Powering Progress:
The Potential of Renewable Energy in Somalia

a Research Report by

Jami Nelson Nuñez

February 2015

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Cover Images (clockwise from left)**:** Shuraako, Golis Energy Household and Commercial Products; SECCCO Energy, Solar street lighting; SECCCO Energy, Qardho Hospital Solar Panels; Claudia Schwartz, Electrical lines in Somaliland; Golis Energy, Constructing Wind Turbines

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Abstract

One of the most critical issues for economic growth and stability in Somalia is affordable access to electricity. This report describes the evolving landscape of energy in the country and outlines the burden of limited electricity services and extremely high tariffs on households, businesses, and the environment. The current situation impedes the creation of new businesses and undermines investments in the country. This research explores the viability of and prospects for renewable energy to alleviate the multifaceted energy-related problems hindering Somalia. The paper concludes with four areas where change is necessary in order to foster more momentum in the renewable energy sector.

Executive Summary

Somalia is at a threshold. Emerging from a winter of conflict and instability, the country is at a point where security and growth will continue to take root given the right support for economic recovery and improved governance. To move Somalia past this threshold, more affordable and reliable access to electricity is needed. This report aims to draw attention to the compounding problems associated with energy in Somalia. The majority of people living in rural and peri-urban areas have no access to electricity. Those with access in urban areas are paying some of the highest tariffs in the world for limited and sometimes unreliable services. The burden of such high costs is borne by businesses, which must curtail their productivity due to electricity costs and in some cases consider moving operations to other countries with more affordable electricity services. The strain of limited and expensive electricity is also felt by households, health facilities, and schools. A major casualty of the problem is continued deforestation as people continue to use charcoal from Somalia forests for cooking needs.

No investment can pay social, environmental, and economic dividends like improvements in electricity services would in Somalia. As it has in other countries, more affordable electricity would have a strong economic multiplier effect, increasing agricultural and manufacturing productivity and creating opportunities for the emergence of new businesses. Access to affordable, reliable electricity improves critical public services, such as powering health clinics, hospitals, and schools, and can increase household incomes by reducing time and money directed at procuring cooking fuels. It would also help to alleviate the crushing burden of charcoal consumption on environmental resources in the country.

This research report argues that renewable energy is one of the best ways to ameliorate energy-related problems in Somalia. Investments in renewable energy have increased exponentially across the world as costs of renewable technologies decrease and focused efforts on sustainability create opportunities for investments. Somalia is particularly well endowed in wind and solar energy resources: the country has the highest potential of any African country for onshore wind power and one of the highest rates of daily total solar radiation in the world. As the costs of renewable energy products have come down in the last few years, renewable energy systems have become competitive against fossil fuel options.

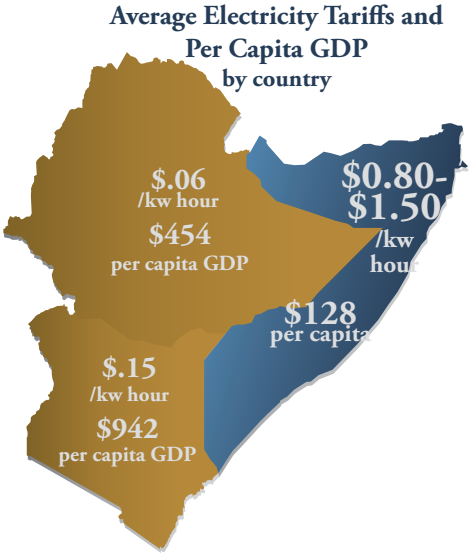
The report aims to demonstrate to entrepreneurs, investors, civil society practitioners, and politicians that renewable energy is not only a solution but a viable investment opportunity. Several developments in the last three years have primed the energy sector in Somalia for investments in renewable energy. These include a vibrant private sector, particularly in electricity and renewable energy, a growing number of successful renewable energy projects that demonstrate feasibility and stimulate further demand, and greater government support.

Finally, the report outlines four steps that should be taken to foster more investment in renewable energy. The first of these recommendations is to focus on building governance structures for the energy sector, including creating energy laws, regulatory bodies, and frameworks for PPPs (public-private partnerships) to ensure transparent and competitive processes. Second, an effort must be made to increase the technical capacity in the country to design, build, and maintain renewable energy infrastructure. The third recommendation is to focus on smaller renewable energy projects and products, such as microgrids and households and commercial products, as they are the most viable and productive investments in the short term. Lastly, the report explores the steps that should be taken in the short term to establish the necessary foundation for larger renewable energy infrastructure in the future.

Section 1: Introduction

Beyond the conflict and instability that have stolen headlines in Somalia for decades, quiet, stalwart progress driven by the private sector has kept the country afloat. Now, given the right support, a thriving business sector in Somalia is poised to help consolidate political and economic stability. An impediment to such progress is the amount of affordable energy to power it. With Somalia's decimated grid infrastructure from decades of conflict and disrepair, their generation of electricity is among the least efficient and most costly in the world.

Somalia suffers from three major problems related to broad-based electrification: lack of access, extremely high costs, and low reliability. Only a small minority of households and businesses in the country have access to electricity.[a] Reliable statistical information about the energy situation throughout Somalia is unavailable as very few surveys have been conducted in the country in the last few years.[b] While the World Bank estimates that 29.1 percent of the population of Somalia has access to electricity, the more recent evaluation from the 2014 African Energy Outlook estimates that less than a quarter of the population has the privilege of electricity.[1]



These estimates obscure a major rural-urban divide. Electricity in rural areas is nearly nonexistent. In urban areas, it varies significantly across the country. Recent estimates for Mogadishu and Hargeisa are 60 percent and 68 percent of the population, respectively, while smaller cities, like Merka, have only 23 percent connected to electrical services.[c] In areas with higher numbers of internally displaced people who are harder to track, the estimates of the proportion with access to electricity are probably overstated.

While these percentages, particularly in Mogadishu and Hargeisa, are actually higher than comparable cities in sub-Saharan Africa, the electricity to which businesses and households have "access" is problematic. The primary issue is that electricity tariffs are among the highest in the world, varying from $0.80 to $1.50 per kilowatt hour.[2]

Comparatively, the neighboring countries of Kenya and Ethiopia enjoy average rates of $0.15 and $0.06, respectively.[3] Not only are Somalis paying substantially higher tariffs for electricity, but they are also earning substantially less. The GDP per capita estimate for Somalia is $128, a fraction of the GDP per capita of $454 in Ethiopia and $942 in Kenya.[4] Somali citizens live in one of the poorest countries in the world and pay one of the highest tariffs for electricity of any country.

