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ENERGY TRANSITION ASSESSMENT

SOMALIA

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ABOUT IRENA

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future and serves as the principal platform for international co-operation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.

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ENERGY
TRANSITION
ASSESSMENT

SOMALIA

Foreword

from the Minister of Energy and Water Resources, Federal Republic of Somalia

I am pleased to present Somalia's Energy Transition Assessment Report, developed in partnership with the International Renewable Energy Agency (IRENA). Somalia is currently at a critical point in its history, having achieved stable governance and institutions after years of instability. As we move forward in the process of rebuilding and modernising our nation, one of our top priorities is to redefine and develop our energy infrastructure to meet the requirements of a sustainable and prosperous future.

Somalia is uniquely positioned to benefit from an energy transition that is both environmentally sustainable and economically transformative. Our abundant renewable energy resources, including solar, wind and bioenergy, provide a great opportunity to reduce our reliance on imported fuel, decrease energy costs, and offer affordable, reliable electricity to all Somali households and businesses. This transition has the potential to bring about macroeconomic benefits by promoting development, improving the balance of payments and creating job opportunities. Additionally, it can lead to microeconomic gains by lowering energy prices and expanding energy access to underserved regions.

This report outlines the critical steps to harness Somalia's vast renewable energy potential. We have made significant progress in developing a policy and regulatory framework, but much work remains to operationalise these policies and ensure their effective implementation. The development of clear and measurable targets, such as achieving 152 MW of renewable energy capacity on-grid and 30% off-grid by 2030, is realistic and achievable. At the same time, enhancing energy access and efficiency will be key to our nation's development and stability.

I want to express my sincere gratitude to IRENA for the invaluable support provided in developing this report. The Agency's collaboration with Somalia's Ministry of Energy and Water Resources has been instrumental in shaping a comprehensive energy transition assessment. IRENA's continued commitment to our partnership is essential as we work together to achieve our renewable energy goals and build a brighter future for Somalia.

I encourage all stakeholders—including government bodies, international partners, private sector entities, and local communities to work together to make this vision a reality. The energy transition in Somalia is not a challenge that can be tackled in isolation; it requires collective effort, innovation, and a shared commitment to sustainable growth. Together, we will develop an energy system that powers our future, sustains our economy, and ensures a better quality of life for all Somalis.

H.E Abdullahi Bidhan Warsame
Minister of Energy and Water Resources
Federal Republic of Somalia

Foreword

from the IRENA Director-General

I am pleased to present this energy transition assessment for Somalia, developed in partnership with the Ministry of Energy and Water Resources of the Federal Republic of Somalia (MoEWR). This comprehensive report marks a significant step forward in the country's efforts to transition to a sustainable, resilient, low-carbon energy future. It highlights Somalia's potential to unlock the benefits of renewable energy and offers key insights on the steps required to deliver a transformative energy transition.

Somalia faces a number of challenges in securing energy access for its people; the country suffers from limited infrastructure and unreliable electricity provision, and is dependent on imported fuels. However, Somalia is also endowed with abundant renewable energy resources – particularly solar, wind and geothermal energy. These resources provide an exceptional opportunity to bypass the development of traditional, carbon-intensive energy systems by adopting clean, affordable and locally-sourced renewable solutions.

The International Renewable Energy Agency (IRENA) has worked closely with the Somali government and its stakeholders to analyse the country's energy landscape, evaluate its readiness for a renewable energy transition, and identify the actions required to create a sustainable energy system that can support economic development and climate goals.

This report outlines both the challenges and opportunities that Somalia faces in moving towards renewable energy, providing a clear roadmap for policy makers, investors and industry leaders. By embracing renewable energy solutions, Somalia can reduce its reliance on fossil fuels, improve energy access for its people, enhance energy security and mitigate the impacts of climate change.

The findings and recommendations presented in this report aim to support Somalia as it undertakes an energy transition that is inclusive, sustainable and aligned with global climate objectives. In particular, they are intended to offer vital inputs to the ongoing NDC 3.0 update, due to be submitted before COP30, that will align the country with the call of the UAE Consensus to triple renewable power by 2030.

IRENA remains committed to supporting Somalia in this important journey, and we look forward to continued collaboration with the Somali government, development partners and the private sector to this end. The energy transition is an opportunity for Somalia to build a more prosperous, resilient and sustainable future for its people. We hope this report will serve as a valuable tool for shaping the path forward and unlocking Somalia's full renewable energy potential.

Francesco La Camera
Director-General
International Renewable Energy Agency (IRENA)

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Abbreviations

AfDB	African Development Bank
COP	Conference of the Parties
ESP	energy service provider
EV	electric vehicle
GDP	gross domestic product
GIS	geographic information system
GoSWS	Government of Southwest State
IFI	international financial institution
IPP	independent power producer
IRENA	International Renewable Energy Agency
kWh	kilowatt hour
MoEWR	Ministry of Energy and Water Resources
MW	megawatt
NDC	Nationally Determined Contribution
NEA	National Electricity Authority
NEEAP	National Energy Efficiency Action Plan
PPA	power purchase agreement
PV	photovoltaic
REA	renewable energy assessment
SCADA	supervisory control and data acquisition
SDG	Sustainable Development Goal
SNREA	Somalia National Renewable Energy Agency
SomaliREN	Somali Research and Education Network
TVET	technical and vocational education and training
UN	United Nations
UNDP	United Nations Development Programme
UNSOS	United Nations Support Office in Somalia

Executive summary

Somalia is at a crossroads. It has a stable government and institutions after years of unrest, but needs to re-define and develop its primary infrastructure, which has fallen into disrepair, to better meet the nation's evolving needs. At this juncture, the government would do well to leverage renewable energy and energy efficiency to transition to a more sustainable, economically viable future. A transition to sustainability would ensure multiple macro-economic benefits, such as bolstering development and the balance of payments (by avoiding refined oil product imports), as well as robust micro-economic benefits (*e.g.* lower household electricity prices, greater access to modern energy services in remote areas).

While numerous challenges remain, Somalia is well positioned to make the transition; its renewable energy resources are varied, abundant and well distributed.

A key first step is to put into action the policy and regulatory frameworks already in place. Other important steps forward are described below.

Outlining a clear vision. A clear vision and corresponding guidelines will maximise potential economies of scale and economies of series. Specific targets for renewable energy penetration, across all sectors of the economy, can be set based on analysis and planning already outlined in the country's Renewable Energy Action Plan.

Targets of 152 megawatts (MW) of grid-connected renewable energy capacity and a 30% increase in off-grid capacity by 2030 are realistic, and offer a strong basis for the revision of Somalia's Nationally Determined Contribution to the Paris Agreement (NDC 3.0), according to IRENA's analysis and projections.

A sustainable energy transition requires Somalia to render its regulatory authority operational so that it can develop and enforce the contractual framework necessary for independent power producers while ensuring that power purchase agreements are sufficiently fungible to allow project-specific funding at minimum risk. Technical standards will also need to be defined and implemented.

Expanding access to modern energy services is key to the country's stability and development. Access-related targets can be announced to help delineate the potential market, and fiscal and financial measures applied to lower the cost of energy service provision.

The majority of meals are still cooked using traditional wood fuel. Strategies and policies to shift to more modern solutions (*e.g.* renewable fuel briquettes, solar cooking and biogas) may be considered while accounting for local contexts. An initial, transitional phase could focus on promoting more sustainable cooking solutions before a shift to entirely different fuel sources becomes possible.

Increasing energy efficiency will also be key to economic development. This requires reducing average energy intensity, which is high in Somalia compared with the rates in neighbouring countries. It also calls for building the capacity of Somalia's institutions and setting targets to achieve greater efficiency. All sectors – from industry to buildings to appliances – could make a contribution. Initial interventions could cover end-use appliances such as efficient lighting solutions, refrigeration and air-conditioning, before policy makers progress to actions that take more time to implement, such as updating building codes.

Although Somalia's transport sector remains small, its importance will increase alongside economic growth. The necessary infrastructure investments are substantial. Policy makers would do well to consider local contexts, prioritising solutions urgently needed to support the existing transport fleet while encouraging the innovative development of low-carbon alternatives (*e.g.* electric vehicles and green hydrogen).

Attracting the necessary public and private finance. Somalia's evolving needs call for significant funding. This highlights the importance of minimising informational costs and risks (*e.g.* by prioritising transparency). Beyond setting targets and publicising an action plan, the clarity and fungibility of institutional, legal and contractual frameworks are key in decreasing perceived risks and associated funding costs.

Fiscal and financial measures are also needed to boost investments in sustainable technologies. International financial institutions active in Somalia are considering technology- and project-specific credit lines held by local banks. These institutions might also consider developing financial-risk-mitigation guarantees for Somalia that include revolving funding for renewables' development, making it possible to support multiple projects over time. Micro-credit solutions might be useful in encouraging off-grid, value-added solutions for the benefit of rural populations. Tax breaks for clean technologies and taxes on polluting technologies and high-value-added activities (*e.g.* telecommunications) could help balance the playing field.

In addition to the measures outlined above, robust capacity-building and training programmes would benefit all sectors. Plans for a newly envisioned national utility need to be finalised and implemented. An improved transmission network and large-scale renewable energy projects promise to decrease electricity prices and expand access.

Critical minerals and materials. Somalia is rich in reserves of many minerals critical to technological development (*e.g.* platinum, lead, zinc, copper, nickel, chrome, manganese, lithium iron and titanium ore), but has explored or exploited few. The government might consider updating and adopting its draft mining policy and mining code to encourage the development of these critical resources. Detailed studies are needed to better quantify economically feasible resources and foster their development.

Institutions that adapt alongside the country's energy transition. Although Somalia has made rapid progress, much remains to be done to create and reinforce the necessary institutions. The Ministry of Energy and Water Resources (MoEWR) might consider creating specific sections to address energy efficiency, biomass, energy access and information collection needs. Meanwhile, capacity building will be key to ensuring that staff have the pre-requisite qualifications. In a similar manner, the regulatory authority needs to be rendered functional, and its staff supported with capacity-building efforts. A rural energy access agency and a national renewable energy agency have been identified as necessary but still need to be defined and launched. Finally, the MoEWR could create a multi-sectoral energy body to co-ordinate all line ministry actions in the energy field. Meanwhile, a donor co-ordination body could support international financial institutions' actions in the field through dialogue and information exchange.

Human resource and skill development. Education and technical training are critical for Somalia to achieve a sustainable energy transition while capturing maximum benefits to employment and local value added. In this regard, Somalia could collaborate with local actors and international development partners to develop a national education and training strategy. Specifically, the government could mandate that all training sessions and materials prepared for individual projects be made available for subsequent training. It could create national training infrastructure, and mandate training and qualification levels for specific roles in the energy field.

Research, development and standardisation. National research and development networks could be supported to participate in the definition, development and use of technical platforms. National standards, norms and equipment testing could be mandated, leveraging existing research networks, while creating the necessary technical platforms for testing and approval of equipment.

