achievements

The responses of Somaliland's energy sector manager's point out the following main achievements:

1. Increased Access to Energy
   - ❖ Hybrid mini-grids through the ESRES program have enhanced access to electricity, especially in rural regions.
   - ❖ Solar energy uptake is increasing, decreasing dependence on costly and polluting diesel generators.
2. Attraction of Investment
   - ❖ Investment Act and regulatory policies have promoted foreign and domestic investments.
   - ❖ SESRP project shows greater confidence of international donors.
3. Reduced Costs and Emissions
   - ❖ Electricity costs have been lowered with hybrid systems, decreasing the cost of energy.
   - ❖ Carbon emissions by diesel generation have been reduced with the use of solar energize

4. Capacity Building

ESRES and other initiatives have raised technical and institutional capacity in renewable energy.

2. Policy Effectiveness in Somalia

Unlike Somaliland, Somalia does not have a policy framework for structured energy, thus it is challenging to quantify the success of renewable energy programs. The following elements identify Somalia's policy gaps and challenges:

1. Lack of a National Renewable Energy Policy

- Somalia has no formalized renewable energy strategy, hence difficult to coordinate the development.
- No energy regulatory body leads to an unstructured and fragmented market.

2. Private-Sector Dominance with No Regulation

- Renewable energy expansion in Somalia is initiated by private enterprises free from government intervention.
- Tariffs are irregular, and grid connection is not regulated, restricting affordability and accessibility.

3. Project-Based Renewable Energy Expansion

- Somalia's renewable energy expansion is dependent on separate donor projects with no policy horizon.
- Solar electrification schemes by UNDP and the EU have minimal nationwide reach due to a lack of policy coordination.

4. Restricted Investment Confidence

- Investors consider Somalia as high-risk as a result of political instability and absence of legal protection.
- In contrast to Somaliland's Investment Act (2021), Somalia lacks legal guarantees for energy investors.

5. Low Public Awareness and Infrastructure

There are no government-initiated awareness programs for the adoption of renewable energy.

Infrastructure issues (battered grid, absence of transmission networks) further hamper renewable energy development.

3. Comparative Analysis: Somaliland vs. Somalia

Factor	Somaliland	Somalia
Policy Framework	Structured (Electricity Act, Investment Act)	No national policy for renewable energy
Regulatory Body	Somaliland Energy Regulatory Commission (SERC)	No centralized regulatory body
Government Role	Actively involved in energy planning	Minimal involvement, private-sector driven
Investment Climate	Investor-friendly policies, donor-funded projects	High-risk, lack of legal protection for investors
Energy Access	Improved through ESRES mini-grids	Highly privatized, inconsistent pricing
Challenges	Regulatory gaps, donor dependence, financial barriers	Policy vacuum, lack of regulation, political instability
Public Awareness & Training	Limited, but improving through ESRES programs	Low awareness, no structured training programs
Policy Effectiveness	Moderately effective, but requires better enforcement	Not measurable due to lack of policies

4. Conclusion and Policy Recommendations

Somaliland: Filling Policy Gaps for More Impact

Somaliland's renewable energy policies have done a good job in encouraging investment, diversification of energy sources, and reducing emissions. Nevertheless, challenges in terms of scaling up, access to finance, and enforcing regulations need to be met.

Main recommendations:

- Enhance SERC's regulatory authority to enhance enforcement.
- Increase renewable energy finance opportunities for firms and households.
- Decrease reliance on donors by drawing more private-sector investment.
- Enhance public education and technical training for the uptake of renewables.

Somalia: National Renewable Energy Policy Needed Now

Somalia's absence of a formal policy structure makes its renewable energy performance hard to quantify. The government needs to make regulatory development a top priority to develop an investment-friendly, sustainable energy climate.

Main recommendations:

- Create a National Renewable Energy Policy modeled after Somaliland's Electricity Act.
- Establish an Energy Regulatory Authority to normalize tariffs and enhance grid access.
- Enact legal safeguards for investors to promote renewable energy projects.
- Encourage Public-Private Partnerships (PPPs) to enable long-term sustainability.
- Increase infrastructure investment to enhance energy distribution networks.

4.10.3 Question three

Analysis of challenges in implementing solar power PV projects in Somaliland

"What are the main challenges in implementing solar power PV projects in Somaliland?"

Comparative Analysis of Challenges in Implementing Solar PV Projects in Somaliland and Somalia

Solar photovoltaic (PV) power offers a renewable solution to energy problems in Somaliland and Somalia. Despite this, both countries have major challenges in the implementation of large-scale solar projects. Somaliland's challenges are financial, regulatory, and technical, while Somalia's solar industry is challenged by political instability, security threats, and the absence of a national energy policy.

This section examines the interview answers to challenges in Somaliland's solar PV market and juxtaposes them with the energy scenario of Somalia.

1. Challenges of Solar PV Implementation in Somaliland

The initial interview response offers a nuanced classification of challenges:

1. Financial Challenges

- High Upfront Costs: Solar PV equipment and installation call for huge initial expenses on hardware and infrastructure.
- Shortage of Access to Finance: Individuals and firms have no borrowing facilities for investment in solar energy.
- No Government Subsidies: There are no tax credits or grants to incentivize solar uptake like in other nations.

2. Technical & Infrastructure Challenges

- Grid Integration Issues: Somaliland's disperse electricity network has difficulty coping with large-scale solar integration.
- Storage Limitations: Battery systems are costly and underdeveloped, impacting energy reliability.
- Quality and Maintenance Issues: Poor quality imports of batteries and solar panels decrease efficiency and lifespan.

3. Policy & Regulatory Barriers

- Lack of Clear Energy Policies: The lack of a robust legal framework for solar regulation hinders investment.
- Fragmented Energy Market: The prevalence of private energy suppliers without a single national grid makes large-scale solar projects difficult.
- Land Ownership Issues: Ambiguous land rights and bureaucratic hold-ups hamper the establishment of large solar farms.