The variation in electricity tariffs within Somalia is explained by location and differential pricing by energy providers. People in locations that are far from urban centers typically pay the most in energy costs.[5] Within cities, tariffs fluctuate across different providers and providers do not necessarily use a uniform rate among their own customers. The lack of transparency and predictability creates problems for users as well as suppliers who compete in the sector.

a. The definitions of "access to electricity" vary; while some refer to access as a connection to a grid, this report defines access as the ability of households or businesses to use electricity in their home or workplace, which could entail connection to a grid or could entail access to power from an independent or standalone power source.

b. Data of most kinds are scarce for Somalia where even reliable GDP estimates have been difficult to ascertain. This report includes several statistical facts that we cite with as much diligence about their validity as possible given the lack of data about the country. All statistics cited should therefore be used cautiously.

c. The *Somaliland Energy Policy* (2010) lists the urban average in the region at 68 percent. In the World Bank paper "Addressing the Electricity Access Gap" coverage for the country is estimated to be 57.5 percent on average in urban areas.

The other issue with electrical supply is its extreme unreliability. Shortages and outages plague the networks due to the limitations of the existing infrastructure. Solutions for electricity transmission and distribution have been improvised without regulation or standards, often without professional technical training. These ad hoc systems lead to inefficiencies, which contribute to substantial losses—as high as 40 percent—during energy production and delivery to end-users.[6]

The problems of pricing, unreliability, and limited access explain why the consumption of electricity in Somalia is among the lowest in the world. The estimate of net consumption of electricity from 2012 was 288.3 million kilowatt hours, placing Somalia in the bottom quintile in the world.[7] Considering consumption per capita paints a direr picture. Somalia's 28.7 kW hour use per capita is a mere 1 percent of the world average (2,798 kWh), half that of Ethiopia's usage (57 kWh) and only 19 percent of Kenya's usage (153 kWh).[8]

Section 2: The Weight of Energy Deficiencies in Somalia

The energy deficit burden in Somalia that stems from high costs and limited access weighs heavily on the economy, the environment, and the provision of basic services. While electricity has the potential to transform Somalia, without prompt and substantial change or investment in the sector, it will continue to be a constraining factor for further development and impede opportunities for growth.

Constraints to the Economy

The high cost of and limited access to electricity have serious economic implications. Across developing countries, the penalty of electrical outages and unreliable service on productivity leads to a substantial aggregate effect on economies.[9] The unreliable electrical supply in Africa can cost an average of 1 to 2 percent of GDP per year, as businesses are forced to shut down operations when the power goes out.[10] As with many fragile and conflict-affected states, in Somalia, electricity is provided by private entrepreneurs who use diesel-powered generation systems that are commonly used or refurbished—a reflection of what is available rather than technically optimal. Ultimately, dependence on such diesel-run systems increases the economic toll of unreliable services to as much as 4 percent of GDP.[11]

The tariffs that Somali businesses pay are among the highest in the world, which makes the high costs of electricity in Somalia perhaps more serious than problems stemming from reliability. This fact impedes the development of new businesses and threatens the thriving business development that has already occurred. The high cost of electricity devours Somali business margins at such a high rate that to remain competitive, production costs must be offset in disproportionately lower raw material or labor costs. Imports are produced more cheaply simply because overhead costs are lower abroad.

These challenges have forced businesses to cut back on local production and consider relocating to neighboring countries like Ethiopia, where large scale hydroelectric and other lower cost and efficient energy generation is a reality.[d] When businesses do close or relocate, the loss not only impacts the economy in the short term, but failures also scare current and future investors. In an analysis of foreign investment in fragile and conflict-affected states, Whyte and Griffin argue that "the most cost-effective way to generate new flows of FDI may be to encourage established investors to expand, deepen, or diversify their operations."[12] Somalia risks losing such investors if the high costs of electricity are not addressed. A recent evaluation of the USAID Partnership for Economic Growth program confirms this concern.[13] It posits that investment in manufacturing will not be likely for several years given the costs of electricity. The report therefore suggests that USAID focus on other sectors for the near future.

d. The survival of businesses is a major concern. Somaliland's National Industry Association found that 39 of the 54 small and medium registered enterprises failed. See the *Somaliland Investment Guide*, also cited by Schwartz (2014).

The need for affordable electricity is especially salient for fragile and conflict-affected states. For example, in Uganda, electricity access was seen as the greatest impediment to investment in the early years of recovery.[14] This experience is echoed in the World Bank Enterprise Surveys, which find that electricity is identified by businesses within fragile and conflict-affected states as the primary obstacle they face. Electricity even surpassed concerns with political stability and corruption.[15]

Investing in electricity presents opportunity for new and existing businesses and can have a strong economic multiplier effect. In developing countries, electricity access has increased agricultural and manufacturing productivity.[16] Increasing access to affordable electricity can create opportunities for the creation of new businesses. Empirical evidence in South Africa, for example, shows that new access to electricity led to the creation of small, medium, and micro enterprises.[17] Access to lighting in Somalia would extend the working day, allowing for the increase of household productivity and the ability of households to commit more time to home-based businesses.

> ***"As a manufacturing company, we use machines and equipment in processing our products. We must have our own electric generators and there is no efficient and reliable public or private electric provider to the Somaliland industrial sector. If your own generators fail or break down, you lose your production. To minimize that risk, you need to buy at least 3 generators working and standby. You could avoid this investment if there were reliable electric companies."***
>
> ***—Ahmed M. Elmi, owner of Zamzam Bakery***

Improving electricity access and affordability will help the country address poverty through increasing household incomes. Although it is difficult to know the size of the effect of electricity on development, a growing number of studies in developing countries uphold the axiom that electricity increases household incomes. For example, a 2002 World Bank study in the Philippines calculated that electricity access increased household income by $81–$150 per month dependent on the number of household wage earners and the level of economic activity in the home.[18] Similarly, a 2009 study in Bangladesh found that electricity access caused a 12.2 percent increase in household income.[19] In 2005, the UNDP (United Nations Development Programme) found that across villages in Mali electrification led to a $0.32 increase in daily income and raised the annual average income of women by $68.[20] The improvement in household income in turn affects poverty, as has been shown in Tanzania where electricity access reduced household poverty between 4 and 13 percent.[21]