Energy Compact on renewable energy for UN peacekeeping. The Energy Compact brings together governments, international organisations, partners, financial institutions and the private sector to achieve commitments towards accelerating the availability of renewable energy in conflict-affected locations. It provides a forum where central actors formulate steps towards the common goal of expanding investments in renewables. Impactful and decisive actions to support renewable energy in fragile settings can help ensure that humanitarian and peacekeeping missions deliver a positive legacy. The renewable energy projects realised and planned under the Compact have helped reduce Somalia's reliance on diesel, thereby reducing greenhouse gas emissions, improving access to clean energy and promoting energy efficiency.

Bolstering national infrastructure on land and at sea. Years of instability have completely degraded Somalia's infrastructure network. Islanded networks, including in urban areas, now need to be inter-connected. The success of this phase will partly depend on the regulator's definition and enforcement of electricity market rules. The planned national utility will also need to be operational to facilitate the development and implementation of transmission projects. Regional inter-connection projects will only become feasible once these steps have been taken.

Mapping renewable energy. Somalia has a wealth of renewable energy resources, but few have been measured and quantified. Solar and wind energy is the most common and well distributed. Solar and wind atlases should therefore be prioritised. Biomass and bioenergy are a close second. Hydro studies should be updated and extended to measure hydropower potential. Geothermal resources also need to be assessed; they could provide base power production that helps stabilise service provision. These resources should be integrated in a publicly available geographic information system database that includes resources, needs and envisaged projects, thus supporting the efficiency of interventions and investments.

1 Background and rationale

1.1 Background

Somalia, located in eastern Africa, has a surface area of 637 657 square kilometres. The environment is semi-arid, affected by both recurring droughts and floods (during the rainy season). Somalia's population numbers 12.3 million (UNFPA, 2014), more than 60% of whom are under the age of 25. Agriculture and livestock activities represent more than 70% of the gross domestic product (GDP) (World Bank, 2022), exposing the national economy to external and climate shocks.

In the past a single utility managing distribution networks in the main urban areas supplied electricity via limited inter-connections and transmission networks. Years of political upheaval degraded this infrastructure, and energy service providers (ESPs) emerged to fill the gap. The current "islanded" mini-grid networks developed by ESPs do not allow efficient operation. ESPs are obliged to manage their generators to follow demand loads. This makes electricity production inefficient and raises electricity prices (USD 0.6-1.0 /kilowatt hour [kWh] on average, compared with USD 0.22/kWh for the Horn of Africa [World Bank, 2022]).

Recognising the urgent need to build up its electricity infrastructure, the federal government has developed a number of policies and strategies to support the sector's growth, based on a body of analysis and assistance provided by international financial institutions (IFIs). The Somalia National Energy Policy 2018 and the Somalia Master Power Plan laid the foundations for the country's policies, while the National Renewable Energy Action Plan set the main goals for renewable energy development. The adoption of the Somalia Electricity Act in early 2023 helped set up a policy and regulatory framework for the sector. However, this framework still needs to be implemented. This is especially the case since market development rules continue to be perceived as unstable, and the co-ordination of regional policies is limited.

The Ministry of Energy and Water (MoEWR) carries overall responsibility for the energy sector with specific sections devoted to key renewable resources. It is now critical that the government quickly create and operationalise the institutions outlined in key planning documents, to facilitate continued market growth while reducing market risks and uncertainties.

1.2 Rationale for renewable energy development in Somalia

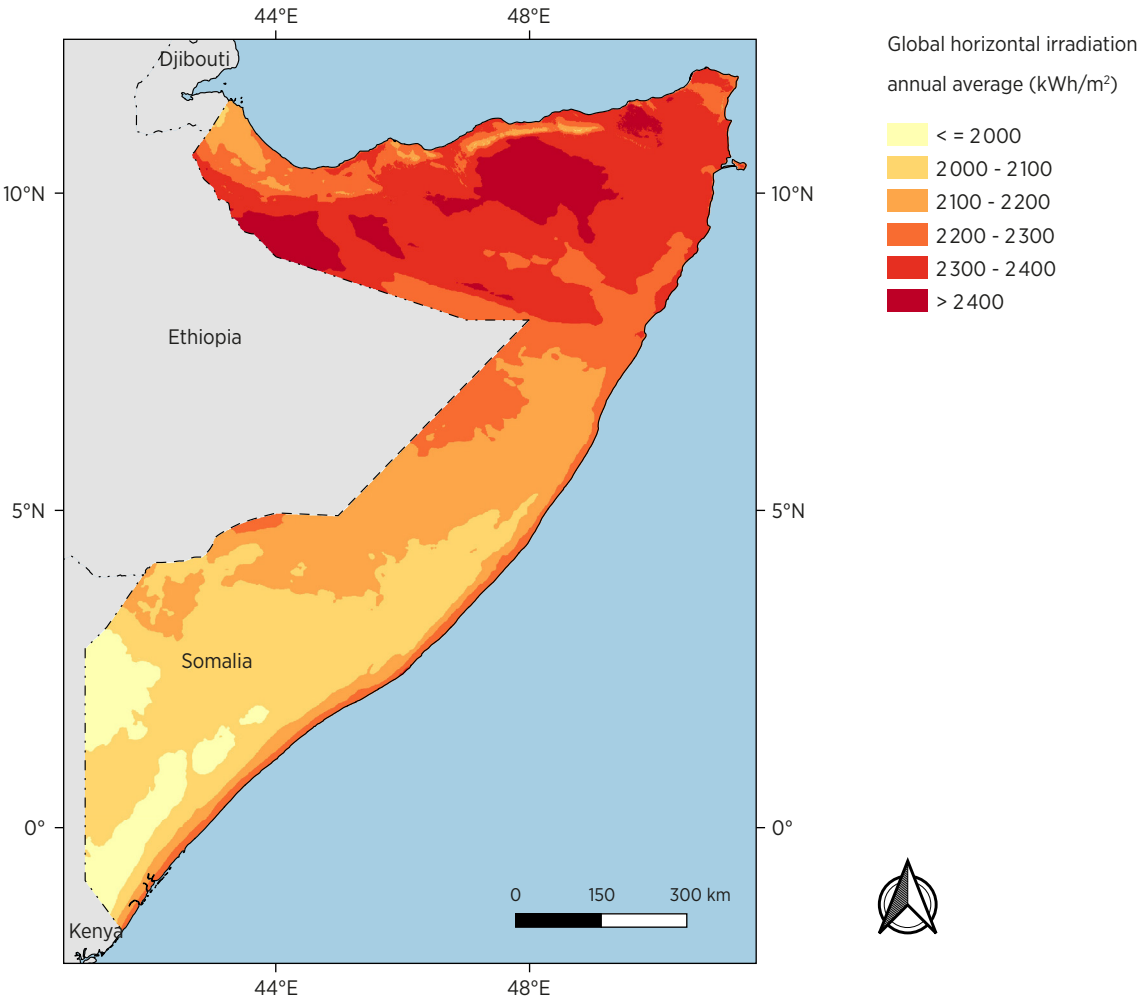
Somalia presents an interesting case for renewables – here, relevant technologies are being adopted not for their environmental benefits, but because they present the most practical option for the country (*i.e.* since they are low cost and modular). The main drivers of renewable energy adoption in the country include cost, the availability of power production, resource abundance, development goals, political priorities, and climate mitigation and adaptation needs.

Somalia was one of 133 countries to sign the global pledge to triple renewable energy and double energy efficiency at the 28th Conference of the Parties (COP28) in 2023. But it has not been able to keep up with the contributions expected; renewable energy capacity grew by only about 7% from 2022 to reach 54.09 MW in 2023. Energy efficiency improvements have been quite modest; energy intensity improved by less than 1%, to reach 6.5672 megajoules per US dollar. Somalia's energy economy therefore offers significant opportunities to advance the sustainable energy transition and contribute to the global tripling goal.

Cost and availability of power production. Electricity prices in Somalia are among the highest in Africa, at around USD 0.4-1.0/kWh relative to an average of USD 0.22/kWh in the Horn of Africa (World Bank, 2022). This is due to several factors, including heavy reliance on high-speed diesel generators, inefficient operation of generators, high losses and oligopolies in the electricity sector. Renewable energy has been introduced into ESPs' generation mix to help reduce generation costs and related electricity prices. The European Union (EU) estimates that for ESPs receiving financial assistance in adopting photovoltaic (PV) and hybridising electricity production, costs could fall to USD 0.4/kWh (EU TAF, 2022).

Resource abundance. Somalia has abundant renewable energy resources. Small hydropower projects have been successfully developed in the past, and larger trans-national projects are being envisaged with neighbouring countries. Sunshine is plentiful: the country receives 6-8 kWh per square metre (m^2) of solar irradiation on average daily (see Figure 1). Somalia also benefits from average annual wind speeds of 4-10 metres per second (m/s); speeds are particularly high in the northern region (see Figure 2). While still not assessed, geothermal resources could perhaps be leveraged for electricity production.

Figure 1 **Solar power potential**

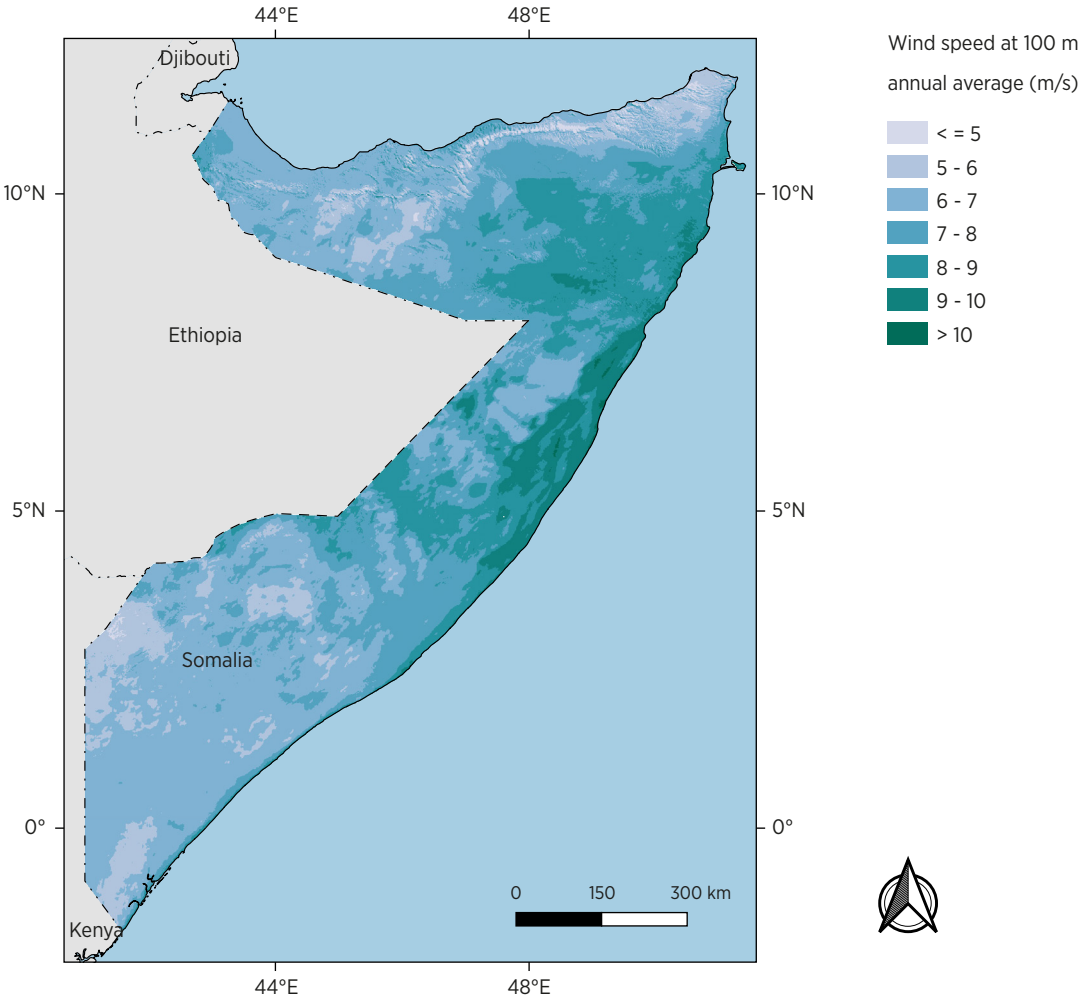


Source: Global Solar Atlas (ESMAP, 2019). Base map: UN Boundaries. The maps are also available on the IRENA Global Atlas for Renewable Energy web platform.