4. Social & Awareness Barriers

- Limited Public Awareness: Most residents and businesses are unaware of solar energy's long-term advantages.
- Resistance to Change: Certain communities are resistant to diesel generators, with concerns that solar can be unreliable.
- Skills Gap: Lack of trained technicians impacts the installation, maintenance, and sustainability of solar projects.

5. Recommendations for Overcoming Challenges

- Financial Support: Implement microfinance, tax incentives, and government subsidies to lower upfront investment costs.
- Regulatory Reforms: Create transparent policies and standardization for solar energy growth.
- Infrastructure Investment: Upgrade the electricity grid and invest in affordable battery storage options.
- Public Awareness & Training: Introduce educational campaigns and technical training schemes to increase adoption and maintenance capabilities.

Some respondents gave concise but consistent answers, the principal obstacle being cited as high upfront costs. The brevity of their responses implies differing degrees of familiarity with wider policy and technical concerns.

2. Challenges in Implementing Solar PV in Somalia

Though Somaliland has made efforts in formulating regulatory guidelines, Somalia has even more challenges since it operates in an unstable political and economic environment.

1. Political & Security Challenges

- Absence of Centralized Governance: Somaliland differs from Somalia, where there is no stable government entity that can apply energy policies.
- Conflict and Instability: Perpetual security threats deter both local and foreign investment in the energy industry.

- Weak Institutional Capacity: Institutions in government are not endowed with the capabilities and funds necessary to manage the energy market properly.

2. Financial Challenges

- High Initial Costs: Solar PV systems, as in Somaliland, involve huge initial capital costs.
- Lack of Foreign Investment: International investors and donors are discouraged by political instability and high risk of investment.
- Absence of Subsidies or Financing Mechanisms: Somalia does not have financial programs (grants, tax credits, loans) to aid in solar uptake.

3. Infrastructure & Technical Challenges

- No Unified Grid System: Somalia, similar to Somaliland, has a fragmented and privatized electricity market, which complicates the integration of solar.
- Storage & Maintenance Problems: Battery storage is still costly and unavailable, while poor-quality solar imports compromise system reliability.
- Deteriorated Energy Infrastructure: Much of the country lacks the rudimentary infrastructure necessary to accommodate renewable energy growth.

4. Policy & Regulatory Obstacles

- No National Renewable Energy Policy: Somalia lacks a written legal policy for solar energy growth.
- Unregulated Energy Market: Electricity companies sell electricity without standardized tariffs, regulations, or consumer protections.
- Weak Investor Protections: The Investment Act of Somaliland provides legal guarantees for energy investors, but not in Somalia.

5. Social & Awareness Barriers

- Low Public Awareness: Limited understanding of benefits of solar due to no government education campaigns.
- Skills Shortage: No formal technical training for installation and maintenance of solar.

- Diesel Generator Preference: Several companies still employ diesel-based power because of familiarity and perceived dependability.

4. Comparative Analysis: Somaliland vs. Somalia

Challenge Category	Somaliland	Somalia
Political & Security	Stable government, but limited energy policy enforcement	Political instability prevents policy development
Financial Challenges	No subsidies, high costs, limited financing	No investment security, lack of donor confidence
Regulatory Barriers	Regulatory gaps, fragmented energy market	No energy regulations or investor protections
Technical Challenges	Grid integration issues, storage limitations	No national grid, infrastructure damage
Public Awareness & Skills	Low awareness, lack of trained technicians	Even lower awareness, no structured training programs
Investment Climate	Some donor-funded projects, weak private financing	High risk, minimal private-sector involvement

3. Conclusion and Policy Recommendations

Somaliland: Strengthening Policy and Investment Climate

Renewable energy development has come a long way in Somaliland, but the solar industry is still grappling with financial, technical, and policy issues. In order to overcome these hindrances, the government must design financing schemes consisting of tax benefits, low-cost loans, and grants for solar PV installations. Facilitating PPPs can also attract badly needed investment in the sector. Also, enhancing grid infrastructure and storage technology is necessary, with emphasis on upgrading the electricity grid to handle large-scale solar integration and investment in cost-effective battery storage technology. A strong regulatory environment is key to long-term growth.

Completely empowering the Somaliland Energy Regulatory Commission (SERC) and implementing clear energy policies will assist in streamlining solar project implementation and increasing stability for investors. Increasing public knowledge and training skills is another most important area of emphasis. Initiating awareness campaigns on the advantages of solar power and setting up technical training programs for solar technicians and installers will develop a skilled workforce and boost local participation in the industry.

Somalia: Building a Stable Policy Framework

Somalia's renewable energy industry is very unstructured as a result of political instability and the absence of regulations. In order to establish a more stable platform, the government has to formulate a national renewable energy policy, which involves creating a centralized regulatory body for energy planning. Investor protection in clarity and incentive schemes will also be required for securing both domestic and international investment.

Investment protection has to be enhanced by strengthening legal frameworks that promote foreign direct investment (FDI) and enhancing security arrangements for protecting energy infrastructure. Increasing access to finance is another important step, which involves cooperating with international donors and financial institutions to make solar loans and grants available.

Lastly, technical capacity and public awareness need to be improved by means of nationwide solar energy awareness campaigns and vocational training schools for renewable energy. These efforts will facilitate the creation of a competent workforce, local participation, and the long-term viability of the industry.

4.10.4. Question four

Analysis of Awareness about the benefits of using solar system in Somaliland

"How much do people know about the benefits of generating electricity using solar power (PV)?"

Public awareness is a crucial factor in the adoption and success of solar photovoltaic (PV) energy. In Somaliland, awareness levels vary depending on location, education, and exposure to renewable energy programs. In Somalia, the situation is even more challenging due to limited government initiatives, weak infrastructure, and lower access to information.