Damage to the Environment

Without affordable or reliable access to electricity, Somalis continue to rely on biomass for basic needs, which has serious environmental ramifications for the country. Biomass, the primary source of cooking fuel even for those with access to electricity, accounts for 96 percent of energy sources in the country.[22] Biomass comprises an array of organic fuels including wood, charcoal, and agricultural and animal waste. In Somalia, charcoal remains the primary fuel as electricity or alternative fuels remain uncompetitive, which has led to compounding environmental, economic, and public health problems.[23]

An estimated 2 million bags of charcoal are consumed in Somalia each year, contributing to the devastation of local forests.[24] Overexploitation from domestic charcoal use and illegal exports has reduced forest cover in Somalia from an estimated 60 percent in 1985 to 10 percent in 2001, a stunning reduction that continues at an increasing rate.[25] This deforestation is causing desertification, a process that cuts deeply into the economic prospects for agriculture and ranching industries in the country and is already related to the occurrence of recent famines.[26] At the same time, costs for charcoal have more than quadrupled

since 2007, cutting into the incomes of Somalis, sometimes eating up more than half of households' monthly income.[27] Moreover, the use of charcoal poses significant health risks for families as it is related to child pneumonia, pulmonary disease, and lung cancer.[28] The World Health Organization estimates that indoor pollution–related deaths in Somalia exceed 11,000 per year.[29]

The charcoal dependency has also become intertwined with political stability. Al-Shabaab, one of the threats to political stability and recovery, has capitalized on charcoal exports to the Middle East, helping to bring in $25 million per year to fund its activities, despite a United Nations ban on the trade of Somali charcoal.[30] While the majority of charcoal production is likely related to illegal exports, the production that is related to domestic use is still substantial and addressing energy needs would significantly slow deforestation. The mix of legal and illicit harvesting of charcoal makes enforcement of the ban even less feasible and heightens the need to find alternative fuels for Somali consumption.

Strains on Effective Service Provision

Electricity supports an array of services, including education and health, which are critical for development. For education, electricity can extend the hours students have to study and give students and teachers access to the Internet and experience with computers, leading to tangible differences in educational outcomes. In Nepal, for instance, the extension of electricity services to communities improved literacy rates by 11 percent.[31]

Investing in electricity will also improve public health. Hospitals and health clinics need electricity for lighting in the night, vaccine refrigeration, surgeries, and pumping water. Many vaccines, like the one for polio, require refrigeration and the lack of electricity access in clinics makes national vaccination efforts more difficult. Currently in Somalia, only half of the few clinics that are capable of conducting surgeries have access to electricity.[32] Those that do have electricity struggle with unreliability, with power going off in the middle of surgeries and other procedures. Hospitals that do have electricity are paying very high premiums that cut into their ability to serve the public. For example, prior to the installation of solar photovoltaic (PV) panels at the hospital in Burao, the hospital paid $6,000 per month for electricity.[33]

Electricity is also critical for security services, most directly by lighting streets at night. In Senegal, street lighting brought communities to life after dark, making streets safer for citizens for more hours of the day.[34] Many Somali cities, including Mogadishu, Bal'ad, Jowhar, Kismayo, and Galkayo have newly installed solar street lighting due to support from the Nordic International Support (NIS) Foundation.[35] News coverage of the new lighting in Mogadishu showed how new lighting led crowds of people to be on the streets at night where few had felt safe to go in prior years.[36]

Electricity is both a problem that holds Somalia back and a key opportunity for growth. The current challenges of electricity's high costs and limited access curtail the ability of the country to attract foreign investment, discourage the creation of new businesses, and eat into incomes and business profits. Conversely, expanding energy access in the country could relieve pressure on natural resources, vastly improve services and conditions throughout the country, and increase the productivity and competitiveness of Somali businesses.

There are several ways to address energy poverty and energy-related problems in Somalia. The use of cleaner, more efficient cook stoves, for example, can help decrease charcoal use. Alternative fuels, such as liquefied petroleum gas, also present an important avenue for ameliorating energy problems. Additionally, the possibility of obtaining electricity from Ethiopia's hydroelectric generation is being explored by Somaliland and the World Bank. While these possibilities are essential steps for the country, this report specifically focuses on renewable energy sources as an answer to energy problems in the country due to space limitations as well as an interest in the growing investment opportunities presented by renewables. The next section lays out a map of the current electricity sector in order to understand the drivers of the energy deficit in Somalia.

Section 3: The Landscape of Electricity Provision in Somalia

The energy sector in Somalia has many features common to countries in or emerging from conflict. The most common supply of electricity in such contexts is a decentralized, private supply of energy using relatively small generators.[37] As in Somalia, small, private energy providers have thrived in Lebanon, Cambodia, and Sri Lanka. Larger energy utilities that are the norm in more stable countries are vulnerable in conflicts for two reasons. First, large generators and unified grids are usually public and suffer during conflicts from the diversion of public funds to military spending. Second, consolidated energy markets usually have fewer generators that are located farther from consumers. These are easy targets for groups engaged in the fighting, which can make the entire electrical system vulnerable to disruption.

Small private service providers, conversely, are "robust to circumstances."[38] They hold many advantages that make them adaptable to contexts immersed in or emerging out of conflict. First, they are local, which enables them to more fluidly navigate local dynamics and risks. Second, they can mobilize quickly, typically drawing on private funding, such as diaspora support.[39] The difficulties in getting support for rebuilding large infrastructure projects leave a market for small private actors, even if their services are inefficient and significantly expensive given the lack of economies of scale and the use of outdated and poorly engineered systems. This service provision arrangement also privileges those who can afford high rates for electricity, leaving out the poor and those most affected by conflict.

The conflict in Somalia has taken a particular toll on electrical infrastructure in urban areas.[40] Due to looting and other destruction, the civil war destroyed preexisting infrastructure in most urban areas, which used to be supplied by government-owned power generation plants within unified distribution grids. Repairs and investment in new electrical infrastructure have been undermined by ongoing instability and limited government capacity.

In the absence of government-provided electricity services, several small independent power providers (IPPs) stepped in to address the dearth of electricity by creating small power generation companies. Many of these IPPs entered the sector because they needed access to electricity to run their own businesses, such as telecom companies.[41] Once generators were installed, they began to provide electricity as a business for surrounding households.