Notes: km = kilometre; kWh/m^2 = kilowatt hours per square metre.

Disclaimer: This map is provided for illustration purposes only. The boundaries shown do not imply any endorsement or acceptance by IRENA.

Figure 2 **Wind power potential**



Source: Global Wind Atlas (DTU, 2015). Base map: UN Boundaries. The maps are also available on the IRENA Global Atlas for Renewable Energy web platform.

Notes: km = kilometre; m = metre; s = second.

Disclaimer: This map is provided for illustration purposes only. The boundaries shown do not imply any endorsement or acceptance by IRENA.

Energy access and development. The 2020-2024 National Development Plan 9 aimed to increase energy access from 10% to 45% by 2024. As stated earlier, the abundance of renewable energy sources in Somalia and their quality present a unique opportunity to expand energy access by leveraging renewable energy. Many IFIs, including the World Bank and across the European Union, are promoting renewable energy hybridisation to reduce electricity prices. It is estimated that using renewable energy while synchronising generators could lower generation costs by about 30% (World Bank, 2021). A reduction in prices could strongly affect access, doubling the number of connected customers within a few months (EU TAF, 2022). Renewable energy technologies can help boost energy access by providing modular, low-cost solutions in remote areas.

Climate change mitigation and adaptation. Last, but certainly not least, renewable energy can support climate change mitigation by reducing greenhouse gas emissions. Though Somalia's limited national and per capita emissions (given that it is a least developed country with low per capita energy use) mean that it may not be as motivated by mitigation incentives, it has a direct interest in mitigation led by renewable energy. Since the country is starting from a low energy access rate, with little installed generation capacity and limited electricity inter-connection, it is directly in its interest to develop renewable energy generation from the outset. Since the baseline energy use is supported by unsustainable biomass or fossil fuels, and there is significant suppressed demand, energy access based on renewable energy could yield higher emission reductions and associated mitigation impacts compared with energy economies with more developed energy systems. Limited existing generation capacity means Somalia is not exposed to a lock-in effect of sunk investments in a large, fossil-fuel-based energy system. This means it does not need to replace polluting technologies, but only to develop those technologies that directly benefit its economic, development and human needs in the shape of renewable energy.

Balance of payments. Renewable energy adoption provides Somalia with a strong incentive to reduce its balance of payments deficit, given that fossil fuel imports represent an increasing amount of the current account balance. Once a highly indebted poor country (HIPC), Somalia has successfully reached an HIPC completion point, making it eligible to apply for debt relief with the International Monetary Fund. Its debt is now less than 6% of total GDP (IMF, 2023). Although electricity produced by diesel generators is the norm, renewable energy can help Somalia reduce fuel imports and its balance of payments deficit.

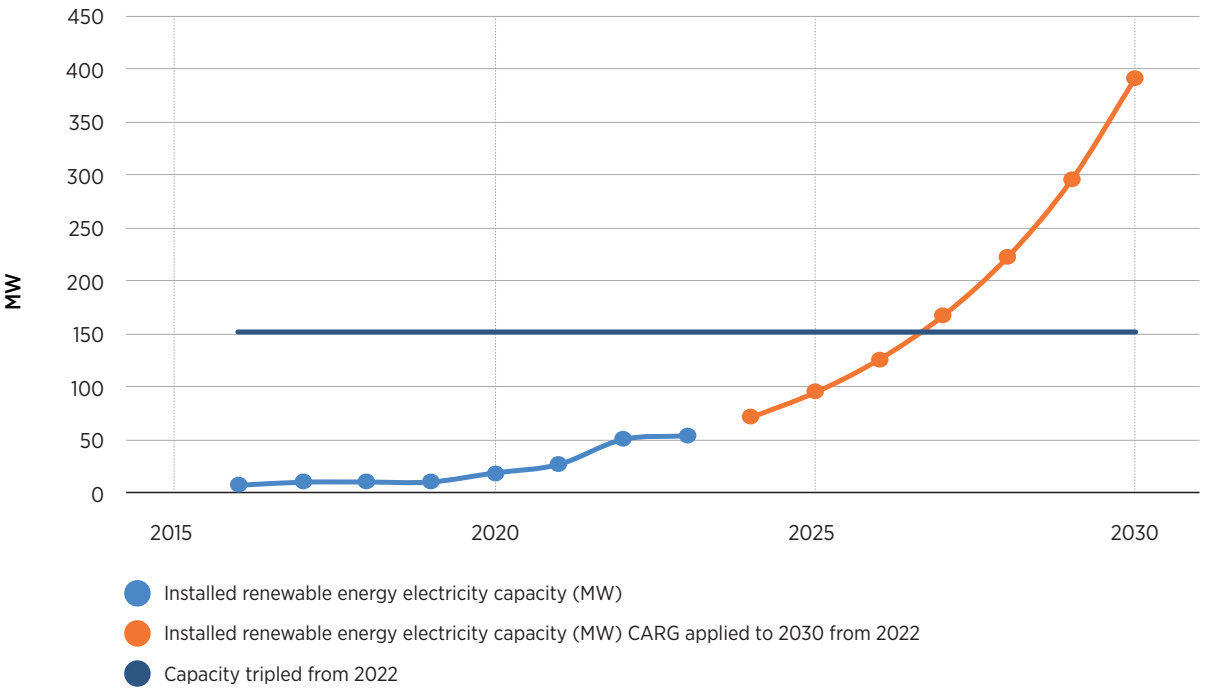
2 Key challenges and recommendations

2.1 Policy and regulatory hurdles

Somalia renewable energy assessment: Tripling renewable energy status and prospects

In the COP28 negotiations held in Dubai on 2 December 2023, Somalia was one of 133 countries to sign the Global Renewables and Energy Efficiency Pledge, aimed at tripling renewable energy power generation capacity and doubling the rate of energy efficiency improvement by 2030 (as compared with 2022). The International Renewable Energy Agency's (IRENA's) statistics on total installed renewable energy electricity capacity show 50.59 MW of installed capacity in 2022. Based on 2016-2023 country-level data, installed capacity is projected to reach 392 MW in 2030 using a compound annual growth rate of 6% per year, as shown in Figure 3.

Figure 3 **CAGR-based projection for tripling renewable energy in Somalia by 2030**



Source: IRENA (2023a).
Notes: CAGR = compound annual growth rate; MW = megawatt.

Somalia appears to be on track to meet the commitments of the Global Renewables and Energy Efficiency Pledge since the projection for 2030 is more than triple the amount seen in 2022 (COP28, IRENA and GRA, 2023).

a. Operationalising a regulatory framework

Although Somalia has taken steps to define key sectoral institutions and their functions, it still needs to operationalise these, as well as an accompanying regulatory and legislative framework, bolstered by the necessary enforcement and compliance mechanisms.

Defining the MoEWR's vision and guidelines. Despite Somalia's focus on renewable energy development, it still lacks a global target (beyond the tripling pledge) to help guide capacity development and attract investments. The MoEWR sets the course for electricity provision and could conduct a review of the country's energy transition needs. Findings could inform planning, set down in a visionary policy document that establishes the main priorities for electricity sector development. A separate renewable energy law could also be considered or simply included within the plan.[1]

Setting renewable energy targets. Although renewable energy has increased, the MoEWR could set specific renewable energy targets in a renewable energy law or energy transition plan, reflecting its COP28 pledge. The challenge is to clearly mandate future investments in renewables and clarify market potential for investors:

- A national target of *152 MW of renewable energy capacity by 2030* is recommended.
- In addition, a target could be set for rural, decentralised electricity production, including a minimum 30% of renewable energy production to encourage fuel savings, minimise electricity prices and save on fuel transport costs.
- To set, measure and assess future renewable energy and energy transition targets, Somalia would have to improve and update data on current energy use and needs. While the rate of urbanisation is high, security risks have prevented new studies. Energy needs may have to be assessed using innovative studies that utilise partially remote methods.

Setting up a functional regulatory authority to implement related policies and regulations. Operationalising and improving the capacity of the national electricity authority (which also serves as the regulatory authority) is one of the first priorities to structure the sector and allow the market to develop. During the Somalia ETA national consultation workshop and validation workshop, participants highlighted that the sector's development requires establishing a contractual framework and the necessary enforcement mechanisms jointly with the country's private sector actors. In a nutshell, several key policy and regulatory instruments are needed:

[1] *Two options may be considered: either directly preparing and voting for a specific renewable energy law to be passed in parliament, or setting the stage for a broader-based policy covering all economic development through an Energy Transition Plan. This plan could in turn build on the existing National Renewable Energy Action Plan and the National Energy Efficiency Action Plan, which would be revised to reflect recent national developments. A formal renewable energy law is not necessarily needed if the country develops a broader-based, updated strategy. Both the specific renewable energy law and the energy transition plan would necessitate specific application decrees to be implemented, whatever the case.*

- *Electricity generation licenses*, setting the conditions for independent electricity generation in the country. The implementation of a transparent licensing system would have the added benefit of providing at least partial funding for the regulatory authority.
- *A framework* for independent power producers (IPPs) and related power purchase agreements (PPAs), which are indispensable when developing a "fungible" market and necessary to facilitate investments in power generation assets. These should allow the "ring-fencing" of project financing and minimise off-taker risks to favour private sector investment.
- *Technical standards* for power plant integration and inter-connection to the grid. Although no standards have yet been established, there is a general push by the MoEWR to transform all existing production networks to high and medium voltage (132, 66 and 33 kilovolts [kV], as well as 11 kV for initial distribution). The grid connection standards should also be defined to allow the remote collection of data on energy production (via supervisory control and data acquisition [SCADA] systems) and control of plant disconnection and reconnection in case of network faults.
- *Standards and codes* for all types of electricity generation systems; these will help guarantee the quality of newly installed capacity. They can be sourced from existing major markets but should nevertheless be verified locally to confirm their relevance.
- *Mandates for renewables-based self-generation projects* with grid interactions; these are key to softening the exponential growth of grid electricity production capacity. Given that the private sector has the capacity to invest in its own self-generation projects and the motivation to level its input costs, such a mandate would support a general increase in electricity production capacity as well as economic growth by providing industry and the services sector with stable, low-cost energy solutions. Such a mandate could initially be piloted in the commercial and industrial sectors, before being extended to households. Further, injection of excess production into grids could help reduce capacity demand on the global electricity network.

b. Improving access to energy services

Increasing energy access is key to Somalia's stability, development and security. However, the scale of demand in rural areas far outpaces the investment capacity of locally based and sourced companies currently serving this market. Energy access investments in rural areas also offer fewer returns on investment. These effects are compounded by the fact that a large majority of cooking, be it in urban or rural communities, relies on traditional wood fuel and charcoal. Among the many environmental impacts, this trend leaves rural communities exposed to erosion and land degradation when non-local actors over-exploit biomass.