This section analyzes the responses from energy sector managers in Somaliland and compares the findings with Somalia's public awareness situation.

1. Public Perception of Solar Power in Somaliland

Public perception of solar photovoltaic (PV) energy in Somaliland is very diverse based on location, educational background, and exposure to renewable energy programs. The energy sector managers' responses reflect the overall lack of awareness, especially in rural areas, and stress the necessity for increased public outreach and education.

2. Limited Awareness in Rural Areas

One of the managers mentioned that people are typically unaware in rural communities where diesel and wood are the prevalent traditional sources of energy. Most individuals there do not understand how PV systems function or the long-term economic advantages. The lack of proper awareness prevents the use of solar energy, as individuals are usually oblivious to other energy options that can be cheaper and more environmentally friendly.

3. Increased Awareness in Urban Communities

One respondent observed that city populations, especially companies and families who are subjected to donor-financed activities such as the Energy Security and Resource Efficiency in Somaliland (ESRES) project, are now acquainted with solar energy.

Nevertheless, solar systems continue to be under perceived on grounds of price, reliability, and maintenance, hence retarding its broad dissemination.

4. Role of Government and NGOs

As per one of the managers, government and NGO-initiated programs, including ESRES, have comprised campaigns for outreach to encourage renewable energy. These initiatives have contributed to raise awareness among the public regarding the affordability, sustainability, and reliability of solar energy. Yet, the manager further indicated that these awareness campaigns are underfunded and inconsistent, limiting their impact in the aggregate.

5. Barriers to Awareness

The managers identified some of the main barriers that hinder extensive awareness of solar power in Somaliland:

- Language and Literacy: Technical information regarding PV systems is not always presented in plain language that can be easily grasped by the general population.
- Cost Misconceptions: Most people think that solar power is too costly, without considering the long-term benefits and available financing mechanisms.
- Cultural and Social Factors: Some groups are accustomed to conventional energy sources, thinking that solar power could be unreliable or hard to repair.

6. Recommendations for Raising Awareness

To overcome these issues, the managers proposed some of the following strategies:

- Public Awareness Campaigns Strengthening: Using media like radio, TV, and social media to raise awareness about the advantages of solar power.
- Community Engagement: Organizing workshops and training in villages to enable individuals to grasp the functioning of solar PV systems and how to finance them.
- Incorporating Solar Education into Schools and Vocational Training: This would assist in creating a workforce competent in solar energy installation and maintenance.

Comparison with Somalia

Somalia is compared to Somaliland, which has even more challenges in increasing awareness of solar power. While Somaliland enjoys donor-funded projects that assist in promoting solar adoption, Somalia does not have organized government policies and extensive renewable energy programs.

Extremely Low Awareness Levels

One of the differences is that, in Somalia, knowledge regarding solar energy is very low in rural and urban settings. Somaliland has not, unlike Somalia, experienced huge donor-funded programs such as ESRES that work towards promoting renewable energy. The majority of Somalis lack understanding of solar power, and the government or private sector does not have a structured program to increase awareness.

Misinformation and Resistance to Change

Because of the absence of education campaigns, there is rampant misinformation on solar power in Somalia. Solar power is viewed as unreliable by some communities when compared to diesel generators. Others believe that solar energy is related to foreign aid projects and, therefore, does not trust it, hence minimal uptake. The high initial investment cost of solar PV systems is also a factor, making many unable to consider solar power as an alternative energy source.

Strategies to Enhance Awareness in Somalia

In order to tackle these challenges, Somalia may adopt the same awareness strategies as Somaliland but with even more emphasis on targeting both urban and rural communities. This may involve:

- Initiating Government and NGO-Funded Public Awareness Programs: Utilizing local media to inform people about the advantages of solar power.
- Engaging Private Sector Stakeholders: Incentivizing solar firms to run awareness programs and provide financing opportunities to enable the accessibility of solar energy.
- Creating Community-Based Education Initiatives: Educating community leaders to serve as champions for renewable energy products.

As awareness of solar energy is slowly growing in Somaliland, there are huge gaps, particularly in rural Somaliland. In Somalia, however, the situation is even worse as there are no government programs, donor projects, and organized public awareness campaigns. Somaliland and Somalia require stronger campaigns, financial education schemes, and technical training to enhance public confidence in solar power and speed up its uptake.

4.10.5. Question five

Analysis of financial Mechanisms

"What financing options can power companies use to install solar energy systems?"

Financial Mechanisms for Solar Energy in Somaliland

Financing is a critical component in the development and expansion of solar energy systems, especially in developing regions like Somaliland. The responses from the interviewed managers reveal both established and limited financing practices used by power companies, highlighting differences in strategy, capacity, and understanding of financial tools.

Diverse Financing Options

One of the managers provided a comprehensive overview of available financing mechanisms. According to this manager, power companies in Somaliland have access to a variety of financing strategies, each with its own benefits and limitations:

- Equity Financing involves raising capital by selling ownership stakes in the company. While this method avoids debt repayments and can attract long-term investors, it may lead to a dilution of ownership and requires the company to have strong business potential to appeal to investors.
- Debt financing, such as loans from banks or development agencies, allows companies to retain full ownership while getting necessary capital. However, high interest rates and strict collateral requirements often pose barriers in Somaliland's context.
- Power Purchase Agreements (PPAs) provide an innovative solution where external investors finance the installation, and the power company agrees to buy the energy over

time. This reduces upfront costs but relies heavily on long-term contractual obligations and guaranteed demand.