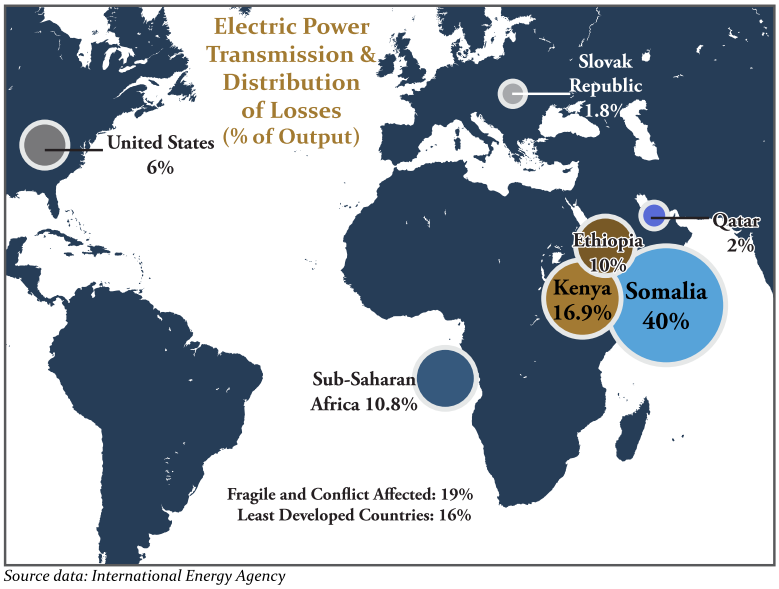
Claudia Schwartz, Electrical lines in Somaliland

The ad hoc nature of private energy services has led to a highly fragmented, nearly fully private electricity sector throughout the country. The sector is essentially unregulated by government, which has to this point lacked the technical capacity and resources to regulate energy service providers. Moreover, sufficient energy laws and electricity service provision regulations are lacking.

Because there are no registries for IPPs, it is difficult to estimate the number of IPPs or their generating capacity. While some cities have only one service provider, many have multiple IPPs vying for customers in cities. Consolidation of IPPs is an ongoing trend, particularly in Somaliland. For example, Hargeisa used to have several IPPs but many have recently merged to form two companies. The size of IPPs varies, with some having grown to the scale of medium-sized utilities generating 5 megawatts, while others generate small amounts of electricity and service a limited set of households or businesses.

In the majority of cases, IPPs rather than the government own the grid. For example, in Somaliland, the grid is owned by IPPs in Borama, Wajaale, Gabiley, Hargeisa, and Burao. In Berbera, Tayo Energy entered into a public-private partnership agreement with the Somaliland government to run the government owned electric company and grid. Each with its own generator and the majority with their own grids,

interconnection between IPP networks is rare. Instead, in many cities of Somalia, multiple distribution lines for various providers hang from electrical poles throughout the city. Because there is no standard or regulation by government, these transmission lines are often unsafe and have electrocuted energy company personnel and bystanders.[42]



Source data: International Energy Agency

Most IPPs use diesel generators that are refurbished and purchased from Dubai. One of the few studies surveying the electricity sector in Somaliland found that only 13 percent of the generators in Somaliland were purchased as brand new.[43] Because the current generators run by IPPs are outdated, they are highly inefficient. Moreover the quality of the distribution systems is quite low. These systems lead to a loss of power that is incomprehensible for more developed areas of the world. In Somaliland, for example, power losses are on average 25 percent, with some IPPs losing more than 40 percent.[44] This is nearly four times higher than the average rate of loss across African countries and even twice the average rate of loss among fragile and conflict-affected countries around the world.[45] When generators break down, IPPs are faced with the cost of sending the equipment back to Dubai to be repaired or, in some circumstances, paying the costs of a visit from a technician from Dubai.[46]

The inefficiencies stem not only from aging equipment but also from the lack of monitoring equipment and expertise. Operators need more technical know-how to be able to understand load estimations and how to optimize systems. Many IPPS are not sure of how much electricity they are generating because their systems do not have motor controllers.[47] Metering electricity usage is impossible for most IPPs so instead they charge for the number of lightbulbs or other appliances in use. Vendors in Hargeisa pay around $10 each month to light a 100-watt light bulb.[48] This provides little incentive for end-users to reduce their use of bulbs and appliances or buy more energy-efficient products, contributing to overall energy inefficiency and driving up electricity costs.[49]

The lack of interconnection between generators also contributes to high prices, inefficiency, and low reliability. Currently, in cities with multiple IPPs, electricity is supplied on multiple networks, referred to as a "radial" system.[50] This drives up costs because providers are unable to achieve efficiencies of scale and because the systems are unable to offset electricity production against each other. To connect the existing generators would require significant investment in infrastructure and research, such as a synchronization facility for each generator, and system stability studies.[51] Not only are these steps expensive, but they would require consolidation or cooperation among IPPs that is currently lacking in many cities.

The production of electricity relies almost solely on imported diesel fuel, an environmentally dirty fuel, which contributes to the uncertainty of access to electricity and unpredictable costs given the extreme fluctuations in diesel prices in the country. According to the GIZ International Fuel Prices Database, the compound annual growth rate of diesel costs in Somalia from 2002 to 2008 was 24 percent, rising from $0.29 per liter to $1.15 over that short time period. The Somaliland government estimates that more than 100,000 liters of diesel fuel is burned daily in Somaliland. The cost of fuel is estimated to eat up 60 to 65 percent of IPPs' revenues.[52] The rising price of diesel has made it increasingly difficult for IPPs to operate at a profit, a struggle that is exacerbated by theft through illegal connections that are hard to identify given the state of the infrastructure.

The burden of high prices, felt by both consumers and providers, exacerbates the public perception of profiteering in the context of a massively inefficient delivery system.

The investment and effort of IPPs has filled a critical service gap in Somalia. While IPPs are frowned upon by some international infrastructure experts due to their inefficiencies and potential to create powerful monopolies, they continue to be necessary service providers in the context of Somalia. In the past, research and policy have supported efforts to create public-private partnerships (PPPs) and large-scale public sector–led projects that create economies of scale. More recently, scholars and energy experts are acknowledging the role of IPPs and exploring new models that support IPPs, at least in the short term, leaving open the possibility that they could continue in the long term as well.

Focusing on smaller microgrid solutions holds more promise than it has in the past.e Operating on the premise that the development of electrical infrastructure should mirror that of countries that have established efficient systems overlooks new possibilities that would allow countries like Somalia to "leapfrog" past the developmental milestones achieved in more industrialized countries. Like the telecom industry using cellular communication, enhancing local microgrid delivery can bring communities online faster and help develop governance and other infrastructure necessary for larger, more consolidated projects in the future.