Energy access policy. The MoEWR could consider reviewing current policies to identify any gaps. It could develop and adopt a national energy access policy and establish goals and the conditions for rural community energy access based on consolidated data. Policies and approaches could benefit from experience in the water sector, where service delivery was extended when public-private partnerships helped attract private sector actors and financing. Key steps include the following:

- Define the goals for energy access in rural communities and the means for meeting them (*e.g.* reduced import taxes for critical equipment).
- Define possible institutions (*e.g.* a rural energy access agency) and inter-stakeholder interactions necessary to ensure progress towards energy access goals.
- Quantify needs and market size. Delineating access policies for urban and rural populations is key. The country should consider updating existing population censuses given its high urbanisation rates. Also, household surveys could help close the information gap in rural areas. Innovative survey methods may be required, given security constraints.

- Develop standards and codes for rural energy access solutions to ensure they are compatible with potential future grid-linked connections, but most importantly to guarantee service quality and safety.
- Mandate a renewables portfolio standard that specifies a minimum percentage of renewable energy. This would help reduce the cost of electricity and reliance on road-supplied diesel fuel, which is exposed to cost spikes and availability due to security issues, by securing a portion of electricity provision through renewables. The minimum percentage could be defined by analysing a share of electricity produced by private sector providers.
- Identify sources for local fund-raising, including taxation and cross-subsidies, to complement possible IFI funds. Access to financing is key in developing this sector. There is a strong need to support investments through sustainable financial instruments, including guarantees to assist the private sector in taking on the necessary risks.
- Favour the development and emergence of local private sector entities and support their efforts to market and maintain relevant technologies, thus ensuring local availability of services, and promoting local employment and development.

Bioenergy policy. Unsustainable charcoal and wood fuel continue to be used for cooking in both urban and rural areas. The MoEWR could consider organising a strategic document on biomass/bioenergy (based on updated data) to provide guidance on:

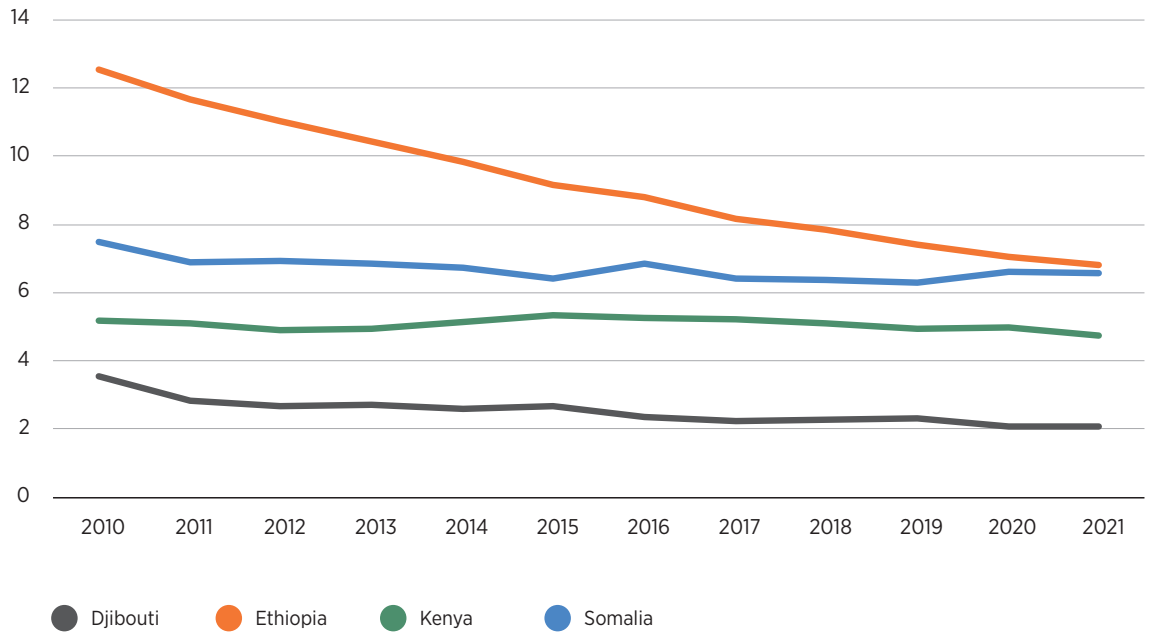
- Strategies and policies to address the current unsustainable use of biomass.
- Transitioning from traditional wood fuel and charcoal, with an initial focus on substitutes, including electric cooking, renewable fuel briquettes and biogas for these uses in urban areas. Biogas is already being produced in the country. As mentioned during the validation workshop, a Somali biogas plant's installed capacity is being increased from 2.3 MW to 12 MW.
- Possible taxation of unsustainable charcoal use in urban areas to partially fund access efforts and sustainable production and use in rural areas (local-community-managed forests and vegetation to ensure stock renewal).
- Alternative solutions to wood fuel use (improved cookstoves, renewable fuel briquettes, solar cooking, biogas) in rural areas. Participants in the validation workshop commended the innovative approach and double benefits of exploiting invasive species as a resource for bio-charcoal, while highlighting the potential need for specific cookstoves. There may also be strong potential for biogas in rural areas, although constraints such as regular maintenance and careful management of biodigesters must be considered. Biodigesters would most notably be of use at the farm or village level to ensure constant supply of resources.
- Informing and educating local communities, with a specific focus on women's groups, is important, to help them understand the benefits of these new technologies and encourage behavioural changes.
- Equipment codes and standards need to be defined to prevent adverse experiences and ensure sufficient quality of materials and solutions.

Somalia already identified clean cooking targets within its first Nationally Determined Contribution (NDC) (UNFCCC, 2021), including targets for the production of renewable biomass briquettes and distribution of improved cookstoves, kilns and biogas-based cookstoves. The actions outlined above would help advance progress towards these nationally determined targets.

c. Promoting energy efficiency, heating and cooling

Energy intensity in Somalia is high, even in comparison with its neighbours (see Figure 4). This disparity stems from multiple factors, for example, inefficient electricity production, generation, consumption and end-use appliances. The global pledge that Somalia signed at COP28 also calls for doubling energy efficiency by 2030. Increasing energy efficiency to fuel the country's growth is one of the low-hanging fruits the government could prioritise; this is in its economic interest, with the added benefit of freeing capacity for more productive uses.

Figure 4 **Energy intensity in Somalia and neighbouring countries, 2010-2021**



Source: (IEA, *et al.* 2024).
Notes: Measured using megajoules/USD in purchasing power parity. GDP is expressed in constant 2017 USD.

Mandating energy efficiency targets. While Somalia has adopted the COP28 energy efficiency targets, how to implement them is the question. Somalia's National Energy Efficiency Action Plan (NEEAP, 2020) identifies priority action areas. The NEEAP could be used as a basis for future implementation, though consolidated data are needed to ensure the quality and applicability of envisaged actions:

- The first priority could be to create a unit within the MoEWR to help implement these actions and follow up on them. It is suggested that this unit be placed under the MoEWR's energy department. Much capacity building and specific projects will also need to be undertaken to develop the necessary actions.
- Concrete needs, identified under the NEEAP, could serve as the preliminary action plan for these energy efficiency targets. Under a first phase until 2030, the objective could be to assess and implement potential energy efficiency measures for lighting, refrigeration and air-conditioning. Other targets related to the efficiency of electricity production are being pursued under the electricity sector plan.

- Participants in the validation workshop highlighted the need to ensure the quality of electrical networks in households and buildings. Following accidents due to faulty installations and low-quality materials, an effort was initiated to register and categorise all building engineers and stakeholders to make sure they have the necessary expertise and qualifications. This can be used as an opportunity to mandate additional training in efficient electrical design for buildings, increasing efficiency and reducing energy waste.

Energy efficiency measures on the supply and demand sides could be mandated across economic sectors. The MoEWR could consider developing a national energy efficiency strategy and policy covering all sectors (and possibly including renewable targets), whether at the national or regional level:

- *Mandating efficiency measures for industry* would have the double benefit of reducing input costs while leveraging the sector's capacity to invest in more efficient technologies. Accompanying programmes could be devised in collaboration with IFIs present in the country, while institutions such as the United Nations Industrial Development Organisation (UNIDO) could offer specialised assistance.
- *National targets could inform energy performance codes* to be adopted in the construction of all new buildings. These targets could also be used to encourage the sourcing of local materials as much as possible, as well as the use of traditional (though modernised) architectural solutions adapted to the country's climate.
- *Renewable energy solutions* such as solar heating and cooling as well as electricity production, could also be encouraged, at least initially, through incentives, before being mandated for all new construction.
- The government of Somalia could clarify and enforce a *building permit obligation and associated building codes* throughout the country. This would provide the opportunity to ensure compliance with mandated efficiency standards. The government would need to clarify the institutional and regulatory structure for new construction projects, along with the necessary enforcement mechanisms, without which no progress will be possible. It is important to ensure sufficient administrative capacity to address requests and provide the necessary feedback to recipients. A building permit fee could as least partially offset administrative costs. Since Somalia has no formal structure for building permits, they would have to be progressively enforced. A first step could be to encourage best practices, to be implemented on a voluntary basis, while measuring and encouraging improved performance, before making permits obligatory.
- Policies could also mandate the exploration of local materials for construction and insulation. This would not only encourage the development of local businesses but also reduce efficiency losses in the transport of imported foreign materials.
- The government will need to collect standardised data on all construction while developing effective, efficient enforcement and compliance mechanisms, including for monitoring, auditing, reporting and verification. Penalties, subsidies and efforts to raise awareness should also be outlined, to provide a full range of incentives.

d. Decarbonising transport

Although a large majority of fossil fuel consumption in Somalia is related to electricity production from diesel generators, the transport sector will inevitably represent a growing source of emissions. As in most African countries, Somalia's vehicle fleet is relatively old and limited economic capacity is slowing its renewal. Plans will need to reflect these constraints and include electrification and biofuel and synthetic fuel options.