- Leasing or Hire-Purchase Agreements allow gradual ownership of solar equipment through regular payments. This spreads out costs, although the long-term payments and maintenance responsibilities can be burdensome.
- Grants and Subsidies from donors and NGOs help reduce financial barriers significantly, but competition for limited funds and dependency on external support can limit scalability.
- Green Bonds are emerging tools where companies raise money from environmentally-conscious investors for clean energy projects. While promising, they require high transparency, strong regulation, and a developed financial market infrastructure.
- Pay-As-You-Go (PAYG) Models enable companies to recover costs gradually from customers through incremental payments. This model enhances affordability for end-users, particularly in rural or low-income communities.

This detailed insight demonstrates that there are multiple viable paths for financing renewable energy in Somaliland, but implementation depends heavily on the maturity of the financial sector, government policy support, and the willingness of private investors.

Self-Financing

Some managers gave a very brief response, stating that most companies use their own investment. This highlights a common reality in Somaliland, where due to lack of access to financial markets or donor funds, many small and medium-sized energy companies rely on internal capital. While this model offers autonomy and avoids debt, it significantly limits scalability and project size due to capital constraints.

Shareholder Capital and Bank Loans

Other managers mentioned that power companies depend on capital from different shareholders and loans from banks. This aligns partially with the manager's responses (equity and debt financing). It reflects a basic understanding and practical use of conventional financing models, although it does not include more innovative mechanisms like PPAs or green bonds. This also suggests a more limited or cautious approach to complex financial tools.

Comparative Perspective with Somalia

In Somalia, access to diverse financing mechanisms for solar energy is even more restricted. The lack of a stable financial system, limited investor confidence, and absence of robust regulatory frameworks make it difficult to implement advanced models like green bonds, PPAs, or PAYG schemes. Most companies in Somalia, especially in the off-grid energy sector, rely on informal financing, personal funds, or limited donor support. Banks in Somalia are generally risk-averse and offer minimal support to renewable energy ventures due to uncertainty in repayment and poor collateral systems.

Furthermore, unlike Somaliland, which has started benefiting from initiatives like the Somaliland Electricity Sector Recovery Project (SESRP), Somalia lacks coordinated investment frameworks that would allow the adoption of structured financial tools. Therefore, while both regions face funding challenges, Somaliland has a slightly more advanced and diverse financing landscape due to relatively more stable governance and the presence of donor-backed renewable energy projects.

4.10.6. Question Six:

Analysis of Socio-Economic Impact

"How has renewable energy affected the economy and society in Somaliland?"

Detailed Socio-Economic Overview (Somaliland)

The Respondents offered a deep dive into both economic and social effects. On the economic front, projects like the Berbera Wind Farm and solar mini-grids have created jobs, lowered energy costs, and attracted foreign investment, particularly from UAE-based projects.

The shift from diesel to renewables has improved energy security and economic resilience, especially for small and medium enterprises (SMEs). However, the country still faces issues like dependence on donor funding, maintenance challenges due to limited technical expertise, and inequity in benefits across urban and rural areas.

Socially, off-grid solar systems have expanded electricity access in rural areas, improving education, health, and gender equity by reducing the burden of traditional fuel collection.

Despite these benefits, challenges remain in the form of land conflicts, information gaps, and the political ambiguity that limits broader financing.

Basic Benefits (Somaliland)

The managers offered a brief but practical point: renewable energy reduces energy costs once installed, effectively offering "free of charge" energy. This highlights its accessibility and long-term savings potential, especially important in low-income areas. While this response didn't cover broader impacts, it reflects an essential viewpoint of renewable energy as an immediate economic relief.

General Positive Outlook (Somaliland)

This managers recognized renewable energy's role in stimulating economic growth, job creation, and human wellbeing, as well as supporting climate goals. The only major challenge mentioned was the high upfront cost, echoing a consistent theme across all responses.

Comparison: Somaliland vs Somalia

Policy Environment and Implementation

Somaliland has shown stronger progress in developing specific renewable energy programs (e.g., ESRES, SESRP), regulatory bodies (SERC), and international partnerships (UAE, UK, World Bank).

Somalia, while making strides, remains more limited in implementation. The lack of centralized governance in many regions hampers the rollout of large-scale projects. Policies exist on paper (such as the 2016 National Energy Policy), but enforcement and funding mechanisms are weak.

Somaliland's relative political stability and self-governance, despite lack of international recognition, have allowed more coordinated efforts in energy access than in Somalia.

Socio-Economic Impact

In Somaliland, solar and wind projects have brought tangible benefits—like lower household energy costs, improved rural electrification, and small business development. The Berbera Wind Farm and NGO-led rural solar grids are real examples.

In Somalia, access to renewable energy is more uneven and concentrated in private sector-led urban micro grids. There's limited outreach to rural areas, and public awareness is lower. Socio-economic benefits exist, but are less institutionalized, and tend to be localized or privately funded.

Donor dependency is high in both, but Somaliland has been more successful in attracting structured foreign investment.

Equity and Inclusivity

Somaliland is beginning to recognize and respond to inequities in energy distribution (urban vs rural, rich vs poor).

Somalia, on the other hand, still sees energy access as a luxury in many regions, with conflict zones receiving little to no development support. This results in greater inequality in energy distribution and socio-economic opportunity.

4.10.7. Question Seven

Analysis of SDGs and Renewable Energy

"What role does renewable energy play in helping Somaliland achieve the Sustainable Development Goals (SDGs)?"

In-Depth Analysis (Somaliland)

The managers provided a detailed breakdown of how renewable energy directly supports multiple SDGs:

- SDG 1 & 8 – No Poverty / Decent Work and Economic Growth

Renewable energy opens up job opportunities and supports rural economies by lowering energy costs and reducing reliance on imported fossil fuels.