Despite the stagnation in the last few years and ongoing issues with private energy providers relying on diesel generators, the current landscape of the energy sector is becoming more dynamic and responding to these problems. An important step is the consolidation of and cooperation among IPPs, which can make distribution more efficient and achieve better economies of scale. Policy and regulation can encourage systemic consolidation and cooperation, but in the continuing vacuum of policy and enforcement, some consolidation and cooperation are already naturally occurring. The grid in Hargeisa, for example, is now largely controlled by two consolidated energy entities: General Electric and Alel Power Company. As another example, Burao's IPPs recently merged into Heco Electric Supply Company. The risk with consolidation, however, is the downward pressure on competition as control of the electricity provision lands in the hands of a few powerful players. There is already concern for some that IPPs can behave as cartels, stifling the development of new energy projects and stalling the implementation of policies.[53]

Some IPPs are investing in modifying existing systems to make them more efficient. Replacing old generators with newer ones and modifying generators to enable them to use cheaper fuels could decrease losses and pave the way for lower tariffs. Such renewal and renovation is already helping to address the inefficiencies of IPPs in Somaliland.[54]

Lastly, the interest in renewable energy options is growing. Renewable sources could be added to the mix of energy production for IPPs, offsetting the drawbacks of diesel-based systems. As an example, Aloog Energy in Borama, with support from the Somaliland Business Fund, has invested in wind turbines to supplement their diesel generators. Investing in off-grid or renewable energy products that do not require a grid is another approach. In fact, renewable energy sources offer a wide spectrum of options that could benefit Somalis, from solar lightbulbs bringing lighting to those without access to electricity, to larger-scale renewable energy projects that can bring modern energy to smaller towns and allow facilities, such as airports and schools, to operate on lower-cost, sustainable sources. The following sections of this report explore this particular avenue for change.

e. Microgrids are systems that include energy generation, transmission, and distribution to multiple users. They can vary in their characteristics, sometimes connecting into larger grids and other times operating like isolated islands, as they do for most IPPs in Somalia. Microgrids can be used in a variety of contexts, such as systems that are used as backup generators when electricity provision is unreliable, to rural villages like mini-utilities. For a good explanation of microgrids, see the following blog by Marilyn Walker at HOMER Energy: http://microgridnews.com/microgrid-categories-quality-standards-training-capacity-building/.

Section 4: Renewable Energy as a Viable Solution

Growth in renewable energy has been slower than renewable enthusiasts would have predicted twenty years ago. Carbon-based energy has a foothold in markets around the world and has historically offered quicker returns on investments. Across the world, and especially in Africa, however, there is a change afoot. According to the Renewable Energy Policy Network for the 21st Century, investments in renewable energy in 2012 and 2013 were greater than the previous eight years combined for the Africa and Middle East region.[55] In the case of Somalia, renewable energy presents a way to address the current energy deficiencies and related problems in the country. Renewables are a particularly lucrative option for the country given their abundance, the increasing affordability of renewable products, and the fact that a market for renewable energy has already been established in the country.[56]

Abundance of Renewable Energy Sources in Somalia

Somalia is particularly well endowed in wind and solar energy resources. According to an analysis by Mukasa and colleagues for the African Development Bank Group (AfDB), the country has the highest potential of any African country for onshore wind power.[57] A recent World Bank document asserts that the potential of onshore and offshore wind power in Somalia along with tidal and wave power on the Somaliland coast could generate more power potential in the long term than the hydropower potential of Ethiopia.[58]

Somalia is a generally windy country and although wind speeds vary seasonally, according to Abdilahi et al., who draw on data from NASA, wind speeds are sufficiently strong throughout the year to support wind-generated energy.[59] A commonly cited statistic is that half of the country has wind speeds greater than 6 meters per second, which are excellent for electric energy production. More feasibility studies are needed to confirm these claims. One such advance is the effort to build four wind-monitoring stations in Somaliland, which were installed in different cities of Somaliland with support of USAID's Partnership for Economic Growth. The data generated by these monitors are available online.[60]

Solar energy is also a viable option throughout the country. Somalia gets on average 2,900 to 3,100 hours per year of sunlight.[61] It has one of the highest daily averages of total solar radiation in the world.[62] The yearly average solar radiation for Hargeisa is 6.4 kWh/m2/day.[63] Furthermore, the average yearly temperature in the country is 27 °C, a reasonable temperature to permit a satisfactory operation life of solar PV systems.[64]

While there are other renewable energy options that could be pursued, such as bioenergy or hydroelectric plants, the plentiful resources of the wind and sun in the country are currently the most viable pursuits. Only one hydroelectric plant exists in the country. It was built in Fenole in the south with a capacity of 4.6 MW but it is not currently working. The generation of power at the plant was reportedly unreliable due to seasonal low flows of the Jubba River but this information is difficult to validate.[65] Prior to 1989, there was an attempt to build a hydroelectric dam at Bardhere but these efforts came to a halt with the outbreak of conflict and were complicated by discussions with the upstream country, Ethiopia.[66]

Given its proximity to the Rift Valley, geothermal may be another option. Unfortunately, very little data on geothermal options for Somalia exist. One study from 1982 posits that Somalia has the potential of 52 MW of energy from geothermal sources.[67] This is clearly an area that merits further research but is too underexplored for further analysis in this report.

Increasing Affordability of Renewable Energy Options

Wind and solar energy sources are not only plentiful in Somalia but they are also becoming a more financially attractive option. Renewable energy options have come down in cost in the last few years.[68] Due to a number of factors, including improvements in efficiency from technology and falling financing costs from reduced

risk perceptions, prices for PV modules fell by more than half from 2008 to 2011 and projections of future prices are optimistic given the potential for further technological advancements.[69] Globally, for some microgrid options, the levelized cost of energy for diesel became equivalent to the levelized cost of solar PV in 2011.f Global prices for wind turbines have also declined since a peak in 2008.[70] Falling costs of renewable energy imports in Somalia have followed the global trend.[71]

Few studies simulating the comparative costs of energy generation between diesel and renewables for Somalia exist. One helpful exception is a study produced recently by Abdilahi et al. using HOMER software to compare diesel-based systems to hybrid diesel, wind, and solar systems in Hargeisa. In their simulations, they find that diesel-based power systems are 1.5 times more expensive than hybrid systems that supplement diesel systems with wind and solar options.