Somalia could consider defining a *national strategy and policy for the transport sector* that considers local constraints and capacities. Policy should reserve sufficient flexibility to adapt to evolutions in clean transport. The global electric vehicle (EV) market is growing exponentially; technological improvements in battery chemistry may soon provide a wider range of options.

Biofuels. Although biofuels were earlier dismissed for potential "food for fuel" competition, they should not be excluded as an option to drive clean transport. Somalia's government could evaluate possibilities to produce biofuels locally without constraining agricultural production. With biofuels, immediate decarbonisation of transport is possible, without a complete overhaul of the vehicle fleet:

- Third- and fourth-generation biofuels may very well prove to be economically and environmentally viable for easing decarbonisation efforts.
- The direct use of vegetable oil may be viable for older and utility vehicles that do not rely on turbocharging or direct injection. This option could be piloted in a small fleet.
- The government should also consider mandating the recycling of used vegetable oil as a short-term, low-hanging fruit. The conversion of used vegetable oil into biodiesel is a mature, low-cost solution already employed in many countries, including developing ones.

Electric vehicles. Two specific constraints may, at least temporarily, delay the widespread adoption of EVs in Somalia. EVs still have significantly higher initial costs than traditional combustion engines. This price disparity could be reduced over time if global EV sales increase and affordable EVs become more available, but this will not happen overnight. Besides, electricity is still mainly produced with inefficient diesel generators, and grid and production capacity are quite limited.

In the meantime, *pilot projects* could explore the use of EVs. Captive vehicle fleets (public transport, taxis, freight vehicles and for specific rural uses) could utilise renewable energy charging stations. In turn, charging stations would start to penetrate, without the need to immediately invest in an extensive network of stations.

As highlighted during the validation workshop, the Ministry of Environment is already envisaging pilot projects. One such project involves the distribution of electric three-wheeled vehicles (tuk-tuks) and the construction of charging stations. Motorcycles and mopeds could also be among the first targets, since renewing their fleet will take less time than for cars and trucks.

Hydrogen. As for EV charging, the infrastructure for a hydrogen-based transport network would require significant investments. Yet, considering Somalia's abundant renewable energy resources, renewables-based hydrogen production may prove to be economical in the future.

Somalia could start by exploring *hydrogen production for growing export markets*. This would allow it to initiate local production and the development of the requisite infrastructure. Once this has been achieved, pilot projects could be initiated for captive fleets and the domestic industry to prove the concept, before viable technology offerings appear on the market.

2.2 Key challenges in attracting public and private finance

Somalia's economy and infrastructure are in dire need of funding after decades of under-investment. This is both a curse and an opportunity. A lack of investment has limited progress while avoiding the lock-in of older technologies. The country can now leapfrog to 21st century solutions that are, in essence, better adapted to domestic needs and future constraints. However, there is a need for substantial funding over the next decades.[2] Further, renewable technologies require significant capital given their low variable costs. While renewables stabilise electricity production costs (since they do not rely on variable fuel costs), it becomes important to manage their financing.

As can be seen, efforts towards a sustainable future require financing. The cost of project financing (both equity and debt) can represent up to 50% of the final cost of electricity. To lower this cost in Somalia, it will be important to manage perceived country, market, and technology risks.

a. Reducing market risks

Besides country risk, which depends on Somalia's political and economic environment and is not directly related to this assessment, market risk is a main contributor to investment costs. Creating a transparent, cohesive market in Somalia requires comprehensive strategies and legislation, a regulatory framework and enforcement mechanisms ensuring the framework is applicable and defined in co-ordination with private sector actors already in the market. The framework should also allow for the "ring-fencing" of projects so that funding for individual projects can be mobilised while not affecting the holding company beyond its equity investment in the projects themselves. There is significant potential for diaspora investment, which may be encouraged by the following measures:

- **Defining and adopting a renewable energy/transition law.** Clear, realistic objectives for renewable energy penetration and integration would help reduce market risks. These *objectives* could be included in a specific *renewable energy law*, which would then need to be translated into applicable decrees. Alternatively, a more global *energy transition law* could cover all sectors, with specific decrees for individual sectors. This could have the added benefit of requiring a single, more central law providing direction for the country's energy future. *The energy transition/renewable energy law could be developed based on* the National Renewable Energy Action Plan (NREAP, 2020) and National Energy Efficiency Action Plan (NEEAP, 2020), composed in collaboration with development partners and IFIs, and help clarify the expected market size and calendar.
- **Setting energy access targets.** Defining and adopting *clear energy access targets and frameworks* based on updated data will aid partners in quantifying the potential market and defining the instruments needed to help fund it.
- **Independent power producers.** The status of the project companies created to manage different projects will also strongly affect the perceived risks. The Electricity Authority should define an IPP policy and status to clearly set out *IPPs' obligations and rights*.
- **Power purchase agreements.** Besides the IPP framework, projects' economic viability will rely on the associated PPAs that are signed. These *PPAs and the related guarantees and obligations* will determine the funding conditions for projects.

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[2] *Somalia's updated 2021 NDC specifies investments of USD 1.29 billion for climate mitigation in the energy sector and USD 10 billion for climate adaptation over 2021-2030.*

Several pilot projects, including the Kube Energy project detailed in Box 1, and Equator Energy's 1.2 MW PV grid-connected solar power plant in Somaliland (USAID, 2022), have helped set a precedent for PPA and IPP contracts in Somalia. A project of the United States Agency for International Development (USAID, 2022) evaluates conditions for sector development and investment. These projects can help shape the contractual framework for independent power production.

All these measures are of little use without associated enforcement mechanisms to ensure principles are applied. Model IPP, PPA and connection contracts should be developed and implemented in co-ordination with the principal IFIs and local stakeholders to make sure they are compatible with international standards and, in turn, to gain clarity on their perceived implementation risks, which strongly affect financing costs.

2.3 SDG 7 Energy Compact on Renewable Energy for Peacekeeping

a. Background

The SDG 7 Energy Compact was launched at the 13th IRENA Assembly in 2023 and supports the United Nations (UN) Secretariat's target of sourcing 80% of electricity from renewables by 2030. The aim is to leverage the Compact to potentially develop renewable energy infrastructure and markets that outlast the peacekeeping missions. Depending on assessments of renewable energy potential, the initiative seeks to expand energy access for host communities under specific circumstances.

Host countries can diversify their energy base, reduce fossil fuel reliance, and generate capacity building and economic development opportunities by leveraging the environmental footprint in UN peacekeeping operations as a basis to build new clean energy infrastructure in fragile settings.

The Compact is led by the UN Department of Peace Operations (UNDPO) and the UN Department of Operational Support (UNDOS), in collaboration with IRENA, Denmark, Norway, the United Arab Emirates, and other supporting and host countries, including Somalia. Further, at a ministerial meeting at COP28, the partners adopted a declaration (IRENA, 2023b) to mobilise international support towards this specific Energy Compact. By supporting renewable project development in fragile settings, the collaboration seeks to enhance energy access in surrounding communities and help counter drivers of conflict and displacement (IRENA, 2024).

Somalia is one of the priority host countries. A country-specific assessment has helped identify several potential projects for the United Nations Support Office in Somalia (UNSOS).

Box 1 **Powering the UN peace operation in Baidoa, Somalia**

Baidoa is a significant city and economic center in the Southwest State of Somalia. It is situated along a crucial trade corridor that links to the seaport of Mogadishu. The Government of the Southwest State (GoSWS) is based in Baidoa, which also hosts the headquarters of the African Union Transition Mission in Somalia (ATMIS), the United Nations Assistance Mission in Somalia (UNSOM) and various other United Nations entities. The UN, the GoSWS and other international organisations have traditionally relied on diesel-powered generators for their operations, which is both environmentally unsound and a hinderance to the efficient delivery of services. Therefore, a transition to renewable energy is essential to achieve climate and sustainability goals (including with regard to peacekeeping operations). For Somalia, transitioning away from environmentally unsustainable fossil fuels, charcoal and firewood is also urgent. The country needs to develop its renewable energy infrastructure to support this shift (Wilson Peak, 2022).

A Norwegian renewable energy services company, Kube Energy, entered into an agreement with the GoSWS in 2018 to develop a hybrid PV plant in Baidoa (figure 5). The constructed power plant is located within the "green zone", near Baidoa airport. The plant has 2.8 MW of solar PV capacity and 4.8 megawatt hours of battery storage integrated with synchronised diesel generators. The project site is a vacant 4-hectare plot owned by the GoSWS, which leased the land to Kube Energy Somalia – the company registered and licensed to operate the plant in Somalia – for 15 years. After 15 years of commercial operation, the plant's ownership will be transferred to Southwest State, with the intention that it will form part of Baidoa's permanent energy infrastructure (Wilson Peak, 2022).

UNSOS, which provides support to ATMIS and other UN offices, is the largest consumer of the electricity produced by the Kube Energy power plant, with which it has entered into a Power Purchase Agreement (PPA). Kube Energy Somalia's operating license allows it to sell and distribute power to international organisations within and adjacent to the green zone. Power generated by the plant may be distributed outside the green zone to a local entity via a locally registered utility company (Wilson Peak, 2022).

The World Bank Group's Multilateral Investment Guarantee Agency has issued a guarantee to cover Kube Energy's equity, and debt investments in Kube Energy Somalia, for a period of up to 15 years. The guarantee has been issued against risks of expropriation and war and civil disturbance (MIGA, 2023):

- The provision of a PPA by UNSOS for the this and prospective projects encourages the private sector to participate in the construction and management of Somalia's renewable power plants. This is an initial success story for foreign investments in renewable power production in the country.
- The PPA in Baidoa offers a model for consideration for other sites in Somalia, as well as in other UN peacekeeping operations. The PPA model presents several notable benefits. First, it offers a viable pathway for the United Nations to rapidly scale its use of renewables to achieve its ambitious climate goals, including reaching 80% renewable energy use by 2030. Second, PPAs can help Somalia overcome a key capacity challenge for its national electrification strategy if they are used more in renewable energy projects to leverage new private sector investments. Third, this strategy can support wider peace and development goals by helping local communities access the benefits of new energy access due to UN missions.

Box 1 Powering the UN peace operation in Baidoa, Somalia (continued)

Project impacts include, among others:

- Reducing fossil fuel reliance, greenhouse gas emissions (which contribute to climate change) and other harmful air emissions in Baidoa's electricity supply.
- Creating job opportunities during the plant's construction and operation, as well as indirectly through the utilisation of local service providers.
- Generating cost savings and providing more reliable electricity to off-takers such as the GoSWS, UNSOS and other international organisations, potentially facilitating more efficient service delivery to the people of Baidoa.
- Contributing to Baidoa's long-term renewable energy infrastructure (since the plant's ownership will be transferred to the government after 15 years of operation).