- SDG 7 – Affordable and Clean Energy
  Somaliland's abundant solar and wind resources offer a pathway to affordable and sustainable electricity, especially in off-grid rural areas.
- SDG 3 – Good Health and Well-being
  By reducing emissions from diesel generators, renewable energy contributes to better air quality and public health, and powering clinics ensures continuity of medical services.
- SDG 4 – Quality Education
  Electricity enables schools to use lighting and digital tools, improving study conditions and learning outcomes—especially for students in rural areas.
- SDG 9 – Industry, Innovation, and Infrastructure
  Renewable energy helps reduce industrial energy costs and supports infrastructure development.
- SDG 13 – Climate Action
  The shift to solar and wind power lowers carbon emissions and boosts climate resilience in the face of droughts and extreme weather.
- SDG 6 & 11 – Clean Water & Sustainable Communities
  Solar-powered water pumps and off-grid systems improve water access and help build inclusive energy access in both cities and remote settlements.

Summary Response

These managers emphasized the goal of clean, affordable energy for all, which directly supports SDG 7 – Affordable and Clean Energy. While the answer was less detailed, it reflects the vision of universal access and the shift away from polluting energy sources.

Practical Alignment with SDGs

These managers echoed Manager 1's view, stating that renewable energy is essential to meeting several SDGs, especially through clean, reliable energy access. This view aligns particularly with SDG 7, SDG 13, and indirectly with SDGs related to health, education, and development.

Comparison: Somaliland vs. Somalia

Progress toward SDGs Using Renewable Energy

Aspect	Somaliland	Somalia
SDG 7 (Clean Energy)	Has launched solar mini-grids and hybrid systems in rural and urban areas; backed by donor-funded programs like ESRES and SESRP.	Efforts are emerging, mainly private-sector led. National energy access remains low. No large-scale public renewable initiative yet.
SDG 3 (Health)	Solar clinics improve maternal care, vaccine storage, and reduce indoor pollution.	Limited to urban NGO projects. Many health centers still lack reliable power.
SDG 4 (Education)	Electrified schools increase study hours and learning tools.	Electricity rarely reaches rural schools. Renewable-powered schools are uncommon.
SDG 8 & 1 (Jobs & Poverty)	Local jobs in installation/maintenance growing slowly.	Very few green jobs exist due to lack of investment and institutional coordination.
SDG 13 (Climate Action)	Clear government/donor coordination on reducing carbon footprint.	Climate resilience efforts are limited and scattered. Heavy reliance on diesel continues.
Policy & Institutional Support	Somaliland has the SERC regulatory body and energy-specific programs.	Somalia has general energy policies, but lacks strong implementation mechanisms.

4.10.8. Question Eight

Analysis of Specific SDGs

"Which SDGs are most impacted by renewable energy projects?"

Broad Impact across Multiple SDGs

Some managers provided a comprehensive assessment, identifying **eight key SDGs** impacted by renewable energy:

- **SDG 1 (No Poverty)** and **SDG 8 (Decent Work and Economic Growth)** – through job creation and lower energy costs.

- **SDG 7 (Affordable and Clean Energy)** – due to Somaliland's solar and wind potential reaching underserved areas.
- **SDG 3 (Good Health and Well-being)** – by reducing pollution and powering clinics.
- **SDG 4 (Quality Education)** – by enabling lighting and internet access in schools.
- **SDG 9 (Industry, Innovation, and Infrastructure)** – through renewable-powered industrial development.
- **SDG 13 (Climate Action)** – with reduced emissions and climate resilience.
- **SDG 6 (Clean Water and Sanitation)** and **SDG 11 (Sustainable Cities and Communities)** – via solar-powered water systems and off-grid electrification.

This perspective reflects a strong understanding of how renewable energy interlinks with multiple development goals and contributes to long-term sustainability.

Focus on Health and Infrastructure

Other managers emphasized the impact on:

- **Healthcare (SDG 3)** – highlighting the role of energy in enabling better medical services.
- **Infrastructure (SDG 9)** – focusing on structural improvements from renewable investments.

Although more concise, this response supports Manager 1's views, particularly in the social and structural aspects of energy development.

Prioritization of Key Goals

Other managers singled out the most directly impacted goals:

- SDG 7 (Affordable and Clean Energy)
- SDG 13 (Climate Action)
- SDG 8 (Decent Work and Economic Growth)

This answer distills the primary targets that renewable energy naturally supports, focusing on access, sustainability, and economic benefits.

Comparison: Somaliland vs. Somalia

Somaliland

Somaliland has been more proactive in integrating renewable energy into its development strategy. Its focus aligns with multiple SDGs, thanks to:

- Donor-funded solar mini-grid projects (e.g., ESRES and SESRP)
- Investments in wind power like the Berbera Wind Farm
- Off-grid energy systems bringing electricity to rural areas
- Health, education, and water access improvements through solar

This alignment shows that **SDGs 7, 13, 8, 3, 4, and 6** are being tangibly impacted. However, these benefits are often donor-driven, and challenges such as limited local expertise and infrastructure gaps slow broader SDG realization.

Somalia

In contrast, Somalia is still in the early stages of renewable energy adoption, largely due to:

- Security concerns
- Weaker regulatory frameworks
- Heavier reliance on diesel and charcoal
- Limited donor support in some regions due to instability

As a result, Somalia's impact from renewable energy projects is more limited and uneven. The most realistic contributions align with:

- **SDG 7** (clean energy through pilot projects)
- **SDG 13** (climate action through reduced fossil fuel dependence)
- **SDG 8** (job creation potential, especially in more stable regions like Puntland)

Overall, while Somaliland is actively leveraging renewable energy to achieve a broader range of SDGs, Somalia remains focused on foundational goals, with smaller-scale interventions and slower progress.

4.10.9. Question Nine

Analysis of Monitoring Impact

"How do you measure the effects of your renewable energy projects on the SDGs?"