The initial capital costs for diesel generators continue to be lower than wind- or solar-powered systems in Somalia but considering a longer-term investment horizon makes renewable energy options more competitive. The Somaliland government contends that the difference in net revenues between diesel and wind systems favors diesel from installation through the second year of operation but by the third year, favors wind by an increasing magnitude over each consecutive year.[72]

These comparisons make a strong case for wind and solar energy, and most experts suggest that depending on the quantity of energy in demand, the best use of renewables is in combination with diesel or other carbon-based fuel sources in order to maximize the benefits of each. Diesel can offset the variations in power supply from wind and solar, while wind and solar can significantly reduce the dependence on petroleum, which reduces energy suppliers' and clients' exposure to fluctuations in fuel prices, thereby increasing energy security.[73]

Conditions for Investment in Renewable Energy

Several advancements of conditions for investment in renewable energy have occurred in the last four years in Somalia. These include shifts in the private sector, particularly the energy sector, growing experience with renewable energy, and greater government support. This section explores these promising trends in detail.

A strong private sector. One key point about Somalia is that development in the country has been predominately achieved through private investment and entrepreneurism. Unlike some fragile and conflict-affected states, donor activity has been relatively limited. With regards to energy, the lack of a state monopoly on the energy sector allows Somalia to avoid the painful step of unbundling state monopolies on energy that many other countries in the region have faced.[74]

Growing demand and a track record of success. Another condition for investment is the wide range of opportunities for renewable energy products. In Somalia, there is a spectrum of possibilities for renewable energy, from large-scale renewable energy generation projects to individual solar-powered lights. At the most inexpensive end of the spectrum, small standalone solar products have made it into Somali markets. Good examples are solar lightbulbs, solar phone chargers, and solar stoves. There is ample

f. The levelized cost of electricity is a measure used to compare different generating technologies factoring in the per-kilowatt hour cost of capital costs, fuel, operations and maintenance costs, financing costs, and an assumed utilization rate. To arrive at specific comparisons of the levelized costs of diesel versus other renewable energy options, a number of factors need to be considered, such as the need for battery storage, the cost of connections into grids, local costs of materials and other inputs. The Renewable Energies for Remote Areas and Islands (REMOTE) report from 2012 includes a helpful discussion on this topic.

potential for these products given the lack of electricity in rural and peri-urban areas and the high costs of electricity in urban areas. Although the least expensive options often have short battery and device life, there are more suppliers and innovators in this solar product market than ever before. Examples are Divi Power, which has developed a pay-to-own system for small solar-powered products, and Nokero, which is producing higher quality solar products for households and businesses, such as lightbulbs and lighting for fishermen. The efforts to create markets for small solar devices are recognized in the REN21 2014 report as successful approaches in extending lighting and access to more modern forms of energy across the world.

Investment in larger renewable energy products in Somalia is also expanding, with a substantial number of projects completed in the last four years. Although some renewable projects larger than 250 kW have been attempted, the bulk of the investments have been focused on small projects like household installations. There are now more renewable energy companies that are selling standalone renewable energy products in the country that are suitable for organizations and households that can afford them. There are also a number of small-scale, wind-powered water pumps throughout Somalia for consumption and irrigation.[75]

Information about existing renewable energy projects is more readily available for Somaliland than other areas of the country. A survey conducted by the Adventist Development and Relief Agency (ADRA) in the region found that of 133 installations sampled of various kW capacity, the majority of systems were installed for households (59 percent); followed by institutions such as NGOs, health clinics and hospitals, and schools (29 percent); and businesses (12 percent).[76]

The table below shows a snapshot of the progress for renewable installations for 1.5 kW and above that has been made in the country. With these projects, awareness of renewable energy options is growing, creating more demand for renewable products.

Dynamic local partners. Several renewable energy companies have established themselves in the past four years and their expertise continues to grow with each project implemented. These companies provide local support and expertise to move forward with more systemic change and investment in the energy sector. Renewable energy organizations in Somaliland have initiated a renewable energy association, the Somaliland Renewable Energy Power Association, which aims to call attention to the renewable energy sector and further professionalize the sector.[77] Such associations can elevate the voice of renewable energy companies and enhance cooperation among them, which will in turn help reinforce these companies' sustainability and success.

Progress in updating the energy sector. Consolidation of IPPs has been significant, at least in Somaliland and Puntland (information on this in areas of South Central Somalia is limited). This consolidation will pave the way for more economies of scale. While the urban grids in Somalia are not currently sophisticated enough to allow the synchronization of multiple microgrid systems run by IPPs, there is movement to conduct feasibility studies to revamp cities to have one central grid. For example, DANIDA has met with IPPs in Borama to work on a master plan to fix the grids there and in other Somaliland cities.[78]

Greater government support. The growth of the renewable energy market is accompanied by interest on the part of Somali governments for development of the renewable energy sector. Investing in renewable energy is a part of the 2014–2015 Economic Recovery Plan produced by the Somali Federal Government. In Puntland, the government listed renewable energy as one of four key priorities for the economy in its 2014–2016 plan. In its five-year plan, the Puntland government outlines a target of a 20 percent increase in the use of solar and wind energy over five years.[79] The Somaliland government has progressed the furthest with some help from international organizations. It produced an energy policy in 2010 and has completed a policy dialogue series bringing together stakeholders to outline goals and shared concerns.

Examples of Renewable Energy Projects in Somalia			
Project	Onsite Organizations	Energy	kW
Borama Wind Turbines	Aloog Energy	Wind	900
Burao Wind Turbine	Beder Power	Wind	450
Erigavo Wind Turbines	EPCO	Wind	450
Las Anod Solar Farm	Golis Energy/ LASCO	Solar	250
Sheikh City Wind Farm	Beder Power	Wind/Solar	100
Egal International Airport in Hargeisa	Golis Energy/ General Electric/ Somaliland Government	Wind	100
Oog Wind Farm	Beder Power/Golis Energy	Wind	60
Aynabo Wind Turbines	Beder Power/Golis Energy	Wind	60
Berbera Regional Hospital	Golis Energy	Solar	60
Berbera City Wind Turbines	Golis Energy/ Tayo/ Government	Wind	60
Abaarso Tech outside of Hargeisa	Golis Energy	Wind	20
Qardho Hospital	SECCCO	Solar	18
Sheikh Referral Health Centre	Golis Energy	Solar	9
Abda Rural Health Clinic	Golis Energy	Solar	5
Godawayn Rural Health Clinic	Golis Energy	Solar	5
Dilla solar water pump	Golis Energy	Solar	5
Zeila solar water pump	Golis Energy	Solar	5

Section 5: Next Steps: Paving the Way for More

Renewable Energy Investments

The trailblazing projects in renewable energy in Somalia to date can help current and future investors and entrepreneurs address remaining issues that impede progress in the sector and the success of renewable energy projects. This section outlines four key areas where change is necessary in order to foster more momentum in the renewable energy sector, including addressing needed changes to governance, increasing technical capacity, focusing on smaller renewable energy projects, and taking steps to enable large renewable infrastructure projects in the future.