Figure 5 **Construction phase of the solar power project in Baidoa**

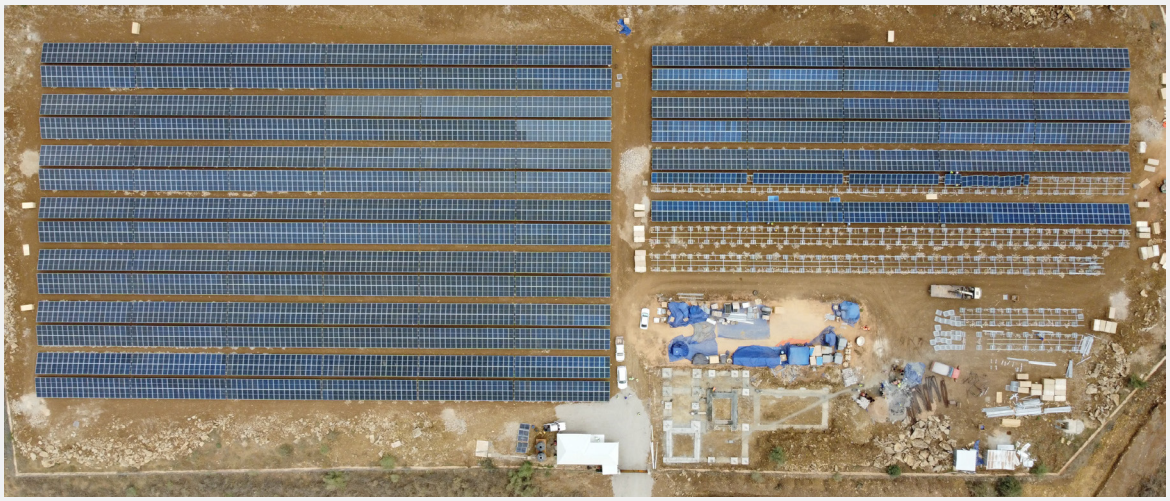

Photo: © Kube Energy.

Given that climate change and inadequate energy infrastructure create challenges for Somalia, integrating renewable energy solutions into peacekeeping and development efforts presents a unique opportunity. The following conclusions and recommendations highlight the strategic frameworks, investments and actions needed to foster energy security, support peacebuilding and ensure long-term sustainability in Somalia.

b. Conclusions from the Peacekeeping Energy Compact

1. **Energy security for peacebuilding and stability.** Investment in energy security, particularly for displaced communities and surrounding areas, offers a pragmatic, long-term approach to fostering peace and stability. Such investment can reduce reliance on unpredictable fuel markets and protect energy systems against local conflicts, in turn ensuring a reliable power supply and supporting wider peacebuilding efforts. The existence of significant international operations in these areas offers a unique opportunity to attract renewable energy investments that can benefit local communities and lay the foundation for expanding public energy grids.

2. **Leadership and oversight in energy decisions.** Effective energy decisions require robust political engagement and leadership guidance. By aligning energy strategies with UN mandates and peacebuilding objectives, senior mission leaders can ensure that renewable energy initiatives not only support environmental goals but also contribute to the overall success of peacekeeping missions.

Unlocking clean energy partnership opportunities that benefit the United Nations and host communities:

- Accelerating the transition to renewable energy (United Nations and Somalia as a host country)
- Contributing to electrification in rural settings
- Leaving a positive legacy in the host community

Figure 6 **Key actors co-ordinating efforts to achieve Sustainable Development Goals**

Source: UN DOS.

The Energy Compact could be operationalised in the field through:

- The UN outsourcing renewable energy supply to a private power producer or to utilities that also provide energy to the host community;
- UN missions acting as anchor clients;
- Power purchase agreements; and
- New energy infrastructure contributing to the government electrification plan.

c. Recommendations

- **Strengthen political and financial support for renewable energy.** There is a pressing need for sustained political and financial support to ensure the transition of peacekeeping missions to renewable energy. Governments, international organisations and financial institutions must collaborate to remove barriers and scale up renewable energy adoption in peacekeeping and humanitarian operations.
- **Invest in decentralised renewable energy solutions.** The experience from South Sudan can be effectively applied to the context of Somalia, where a focus on decentralised renewable energy solutions (*e.g.* solar micro-grids and wind power) could significantly enhance energy access. This strategy would reduce reliance on diesel, minimise supply chain risks and support the long-term recovery and resilience of vulnerable populations.
- **Leverage PPAs for local development.** The UN's strategy in South Sudan can also be applied to Somalia, where projects are already being implemented through PPAs. In this context, the UN should continue leveraging PPAs with local renewable energy providers to secure cost-effective and reliable electricity for peacekeeping operations. By reducing reliance on diesel and fostering local market growth, PPAs can contribute to both economic recovery and sustainable development in Somalia's conflict-affected regions.
- Beyond the strict remit of the Energy Compact, UN bodies may explore the possibility of training displaced populations in UN camps in the installation of solar pumping and rural energy access solutions – for the benefit of their areas of origin, including rural areas, once these populations are re-settled. This model has already been successfully implemented in similar conditions in Chad.

The recommendations suggest a potential path for integrating renewable energy into Somalia's peacekeeping and recovery efforts.

2.4 Reducing technology risks

Mature technologies and equipment with proven performance track records have lower associated technical risks and financing costs. Somalia could focus its primary efforts on proven renewable technologies and components, while mandating *norms, standards and testing for imported technologies*. Many major markets (Europe and the United States) have adopted performance standards that can be applied in Somalia.

More innovative technologies or component assembly may be needed to adapt offerings to the local market. The viability of these technologies should be thoroughly tested in the country following equivalent methodologies. Pilot projects with robust data collection, evaluations and publications will help reduce the perceived risks when scaling up. As more systems are deployed, their perceived viability will also increase.

2.5 Creating transparent, cohesive markets

Targets. Clearly defined, realistic and transparent targets for renewables' deployment can help reduce information costs and ensure ease of financing. Well-defined national targets – developed based on updated, consolidated data – can help mobilise the necessary stakeholders, creating an opportunity for economies of scale. The multiplication of well-defined and known projects will lower the scale of risk assessment needed for individual projects, in turn lowering the individual costs of financing those projects (economies of series). This highlights the importance of defining clear, realistic and sustainable renewable energy and energy access targets in the laws and policy documents covering their implementation. It also shows to what

extent Federal Member States may benefit from applying the Federal Government of Somalia's objectives and regulations, in turn lowering their own funding costs.

Information. As stated earlier, information costs will also affect funding, although a number of specific, low-cost measures can help reduce these costs:

- **A national database that includes all anticipated national projects and needs.** This database should include geographical data and all known technical information (*e.g.* population, uses and applications, and land characteristics) so that resources can be efficiently exploited. All projected energy uses, including those planned for by development projects in health, agriculture, rural development and other sectors, could be publicised in a similar way to allow common energy approaches for dissimilar uses. Updated and consolidated data will need to be collected through household surveys and censuses, which may employ innovative techniques in areas affected by insecurity. The government has already initiated geographic information system (GIS) mapping and tools for renewables with Sweden's support, and for project mapping with support from the United Nations Development Programme; these instruments need to be updated and reinforced.
- **Renewable energy resource database.** In a similar vein, all renewable energy resource data should be collected in a centralised, publicly available database to reduce information costs.
- The government could create a **national energy donor co-ordination body** to help co-ordinate IFIs' energy-related interventions. For example, the MoEWR could convene a bi-annual meeting of donors to facilitate co-funded projects and collaboration across priority areas. A co-ordination body of this type has been an important facilitator of interventions in countries where it has been applied (*e.g.* in Tunisia under the name of BATTERIE).

2.6 Possible fiscal and financial measures

Some targeted fiscal and financial measures may be needed to boost investments in sustainable technologies.

Credit enhancement/incentives

- Somalia could, in collaboration with the major IFIs in the country, envisage the creation of "*credit lines*" for funding specific types of renewable energy projects with similar characteristics (*e.g.* a "credit line" for diversifying electricity production from ESPs to include renewable energy production). The United Nations Industrial Development Organisation (UNIDO) and United Nations Development Programme (UNDP) have been working on these issues with specific programmes, while the European Commission/European Union has launched a GET.invest programme to bridge the gap between developers and local companies. The programme helps investment projects become bankable and links project developers and companies with financiers. However, a specific national programme in this area may help encourage investments in the field.
- *Micro-credit* programmes should also be initiated within existing financial institutions to facilitate investments in renewable energy and access to energy services for rural households. Micro-financing for solar pumping in rural areas could contribute to the development of subsistence agriculture while encouraging the development of rural agricultural production for national consumption. Financing of this type could also help fund the local distribution of efficient technologies in rural areas.

Risk mitigation

- *Risk mitigation guarantees* and financial instruments could be implemented for easy provision of local debt for national projects using IFI funding. This could help boost local debt funding from national financial institutions while reducing the cost of capital. An instrument of this type can also be renewed and help reduce overall government outlays because guarantees can be transferred to new projects once previous projects have been finalised.

Fiscal measures

- Specific *tax breaks* could be implemented for public interest technology imports and subsistence farming technologies. Solar panels, solar pumps, wind turbines and related balance-of-system technologies could be exonerated from import taxes in recognition of their public benefits. Their impact on public finances will have to carefully considered to avoid undue financial stress.
- *Specific taxes* could be used to penalise more polluting technologies (*e.g.* urban charcoal use), while other taxes on high-value-added sectors (*e.g.* telecommunications) could advance public sector objectives (*e.g.* energy access) that can be used to sustain business models. Without national sources of funding for areas such as energy access, it will be more difficult to mobilise funding.

Two other specific interventions should be planned to facilitate the funding of national objectives:

- Capacity building and training could facilitate funding from national private financial institutions for renewables and energy efficiency projects.
- The implementation of a *national utility* will facilitate state financing for projects (based on sovereign guarantees) and support large-scale transmission and generation projects of national interest, at a lower financing cost.

2.7 Critical mineral reserves

Somalia is rich in mineral reserves but few have been explored to date; and economically feasible and proven reserves have yet to be measured. Somalia's mining sector represents a huge opportunity for foreign investors.

Policies

- The Federal Government of Somalia has prepared a *draft mining policy* acknowledging the mining sector's importance. The policy should be finalised and adopted to clarify the country's goals, and could include mandatory renewable energy content for locally produced electricity and energy efficiency measures.
- A *mining code* should also be developed and adopted to clarify exploration rules. A mining code was adopted in 1984, but it is not publicly available or seemingly used.

Market development

Beyond the specific policies and codes that are indispensable to developing the sector, the government might consider the following points:

- A coalition of IFIs interested in supporting the sector's development could help define and fund first steps to promote the market. Key steps could include organising initial *geological surveys and site assessments for critical material resources* that are yet to be extracted.
- Based on these early assessments, *more detailed studies of economically viable critical minerals* could be launched with IFI funding.
- Blocs for mineral exploration and exploration for mining could then be defined and auctioned to kick-start the market.
- While the mining sector is being developed, it is important to build local capacity to refine and process critical minerals.