Comprehensive Monitoring Framework

Manager 1 offers a structured and detailed approach by linking specific SDG targets to measurable metrics and tools. The key focus areas are:

- **SDG 7 – Affordable and Clean Energy**
  - **Metrics:** Number of households and businesses connected, cost comparisons (before vs. after), and % of energy sourced from renewables.
  - **Tools:** Smart meters, energy surveys, and government data.
- **SDG 13 – Climate Action**
  - **Metrics:** CO_2 emissions avoided and diesel generator usage reductions.
  - **Tools:** Emissions tracking software and satellite data.

This approach is data-driven, structured, and emphasizes long-term impact tracking with both quantitative and technological tools.

Outcome-Focused but Generalized

Manager 2's answer is goal-oriented but lacks specifics. The response emphasizes that:

"People should get affordable, reliable, and sustainable energy."

While this reflects the essence of SDG 7, there's no mention of how to measure these outcomes—no metrics, no tracking systems, no assessment framework.

This is a values-based answer rather than a monitoring methodology.

Targeted Metrics, Practical Focus

Some managers identifies three practical indicators used to assess SDG progress:

- Number of people gaining electricity access
- Renewable energy generation capacity
- Improvements in energy access, especially in underserved communities

This focuses mostly on SDG 7, touching on access equity and capacity growth, with an emphasis on coverage and infrastructure expansion.

A practical and realistic approach, though still less comprehensive than Manager 1.

Comparison: Somaliland vs. Somalia

Somaliland: Progress in Monitoring Systems

Somaliland is actively working with international partners (like ESRES and SESRP), which often require impact tracking as part of funding agreements. As a result:

- Data collection and reporting systems are increasingly being integrated into projects.
- SDG indicators like access, affordability, and emissions are monitored through donor support.
- Some projects use satellite and IoT-based monitoring tools for emissions and energy use.

However, challenges remain:

- **Limited local technical capacity** to analyze and act on collected data.
- **Gaps in coordination** between energy providers and government data systems.

Somalia: Lagging Monitoring Infrastructure

In Somalia, the situation is more fragile:

- Security issues and political fragmentation make consistent monitoring difficult.
- Energy initiatives are often small-scale, community-driven, or NGO-led, without robust tracking systems.
- Where data exists, it’s often project-specific and not integrated into a national SDG tracking framework.

Some regions like Puntland are beginning to adopt frameworks (with donor help), but overall, the country lacks a centralized monitoring system.

4.11 Risk Analysis: The Effectiveness of Renewable Energy Policy in Somalia

The development of renewable energy in Somalia is a high potential route towards realizing multiple United Nations Sustainable Development Goals (SDGs). Yet, the effectiveness of the country's and sector's policies is highly critical for the success of this route. If the policies weaken, become fragmented, or ineffective, various risks might destroy the sustainability as well as the scalability of integrating renewable energy.

1. Policy and Governance Risks

Somalia's political climate remains tenuous, with governance systems still evolving after decades of uncertainty. Without effective implementation of renewable energy policies, the risks are:

- Fragmentation of the energy market, as private players persist in running isolated diesel-based mini-grids without synchronization.
- Investor uncertainty, since uncertainty regarding tariffs, subsidies, and regulatory norms discourages both domestic and foreign direct investment (FDI).

- Corruption and ineffective enforcement, resulting in selective use of incentives or mismanagement of international assistance.

Impact: Without effective governance, renewable energy initiatives risk being small-scale, diffused, and unviable.

2. Financial and Economic Risks

A poor policy climate could restrict access to financing facilities for renewable energy.

- High capital prices of solar and wind projects will continue to be out of reach for households and small enterprises.
- Lack of subsidies or tax incentives will discourage adoption, leaving Somalia dependent on expensive imported diesel.
- Hesitant private-sector engagement, as uncertain rules deter long-term investment.

Consequence: Energy poverty remains, with households paying as much as 50% of their income for energy, subverting SDG 1 (No Poverty) and SDG 7 (Affordable and Clean Energy).

3. Social Risks

When policies are not inclusive or do not take into account community needs:

- Limited public confidence can be a result, as individuals stick to conventional biomass and kerosene based on unreliability perceptions in renewable technology.
- Disadvantage inequality risks where only urban elites or multinationals gain from renewable energy while rural societies lag behind.
- Opportunity lost in the area of creating employment and vocational training, compromising SDG 8 (Decent Work and Economic Growth).

Impact: Renewable energy does not attain its needed social change, deepening inequalities among rural and urban societies.

4. Technical and Environmental Risks

Without effectivepolicies:

- Renewable projects could have no quality assurance standards to follow, producing solar panels or wind turbines that are of poor quality or fail early.
- Uncontrolled development might mean inefficient utilization of Somalia's enormous solar and wind potential.
- Increased reliance on charcoal and diesel will increase deforestation and greenhouse gas emissions, compromising SDG 13 (Climate Action).

Impact: Environmental degradation persists, and Somalia misses the opportunity to transition to a low-carbon pathway.

5. Long-Term Strategic Risks

- Unless policy frameworks become stronger, Somalia will miss the world's climate and development goals under the Paris Agreement and Agenda 2030.
- The nation could get trapped in unsustainable energy habits, where short-term use of diesel suppresses long-term investment in renewable energies.
- Foreign donors and aid partners will potentially shift support to more stable policy settings, further secluding Somalia.

Impacts: Somalia's transformative potential from renewable energy may never be harnessed, holding back progress on several SDGs.

Renewable energy policy effectiveness in Somalia is not just a matter of governance but a cross-cutting risk factor for economic, social, and environmental outcomes. Policies failing pose the risks of sustained energy poverty, environmental damage, and foregone opportunities for sustainable growth. Thus, combating these risks involves effective governance, open regulation, financial rewards, and community participation. Resilience in policy development and policy implementation is important to help ensure that renewable energy be able to be a driver for sustainable development in Somalia.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

This study examined the pivotal role of renewable energy in promoting sustainable development in Somalia, with specific focus on its role in the attainment of the United Nations Sustainable Development Goals (SDGs). Utilizing a mixed-methods design—combining literature review, quantitative surveys, and qualitative interviews with sector experts—the research has identified both the transformative potential of renewable energy and the ongoing challenges that have been hindering its large-scale adoption in the Somali context.