Filling the Governance Void

The most pressing problem for the electricity sector and investment in renewable energy is the lack of governance. While this is an understandable gap given the country's long experience with conflict and instability, the path ahead for more prosperity and development requires greater cooperation and clarity of rules, regulation, and plans for the future.

As mentioned earlier, renewable energy and the electricity problems in Somalia are clearly on the radar of government. Renewables appear in development and recovery plans for Somaliland, Puntland, and the Somali Federal Government. Somaliland has further developed an energy policy that is based on extensive research conducted by ADRA through the Somalia Energy and Livelihoods Project supported by the European Commission. Following the project, USAID, collaborating with local partners at DAI, facilitated a series of policy dialogues, convening government, IPPs, and other stakeholders in the energy sector to develop an energy law and electricity regulations through deliberative processes. This process helped bring together diverse perspectives and enhance communication about needs and future possibilities between IPPs and the government. This experience can serve as a model for Puntland and South Central Somalia.

The product of this effort in Somaliland is now a bill that has stalled in its passing as of the time of this report.g While the creation of the Somaliland Energy Policy and the energy dialogues have been significant steps forward, the lack of consensus and progress on passing the energy law could signal to investors the inability of government to commit to progress in the sector. Investing in infrastructure is a concern in post-conflict areas where such investments have been viewed as potentially exacerbating conflict with injections of resources that can raise tensions among groups.[80] Therefore, it is critical for the various Somali governments to prioritize the establishment of laws and regulations to assuage such concerns.

The lack of clarity resulting from the void in energy laws and regulation will continue to stymy progress in the energy sector throughout the country. Without clear governmental policy and regulation, international investors deem involvement in Somalia a riskier prospect. Moreover, if and when renewable energy projects that have attracted donor support or foreign direct investment run into problems related to the lack of clear laws and regulation, these setbacks could scare off future financial support to the sector.

Laws and regulations can help clarify relations and the rules for conducting business, and reduce investment risk for local investors as well. For example, if the government sets forth a plan and regulations about the standards of equipment or procedures in place, IPPs and other investors will be affected. Such changes can alter the costs of planned projects and potentially shape current investments if companies have to change in order to comply with new laws.

One outstanding question will be the space for smaller IPPs. While consolidation is naturally occurring, the uncertainty about market share in the future shapes investment decisions today. For example, a 2011 report on energy needs in Somalia issued by the EU suggests that private operators should be forced to form a privately managed company based on shareholding.[81] Smaller companies may find the uncertainty around such possibilities a deterrent to investing in renewable energy options to supplement their diesel-based systems.

Energy laws can also pave the way for more investment by modifying taxes on renewable imports. Currently, in Somaliland, large renewable energy components coming through the ports are taxed at the same rate as large diesel generator imports.[82] As such, there is no tax incentive to invest in renewable options. Tariffs are generally set by number of items coming in (rather than size) as long as they do not exceed certain sizes, which large wind turbines inevitably would, for example.[83]

A further step is to create as much predictability about the future as can be possible in Somalia. Throughout Africa, there is an ongoing effort to create cross-border regional power-sharing networks. One looming possibility for Somalia is the option of connecting to Ethiopia's hydroelectric power, which would dramatically

g. Previous reports, such as the *Mid-Term Performance Evaluation of the USAID Somalia Partnership for Economic Growth* published in July 2014, report that passage of the bill is imminent. Based on interviews with IPPs and government officials, there is clearly interest in passing the law and pressure from IPPs and renewable energy companies so passage may indeed be likely in the near future.

reduce tariffs, but a feasibility study is imperative to clarify the costs and steps involved in such a large infrastructure project. Another regional possibility that would make renewable energy investments more lucrative is the Africa Clean Energy Corridor, an "initiative to promote the accelerated deployment of renewable energy in the countries of Eastern and Southern Africa power pools."[84] This effort, spearheaded by the International Renewable Energy Agency (IRENA), provides support for member countries to plan and carry out integrated connections and create enabling conditions for renewable energy investments. Though Somalia is not currently a member, joining these international efforts and partaking in the dialogue are important while they plan to participate in the program as the energy sector in Somalia improves.

The steps to transition from the existing systems to a long-term vision of efficiency and abundant electricity for the country are unclear. A central overarching strategy as to how the government and electricity providers will cooperate and coordinate to deliver a master-planned system would help clarify horizons for investment, reduce risk, and increase interest in investing in the sector. The stakeholders in the energy sector should strive to create a secretariat to help devise a master plan and steer the sector toward the long-term goals it outlines.

Developing strong institutional frameworks will likely be an arduous process for Somalia. Yet, experience from across the world indicates that major progress in renewable energy investments necessitates stable, clear institutional frameworks. For example, in Mongolia 130,000 wind turbine systems of 200 to 1,000 watts were in operation as of early 2013. This progress is attributed to the strong legal frameworks in the country and a deep investment in a regulatory body, which have improved the energy sector in a short time frame.[85] For Somalia, solutions to current institutional deficiencies and enthusiasm for greater cooperation will not occur without serious effort and time. That said, the underlying necessity for established laws and strong regulation is of the highest priority in order to address the current electricity deficiencies and unlock the potential for a dramatic increase in reliable, sustainable energy generation.

SECCCO Energy, Qardho Hospital Solar Panels

Building Technical Capacity

Despite the growing base of renewable energy expertise from the projects executed in the last four years, the need for technical experts in Somalia remains. The call for training in renewable energy continues to surface in most assessments and reports about Somalia.[86] In several interviews for this report, stakeholders have expressed their concern, and sometimes even surprise, about the limited number of people available to design renewable energy systems and assess the feasibility of renewable energy projects.

One owner of a renewable energy company pointed out that there are few professionals in the country, who are mostly older people that were working in the sector before the Somali central government collapsed in 1990. Few other people have been trained locally, with some expertise coming in from Kenya and Uganda.[87] Many of the larger renewable energy projects in Somaliland have depended on the help of one Somali energy expert that is based in the United States.