2.8 Institutional landscape and capacity gaps

Somalia has re-established its institutions after years of instability. Although much has been done to create and define the necessary institutional framework to help the country re-develop its infrastructure and market, significant further action is required.

a. Institutional gaps and capacity building

Somalia has already identified major institutional gaps in guiding documents such as the Electricity Act:

- **MoEWR.** The ministry may envisage creating a specific unit within its Department of Energy to address energy efficiency, energy access and biomass/bioenergy – with the capacity to address these priority sectors. The ministry should also strengthen its information collection capacity within the departments of policy, planning, and monitoring and evaluation, as well as provide further training on data collection quality and the related GIS databases. Department-wide capacity-building actions are needed to help the Department of Energy meet the emerging challenge of new market developments. This could include planning more exchanges with regional actors to collect best practices from neighbouring countries and regional institutions such as the East Africa Center of Excellence for Renewable Energy and Energy Efficiency (EACREEE), the Eastern Africa Power Pool (EAPP), the Intergovernmental Authority for Development (IGAD), the Common Market for Eastern and Southern Africa (COMESA), the East African Community and the League of Arab States. The MoEWR could also collaborate with the Ministry of Mines to help reinforce mining resource assessment, and the policy, strategy and regulatory structure for developing critical materials.
- **The regulatory authority** needs to be able to build up its staff and capacity. It still needs to *define and implement a regulatory framework*, for example, for electricity production licenses, and grid connection and market rules (IPPs and PPAs), including possible mandates for renewable energy production. Electricity production licenses should be a top priority since they will mobilise financing to at least partly fund the institution. Grid connection (including the use of SCADAs and remote control by the utility), IPP statutes and PPA contracts should follow closely to properly regulate the sector. Robust capacity-building programmes should also be initiated to help train and assist the necessary staff.

- The envisaged **Rural Electrification Agency** may benefit from a slight re-definition of its mandate to become the Rural Energy Access Agency – in order to better meet the needs of rural populations. The agency's mandate and governing laws should be determined promptly to allow its creation and empowerment. The agency's creation would allow the definition of more specific rural energy access targets. Partial funding for this agency could be raised through an electricity production/energy service provision license for rural areas.
- The **Somalia National Renewable Energy Agency** (SNREA), not yet established, would promote the development of renewable energy resources. The SNREA could provide much-needed assistance in mapping renewable resources and promoting renewable energy technologies and competencies throughout the institutions in individual states. The agency could also be in charge of testing imported technologies and components for their performance, and for setting performance standards for all related technologies. Sustainable financing sources for the SNREA should be identified and the necessary capacity-building actions taken.
- The **national utility**, acting as the transmission system operator (TSO) and a large-scale generation project developer and operator, has been defined in the Electricity Act but remains to be created and capacitated. The utility will be key in integrating existing ESPs into the network in collaboration with the regulatory authority. It is also crucial in the construction of projects of national interest. Robust capacity building will also be necessary to help the national utility perform its role as the TSO, collect and manage data from IPP SCADA systems and remote control projects to disconnect and reconnect them to and from the network during maintenance and management.
- **Multi-sectoral energy body.** A multi-sectoral energy body re-uniting representatives from all concerned line ministries (including agriculture, education, health and mining) could be created. This structure could help identify, integrate and co-ordinate individual territories' energy needs and address them efficiently. This would enable benefits due to economies of scale and series and ensure greater ease of maintenance and project sustainability. Similar bodies have been created in the context of water management within Somalia; they could be used as an example.
- **Donor co-ordination body.** Although IFIs are increasingly co-ordinating their actions and building co-funded programmes, Somalia can contribute significantly in this effort by organising regular exchanges for donor co-ordination for energy-related programmes. This low-cost but highly effective strategy can help make on-the-ground interventions more efficient. Bi-annual meetings are sufficient to help co-ordinate and integrate interventions and have shown great success in other developing countries. Donor co-ordination is already being used for the water sector. Future energy co-ordination could use this experience while accounting for the necessary increased workload to maximise the efficiency of additional co-ordination efforts.

All these actions – be they at the ministry, regulatory or agency level – should be documented, publicised and shared with Federal Member States for them to develop their own capacities and markets in compatible ways. This trickle-down effect will also help cement the relation between the federal government and member states, while ensuring a more homogeneous market to lower risks and costs of investment.

2.9 Human resource and skill development

Human resource and skill development through education and training may be a critical contributor to Somalia's sustainable energy transition while capturing maximum benefits in employment and local value addition. They would benefit Somalia's youth-weighted population pyramid by enabling it to grab employment opportunities, while ensuring the creation of qualified jobs.

- Somalia could shape a national *strategy for education and training* in co-operation with local actors. Some of these actors have already organised themselves within the SomaliREN research and education network, while the MoEWR has helped establish a national TVET (technical and vocational education and training) centre and a Solar Technology Application Resources Centre (STAR-C) to assist in training, testing and knowledge management. These actors can help ensure that the measures taken are applicable. The participants of the validation workshop highlighted how current technical training does not meet demand, while the creation of a national strategy could help clarify and quantify future training needs and help with planning.
- Within this training strategy, the government could mandate that all *training sessions and materials* prepared for individual projects be made *publicly available* for additional training. Often the training materials used in training sessions organised under development projects are considered proprietary information, and training cannot be extended to subsequent recipients once the initial participants have completed it. In the case of Somalia, when possible, extra effort should be made regarding "training the trainers" to ensure the training continues to benefit people, and is adapted to local needs and constraints.
- Somalia could create and implement a *national training infrastructure* along with the means and strategy to maintain it. It could develop and maintain technical platforms within major research and education centres to ensure modern, up-to-date equipment can be accessed. These shared platforms could also aid in research as well as testing and certification. The cost to maintain the shared resources would be manageable, and the platforms would facilitate participative financing from multiple sources.
- Somalia could rationalise and mandate training and qualification levels for specific roles in the energy field. Qualifications should be based on existing international certification levels, and the certifications could be formalised in collaboration with existing global training institutions. An effort should also be made to make these certifications regionally compatible with neighbouring countries. The validation workshop participants highlighted a need to mandate training certifications and qualifications for each level of intervention in project development, management, maintenance and financing so as to verify that qualified workers are carrying out these roles. This was specifically highlighted during the workshop since an effort is being made to ensure the engineers, technicians and legal parties involved in the building sector have the requisite qualifications. Workshop experts affirmed that the standardisation of qualifications and training could make or break the market itself.

2.10 Research, development and standardisation

Somalia already has an organised network for research and education – SomaliREN, which it can build upon.

- The country could *support and develop existing national research and development networks* and co-operation mechanisms, giving them an opportunity to participate in the definition, development and use of technical platforms.
- The country could mandate national standards, norms and equipment testing by leveraging the existing research network. It could ensure alignment with the International Electrotechnical Commission/International Organisation for Standardisation (IEC/ISO), while building the necessary technical platforms for recognising equipment testing and approval. Some of these testing facilities could be shared with neighbouring and regional partners to share the burden of testing and platform maintenance.
- Somalia could identify roles and actions to be undertaken by the research community that can support national objectives (*e.g.* the definition and testing of solar kits and specific technologies adapted to Somalia's needs).
- These actions could help ensure the existing training and testing platforms are fully utilised, and help fund the community partially.

2.11 Bolstering national infrastructure on land and sea

While the complete degradation of Somalia's infrastructure network, due to years of instability, poses a constraint, it allows the complete rethinking of network needs, opening the way for the most efficient solutions to meet the country's needs:

- In a "back to basics" approach, Somalia must now inter-connect existing islanded networks with more efficient transmission/distribution networks, including in urban areas. A key to the success of this first phase of inter-connection will be the *definition and enforcement of electricity market rules* by the regulatory authority and the physical connection of existing networks by the national utility.
- Studies for the creation of a *national transmission infrastructure* have already been carried out, and follow-up prefeasibility studies for these inter-connections are being implemented. However, until the national utility is created and operationalised, these projects will have nowhere to be housed.
- Once this national transmission network has been initiated, *regional inter-connection projects* that have been envisaged with neighbouring countries will become feasible. Within a context of increased domestic renewables-based production, these regional inter-connections will be crucial in maintaining network stability. The regional inter-connection projects have a double advantage: they allow sharing physical infrastructure and production means while encouraging regional political collaboration in a region still exposed to tensions between countries. Although not a panacea, this will open lines of communication and co-ordination between countries in a politically fraught environment.
- Last, but not least, the implementation of envisaged large-scale regional renewable projects will help reduce the cost of electricity provision throughout the region.

2.12 Renewable energy resources

Although Somalia has abundant renewable energy resources, few have been measured and quantified. Somalia could rapidly initiate the measurement of these resources and the creation of publicly available resource atlases. Atlases for solar and wind – the most common and well-distributed renewable energy resources – should be prioritised, with biomass and bioenergy coming a close second. Hydro resources have already been partially studied for irrigation and drinking purposes, although these studies would have to be updated to include hydropower potential. There is also a great, albeit more local, potential for geothermal energy. Studies in this area could help identify potential sources for on-demand, base power production, which could significantly contribute to stabilising the country's electricity provision. Resources, needs and potential projects could be integrated into a GIS database. The data stored in this database will make domestic energy production and distribution more efficient.

As a specific measure to help develop an information base for renewable resources in the country, the MoEWR should mandate the sharing of resource information from all existing renewable power plants and pilot projects. All renewables-based power production plants have measuring stations to compare production to resource availability to measure plant performance, and SCADA systems to track plant production and performance. Data collected from weather stations installed by the MoEWR's Department of Hydro Meteorology should also be exploited. These existing data can be a treasure trove for collecting information on resource availability with little if no additional investment. To do so, the MoEWR would have to create a specific unit to collect and collate these data within a common, publicly available GIS-based database.

3 Action plan

Table 1 outlines the parameters of key recommended actions, including their justification, detailed descriptions, important partners, proposed time frame and critical success factors.

The action plan can be divided into three phases: a first phase addressing the most immediate short-term needs (Priority 1), which can condition the choice of follow-up actions; a second phase addressing short-term needs (Priority 2) to create the capacity to implement and fund actions; and, finally, a third phase including "medium-term" (Priority 3) actions, which will depend on the short-term needs under Priorities 1 and 2 and help Somalia advance its development into the next century.