The results affirm that renewable energy, specifically wind and solar, has a direct contribution towards SDG 7 (Affordable and Clean Energy), whilst also contributing to other linked goals including SDG 1 (No Poverty), SDG 3 (Good Health and Well-being), SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 13 (Climate Action). Off-grid solar projects, mini-grids, and hybrid renewable systems have enhanced access to electricity, especially in rural and unserved areas. These efforts have had positive effects on livelihoods, education, healthcare, and business growth, reflecting the close synergy between clean energy access and sustainable development.

Despite the findings of significant barriers to access, however, the research also noted significant barriers. Among these, most immediate are high capital requirements, limited access to finance, weak regulation, deficiency in skilled technical staff, political instability, and low public consciousness. In addition, monitoring and assessment of renewable energy contributions toward SDGs remain disconnected. Donor-funded schemes have achieved some advances, though Somalia has no nationally coordinated scheme to monitor the performance of renewable energy against sustainability objectives.

By juxtaposing Somalia with regional standards, the research identifies that, while the nation possesses expansive untapped renewable resources and increasing stakeholder attention, policy, investment, and institutional preparedness remain at the nascent stage. However, the scope for scaling up renewable energy as a strategic pillar for sustainable development continues to be huge. With focused reforms and prolonged multi-stakeholder cooperation, Somalia can move towards a cleaner, more equitable, and more resilient energy future—one that directly drives progress across the SDG agenda.

5.2 Recommendations

Based on the findings and analysis of this research, the following recommendations are put forward to promote the adoption and influence of renewable energy in Somalia:

1. Strengthen National Renewable Energy Policies and Governance

- Formulate and enact a holistic national renewable energy policy consistent with SDGs.
- Create a specialized renewable energy regulatory agency to oversee policy implementation, licensing, and quality control.
- Encourage policy stability to ensure long-term private and donor investment in the energy sector.

2. Increase Access to Financing and Minimize Upfront Costs

- Ease access to low-interest loans, grants, and subsidies for families, SMEs, and investors in renewable energy.
- Encourage Pay-As-You-Go (PAYG) and microfinancing schemes to allow low-income communities to pay for solar home systems.
- Create a Renewable Energy Investment Fund to consolidate resources from donors, diaspora, and private sectors.

3. Invest in Local Expertise and Capacity Building

- Establish vocational and technical training programs for solar, wind, and biogas installation and maintenance.
- Collaborate with international organizations to develop renewable energy training institutions within Somalia.
- Promote research and innovation in locally adapted clean energy technologies.

4. Develop Hybrid and Off-Grid Renewable Solutions

- Prioritize decentralized off-grid systems and mini-grids as the main solution for rural electrification.
- Promote hybrid models (e.g., solar + diesel, wind + solar) to enhance reliability in off-grid locations.
- Use Somalia's solar and wind mapping data to strategically locate infrastructure at high-potential sites.

5. Enhance Monitoring and Evaluation Systems

- Develop a national data monitoring system to measure the real-time impact of renewable projects on SDGs.
- Embed energy access, emissions reduction, job creation, and cost savings indicators into reporting frameworks.
- Partner with global partners to deploy satellite and IoT-based monitoring technologies.

6. Raise Public Awareness and Community Engagement

- Initiate national awareness campaigns on the economic, environmental, and health advantages of renewable energy.
- Local languages and culturally appropriate formats should be used to translate technical information to improve understanding.

- Engage local communities and leaders in project design and implementation to enhance ownership and sustainability.

7. Encourage Public-Private Partnerships

- Facilitate joint ventures among government, private sector entities, and NGOs for renewable energy development.
- Grant tax benefits and land access for private investors for renewable energy facilities.
- Promote foreign direct investment (FDI) in giant solar, wind, and hybrid energy farms.

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APPENDIX

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Department of Mechanical Engineering, MS Energy System Engineering

Dear Respondents,

This questionnaire is designed for academic purposes as part of a study on the impact of renewable energy on sustainable development goals (SDGs) in Somalia. This research is a partial fulfillment of the requirements for my master's degree at the International Islamic University, Islamabad. Your responses will play a crucial role in shaping the outcome of this study, and they will provide valuable insights for policymakers and other stakeholders working towards sustainable development in Somalia.

I kindly request that you provide your honest and thoughtful answers to both the closed and open-ended questions. Your contributions are essential for helping us achieve meaningful and positive results. Rest assured, your individual responses will remain confidential, and the data collected will be used solely for academic purposes.

I greatly appreciate your participation and trust that your views will significantly contribute to the success of this research.

Thank you for your time and cooperation.

Best regards,

[Abdullah Mansour]

Master's Candidate

International Islamic University, Islamabad

INSTRUCTIONS

Please answer all the questions honestly and exhaustively. All the information given will strictly be used for academic purpose/ research only and will be treated with the utmost confidentiality.

Part I: Personal Information

Direction: Kindly tick the appropriate space or provide the data requested where appropriate.

1. **Gender:** Male ☐ Female ☐
2. Age Group

   20-30 ☐ 31-40 ☐ 41-50 ☐ 51- Above ☐

3. **Educational level:**

   Secondary ☐ Diploma ☐ Certificate ☐ Bachelor ☐

   Post graduate ☐ Masters & above ☐

4. **Type of company**

   Public ☐ **private** ☐

5. **Occupation Status**

   Junior Expert ☐ Senior Expert ☐ Head of Department ☐

   Other _____

Part 2. The Various Sources of Renewable Energy Technology in Somalia

2.1. Are you using renewable energy?

A. yes
B. no

2.2. Which of the following renewable sources are you using?

A. Solar energy
B. Wind energy
C. Hydroelectric energy
D. Biomass energy
E. Mini-grids and Off-grid solutions
F. All of them

2.3. Have you noticed the changes in the electricity bill before and after using the renewable energy?

C. yes
D. no

2.4. Is it beneficial?

A. yes
B. no

2.5. How important do you think renewable energy is for Somalia's development?

A. Strongly agree
B. Agree
C. Neutral
D. Disagree
E. Strongly disagree

2.6. Please state your level of agreement to the following:

No	statement	Strongly agree	Agree	neutral	disagree	Strongly disagree
1	Is renewable energy truly unlimited?					
2	Fossil fuels are the best form of energy sources					
3	Gas is more environment friendly than coal					
4	Do you think that Govt. should give incentives to encourage the					

	installation of renewable energy plants?					
5	Should there be lease or rent options for renewable energy devices?					
6	Do you think that the change to renewable energy is an urgent need for fulfilling the requirements of Somalia?					

2.7. How much do the following points influence your decision to switch to renewable energy?

A. Cost of purchasing
B. Maintenance cost
C. Ease of implementation
D. Appearance of the devices
E. social opinions
F. All of them

2.8. Do you believe that the integration of renewable energy will create more job opportunities in Somalia?

A. Strongly agree
B. Agree
C. Neutral
D. Disagree
E. Strongly disagree

Part 3: Perceptions of Renewable Energy's Impact on SDGs

3.1. In your opinion, How important do you think renewable energy is for achieving the (SDGs) in Somalia?

A. Very Important
B. Important
C. Somewhat Important
D. Not Important

3.2. Please rate each statement on a scale of 1-5, where 1 is strongly agree and 5 is strongly disagree.

No	statement	Strongly agree	Agree	neutral	disagree	Strongly disagree
1	Renewable energy can help reduce poverty in Somalia.					
2	Renewable energy can improve education and healthcare in Somalia.					
3	Renewable energy can promote sustainable economic growth in Somalia.					
4	Renewable energy can help mitigate the effects of climate change in Somalia.					

3.3. Which SDGs do you think renewable energy can significantly contribute to in Somalia? (Select all that apply)

A. SDG 1: No Poverty
B. SDG 7: Affordable and Clean Energy
C. SDG 8: Decent Work and Economic Growth
D. SDG 9: Industry, Innovation, and Infrastructure
E. SDG 11: Sustainable Cities and Communities

3.4. What role do you think the government should play in promoting renewable energy?

A. Provide Subsidies for Renewable Energy Projects
B. Develop Policies and Regulations Favoring Renewable Energy
C. Encourage Foreign Investment in Renewable Energy
D. Create Public Awareness Campaigns
E. Other : _____

Part 4. Renewable Energy Development Policy Implementation Strategies in Somalia

4.1 Does the government of Somalia have policies or strategies in place for renewable energy?

A. yes
B. no

4.2. If such policies and strategies for renewable energy exist, how is the Somalia's Renewable Energy Policies' effectiveness?

A. Very effective
B. Somewhat effective
C. Neutral
D. Ineffective
E. Very ineffective

4.3. Does the government of Somalia inspect or monitor firms to ensure compliance with these policies?

A. Yes
B. No

4.4. What are the advantages and disadvantages of implementing policies and strategies for installing renewable energy plants in Somalia?

Advantages:
…….....
Disadvantages:
…….....

4.5. The Effectiveness of Renewable Energy Policies in Somalia

Positive impacts of renewable energy Policies

A. Job creation
B. Access to energy
C. Rural electrification
D. Government commitment
E. Technological advancement
F. Energy security

Challenges or areas where these policies have fallen short

A. Infrastructure gaps
B. Financing constraints

C. Political instability
D. Lack of public awareness
E. Energy access disparities

Part 5. Challenges/Barriers of Renewable Energy Technologies in Somalia

5.1. Which of the following challenges /barriers you faced during the implementation of RETs in Somalia

A. Financial barriers
B. Policy and regulatory challenges
C. Infrastructure gaps
D. Technological capacity
E. Public awareness and acceptance
F. Politics and economic stability

5.2. Specific economic challenges that hinder the widespread use of renewable energy technologies in Somalia

A. High initial cost
B. Energy price dynamics
C. Risk perceptions
D. Return on investment (ROI) concerns
E. Economic stability

5.3. Do you believe there are regulatory or policy-related barriers affecting the renewable energy sector in Somalia?

A. Yes
B. No

5.4. Regulatory or policy-related barriers

A. Policy instability
B. Inconsistent regulatory frameworks
C. Lack of enforcement
D. Permitting and licensing processes
E. Access to finance

Section 6: Impact of Renewable Energy on Local Communities

6.1. Do you believe that renewable energy can improve the livelihoods of local communities in Somalia?

A. Strongly Agree
B. Agree
C. Neutral

D. Disagree
E. Strongly Disagree

6.2. In your opinion, how has the availability of renewable energy affected your local community?

A. Significantly Improved
B. Slightly Improved
C. No Impact
D. Worsened

6.3. Which areas in your community have benefited most from renewable energy? (Select all that apply)

A. Electricity
B. Agriculture
C. Education
D. Healthcare
E. Employment Opportunities
F. Clean Water Supply
G. All of them

Section 7: Recommendations

7.1. What strategies do you recommend to enhance the use of renewable energy in Somalia? (Select all that apply)

A. Increased Government Investment
B. Public-Private Partnerships
C. International Collaboration
D. Strengthening Local Expertise
E. Reducing Costs of Renewable Energy Technology
F. Other: _____

7.2. What future role do you foresee for renewable energy in Somalia's development?

A. Major Role
B. Moderate Role
C. Minor Role
D. No Role