Table 1 **Action plan**

Areas of action	Actions	Subactions	Priority	Institutions	Enterprises	International organisations (prospective)
Strengthen the institutional structures and governance in energy	Create, within the MoEWR, sections addressing energy access, bioenergy and energy efficiency, plus a section handling data collection and dissemination		1	MoEWR		
	Create a national energy donor co-ordination mechanism to help co-ordinate IFIs' interventions in the field and increase the efficacy of on-the-ground interventions		1	MoEWR		Proposal submitted by UNDP Somalia secretariat; all energy-related IFIs
	Create a multisectoral energy transition co-ordination committee to reunite representatives from all concerned line ministries relevant to the energy transition in order to identify, integrate and co-ordinate all energy needs by territory		2	MoEWR, all line ministries (*e.g.* agriculture, education and environment)		
	Create a coalition of partners, including IFIs, interested in supporting the development of the mining sector for critical minerals and material resources relevant to the energy transition, and launch a detailed study of economically viable critical mineral sources in the country		3	MoEWR		World Bank, AfDB, *etc.*
	Reinforce the regulatory agency, the National Electricity Authority (through staffing and funding), to give it the capacity to define and implement future regulations		1	MoEWR, NEA		
	Implement a national utility to ease ESPs' integration into the transmission network, finalise transmission projects and initiate large-scale national and transnational renewable energy projects	The national utility will be the transmission system operator and the integrator of ESP networks.	1	MoEWR, NEA		
	Create and operationalise a rural electrification agency that could become the Rural Energy Agency (REA)	• Identify possible sources of local fund-raising to complement possible IFI funding • Finalise and implement energy access institutions and interaction among stakeholders	2	MoEWR, REA		

Areas of action	Actions	Subactions	Priority	Institutions	Enterprises	International organisations (prospective)
Strengthen the institutional structures and governance in energy	Create a Somalia Renewable Energy Agency (SREA) with a clear set of mandates for the promotion of renewable energy	Among other priorities, help to map resources and maintain a GIS database	3	MoEWR, SREA		
	Rationalise and mandate training and qualification levels for specific roles in the energy field to verify quality and level of expertise (training certifications and qualifications)		2	MoEWR		
Improve the planning, policy and regulatory frameworks for renewable energy	Update and reinforce a GIS database (to be compatible and cross-referenced)	Collect updated, consolidated and standardised data on development needs based on household surveys, censuses and innovative data collection methods for areas affected by security issues (sizing the market for energy access)—ongoing UNDP project mapping exercise to be updated	1	MoEWR		Potential Norwegian Agency for Development Cooperation project/ assistance on GIS reinforcement, formulation and training
		Collect data on renewable energy sources – an ongoing project with Swedish support, to be updated and developed	1	MoEWR, REA		Swedish International Development Cooperation Agency
		Collect data from the SCADA systems of individual power plants for future use and integration by the utility	2	MoEWR, NEA, national utility, SNREA		
	Create a national database on all ongoing and planned national energy projects and needs		2	MoEWR, NEA, national utility, REA		
	Create a centralised, publicly available database to store data on renewable energy resources (reducing information-related costs)	• Mandate the sharing of energy resource measurement data from all national renewable energy plants (solar/wind) • Launch studies to assess, quantify and characterise biomass, hydro and geothermal resources	2	MoEWR, SREA		
	Collect standardised data for all new building construction		1	MoEWR, municipalities		

Areas of action	Actions	Subactions	Priority	Institutions	Enterprises	International organisations (prospective)
Improve the planning, policy and regulatory frameworks for renewable energy	Create an energy transition plan that includes renewable energy targets (using the National Renewable Energy Access Plan) and energy efficiency targets (using the NEEAP as a basis)	Renewables: • Set clear, realistic targets for renewables' penetration and integration in on- and off-grid electricity production for system operators; also set clear, realistic targets for on-grid production and industrial off-grid production for industry and services Energy efficiency. Use the NEEAP as a basis to: • Define concrete targets and assess and implement potential energy efficiency measures for lighting, refrigeration and air-conditioning • Clarify national targets and goals for new building construction: – Initially encourage voluntary compliance and then mandate renewable solutions, solar heating and cooling, electricity production, *etc.* – Use locally available building materials when applicable • Mandate energy efficiency measures in industry	2	MoEWR, SREA		
	Create an energy access plan to define time-bound energy access goals and targets	• Help to quantify the needs and size of the future market • Mandate minimum percentages of renewable energy • Define strategies and policies to address the current unsustainable use of biomass: • Sustainable biomass alternatives, biogas, electric and solar cooking • Possible taxation of unsustainable urban charcoal use to help fund modern cooking solutions for urban and rural uses	2	MoEWR, REA		

Areas of action	Actions	Subactions	Priority	Institutions	Enterprises	International organisations (prospective)
Develop policy instruments and implement initiatives to promote renewables and energy efficiency	Operationalise the existing regulatory authority (priority actions/funding)	• Define and implement electricity production licenses for all power producers (from the utility-to-be to ESPs and off-grid generation) to initiate funding sources for the energy regulatory agency • Mandate the collection of information from power plant SCADA systems and the necessary instruments to remotely de-couple and reconnect from and to the grid, respectively	1	MoEWR, NEA, national utility		
		• Define a framework for independent power producers and power purchase agreements) • Define and implement technical standards for power plant integration and interconnection, in co-ordination with the national utility • Define standards and codes for all electricity production technologies to be connected to the grid	2	MoEWR, NEA, national utility	Nationally present ESPs and IPPs	World Bank, AfDB, United States Agency for International Development
	Develop technical standards and codes for energy technologies and devices for providing rural energy access		3	MoEWR, REA, SNREA, SomaliREN	Nationally present ESPs and IPPs	
	Develop technical codes and standards for alternative cooking solutions (ensuring sufficient quality of the materials and solutions provided)		3	MoEWR, REA, SNREA, SomaliREN	Jinko	
	Mandate self-generation for renewable energy projects for the industry and service sectors and the use of solar (solar water heaters and photovoltaics) for households at a subsequent stage		3	MoEWR, SNREA, industry associations		
	Promulgate and enforce a building permit obligation and the associated energy performance building codes and ensure necessary effective and efficient enforcement and compliance mechanisms are in place		3	MoEWR		

Areas of action	Actions	Subactions	Priority	Institutions	Enterprises	International organisations (prospective)
Promote the use of renewable energy	Participate in the finalisation of the draft mining policy and mining code to clarify the country's goals and ensure the draft policy and code include the framework conditions for extraction, refinement and local value addition for the mineral resources critical to the energy transition. Mandate renewable energy targets for on- and off-grid production.		2	MoEWR, Ministry of Petroleum and Mineral Resources	Industry associations	Related IFIs
	Utility	Inter-connect existing urban electricity networks	2	MoEWR, NEA, national utility		
		Finalise feasibility and implement initial national transmission network projects	2	MoEWR, national utility		Related IFIs
		Launch feasibility studies, develop financial and business arrangements, and initiate the envisaged regional interconnection projects	3	MoEWR, national utility		World Bank, AfDB
	Transportation	Set up pilot projects to explore the use of straight vegetable oil and biodiesel from recycled vegetable oil	2	MoEWR, SNREA, SomaliREN		
		Set up pilot projects for electric vehicles within captive vehicle fleets (public transportation, taxis, freight vehicles and vehicles for captive rural uses)	2	MoEWR, SNREA, SomaliREN		
		Study and implement pilot projects for third- and fourth-generation biofuels and synthetic fuels	3	MoEWR, Ministry of Agriculture, SNREA, SomaliREN		
		Explore the feasibility of producing hydrogen for export markets, based on the export infrastructure – to allow initial limited domestic industrial use – before exploring more advanced transport solutions	3	MoEWR, SREA, SomaliREN		

Areas of action	Actions	Subactions	Priority	Institutions	Enterprises	International organisations (prospective)
Foster investment in renewable energy technologies	Implement credit lines within local banks with IFIs' participation		2	MoEWR, Ministry of Finance	Banking associations	United Nations Industrial Development Organisation, UNDP with specific programmes, the European Commission/ European Union GET. invest
	Implement specific taxes on polluting technologies such as urban charcoal use		2	MoEWR		
	Study the potential for establishing country and off-taker risk-mitigation products, including guarantees to facilitate local debt provision for national energy projects		3	MoEWR	Banking associations	IFIs
	Design, capitalise on and implement local micro-credit programmes through domestic banking systems for energy access projects such as solar water pumping		3	MoEWR, Ministry of Agriculture, REA	Banking associations	
	Study potential tax breaks for public interest technology imports and sustenance technologies		3	MoEWR		
	Study the potential for taxes on high-value-added sectors (*e.g.*, telecommunications) to help fund energy access solutions and business models		3	MoEWR, related ministries		

Areas of action	Actions	Subactions	Priority	Institutions	Enterprises	International organisations (prospective)
Reinforce the continuous creation of institutional and human capacities	Assess and measure skills gaps and training needs for the public and private sectors in the energy field		1	MoEWR		Potential UNDP project to help measure, quantify and qualify training needs
	Shape a global strategy for education and training in co-operation with local actors (*e.g.*, SomaliREN and TVET) to assist in training, testing and knowledge management		2	MoEWR, Ministry of Education	TVET centres	
	Mandate that electronic training sessions and materials prepared for individual donor-supported projects be made publicly available for additional training of trainers and subsequent training		2	MoEWR		
	Benefit from international organisations' assistance of capacity-building programmes and certification frameworks and facilities		2	MoEWR, SomaliREN		Potential UNDP consultant assistance for certifications and partnerships with Nordic institutions
	Provide capacity building and training for private and public domestic banks and financial institutions		2	MoEWR, Ministry of Finance		
	Provide research and training	Create and implement a national training infrastructure platform (physical and virtual) to develop skills for energy transition–related jobs	3	MoEWR, SomaliREN	TVET centres	
		Use the equipment on the training platform to test imported equipment and materials, or locally assembled kits and solutions adapted to the country's needs (*e.g.* solar kits and pumps) collaboratively with national research and development stakeholders	3	MoEWR, SomaliREN		

Areas of action	Actions	Subactions	Priority	Institutions	Enterprises	International organisations (prospective)
Energy Compact on Renewable Energy for UN peacekeeping	Support national-level dialogue and enhance co-ordinated actions on challenges, gaps and opportunities for scaling up renewable energy deployments	Develop a country-level work plan to help realise the Energy Compact and planned projects	1	MoEWR, supporting countries and partners under the Energy Compact	Private sector	UN bodies, IRENA
	Develop and realise a project pipeline to improve access to clean energy to UN bodies and local communities	Provide de-risking instruments and also utilise access to technical assistance, project development and facilitation and financing, including in terms of concessions, for renewable energy projects in fragile settings (IRENA, 2023c)	1			IRENA: Energy Transition Accelerator Financing and Climate Investment Platform IFIs
	Promote collaboration to develop and create, as appropriate, supporting policies and enabling conditions for UN peacekeeping missions and humanitarian operations to procure renewable energy from the local market while creating further benefits for the host community in terms of access to energy services (IRENA, 2023b)	Exchange knowledge and best practices on priority issues pertaining to renewable energy deployment under the Energy Compact, including but not limited to, financing mechanisms, supporting policies and regulations, delivery models and efficient and transparent procurement processes (IRENA, 2023c)	2	MoEWR, supporting countries and partners under the Energy Compact		UN bodies, IRENA

Note: AfDB = African Development Bank; ESP = energy service provider; GIS = Geographic Information System; IFI = international financial institution; IPP = independent power producer; IRENA = International Renewable Energy Agency; MoEWR = Ministry of Energy and Water Resources; NEA = National Electricity Authority; NEEAP = National Energy Efficiency Action Plan; REA = Rural Energy Agency; SCADA = Supervisory Control and Data Acquisition; SNREA = Somalia National Renewable Energy Agency; SomaliREN = Somali Research and Education Network; SREA = Somalia Renewable Energy Agency; TVET = technical and vocational education and training; UN = United Nations; UNDP = United Nations Development Programme.

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