Constraints from the lack of technical capacity have led to lag times in erecting and servicing renewable energy systems. One IPP, Aloog Energy, has been willing to invest in wind energy to supplement diesel generation. They have succeeded in procuring wind turbines from Germany but due to some issues with the parts on the products, they are in need of more advanced technical support to identify and fix the problems. The German company will charge exorbitant daily prices for sending an expert so the project is pending a solution to this lag in technical expertise.[88]

"We need to convert the potential to jump-start energy capacity in a short time period without having to build massive grid systems by tapping this God-given resource: renewables. Energy is available to the common man. There is a benefit in thinking small in terms of getting energy needs met."

—Hussein Abdi Dualeh, Somaliland Minister of Energy & Minerals.

A similar issue has delayed the use of energy from the large wind installation at the Egal International Airport in Hargeisa. The project, implemented by DAI and supported by USAID, aimed to demonstrate the potential of wind energy in Somalia. The turbines were successfully erected by Golis Energy and the PPP was developed to give ownership to the government and management to newly renamed General Electric, formerly known as Kaah Utility Company. To date, however, the turbines have yet to produce energy for any users. The turbines are functional but they are not connected to the grid for distribution due, at least in part, to technical issues in connecting to the grid. Relying on imported and sporadic technical expertise will continue to delay the benefits of renewable energy projects in the country even though demonstrable success in projects is critical for attracting investment.

Not only would an expansion of technical capacity ensure greater success in projects, it could also address other problems in Somalia, such as unemployment. Projects commissioned by international organizations, such as the installation of streetlights, have provided opportunities to hire and quickly train new young professionals. For example, the recent installation of 185 street lights in Galkayo city helped SECCCO, the company contracted for the installation supported by the Nordic International Support Foundation, to hire and train young people and expand the expertise of two newer professionals on staff.[89]

Efforts to create a training center have been made, but have yet to materialize. In 2012, the Somaliland Business Fund and the World Bank tried to create a renewable energy center for training and certification for wind and solar energy systems. The project to this point has faced several problems, including difficulty in attracting technical leaders.[90]

Rather than creating a training center, another approach is to embed training opportunities with existing renewable energy organizations or to establish training programs in collaboration with IPPs and renewable energy companies. This approach incorporates hands-on experience throughout training and ensures that graduates are guaranteed a job and can apply skills immediately. The curriculum is also more likely to match the exact needs of existing and planned renewable energy projects.

Starting Small

While a full spectrum of opportunities for renewable energy is present in Somalia, "starting small" is the best path ahead. Large infrastructure projects are most likely to make needed sweeping changes but several challenges must first be overcome to enable large-scale projects. Alternatively, the smaller end of the renewable energy spectrum, including household and commercial products and microgrids, is where the most demonstrable progress for the country has been made and where the most lucrative opportunities for smart investments are situated.

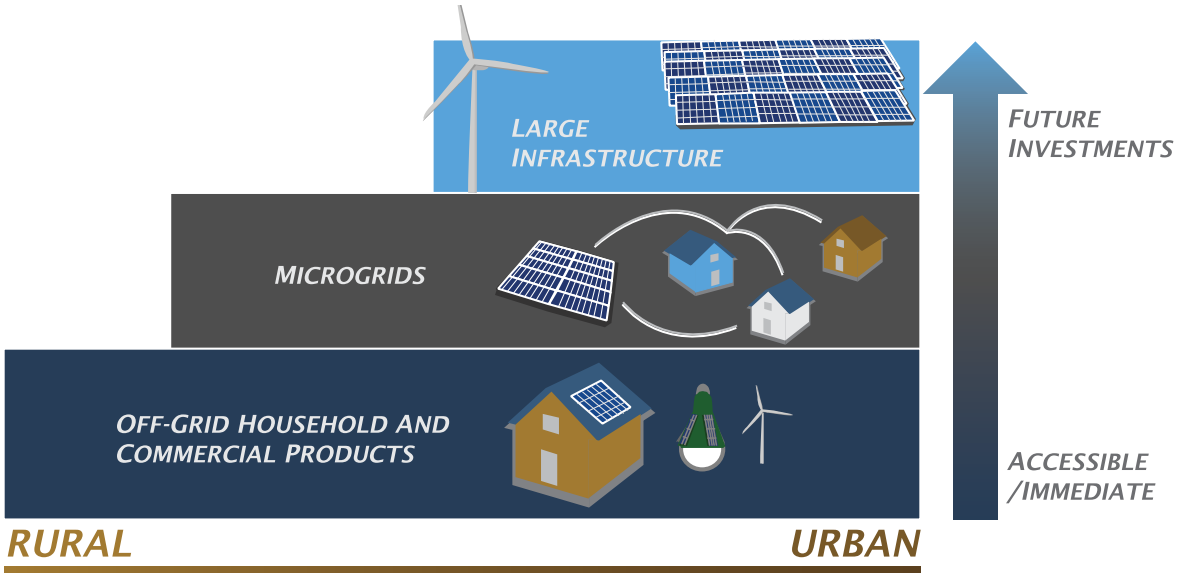
Household and Commercial Products. One of the most promising areas for investment is in renewable energy products for households and businesses. The options here vary from small products like solar lightbulbs to PV panels that power households or buildings without connecting to grids. An important step forward for increasing the use of these products is to develop options that reduce the initial capital costs of investment. This could be done either by supporting credit facilities through local financial institutions or by directly supporting renewable energy companies that would maintain a credit or payment option

for customers. Investments in financing for household and commercial products would have the dual outcome of supporting both renewable energy companies and less well-off households. There is already at least one successful example of this model provided by Golis Energy. When Golis Energy began offering a credit system for clients their sales increased by 40 percent within the first few months and they began to reach more female clients.[91]

Another approach is to finance energy companies to allow them to rent renewable equipment. There are some innovative technologies for small solar lights and appliances, such as DiviLight, that enable pay-as-you-go plans. The development of pay-as-you-go models may allow electricity to better mimic telecommunications, a sector that rebounds quickly in post-conflict areas precisely because of the ability of users to pay low upfront costs and enjoy high flexibility of paying for what they can afford on a variable basis.[92]

Microgrids. Microgrids are one of the most important areas to support for making tangible progress in the short term that is compatible with future investments. Microgrids can work in a number of environments. They are options for electrifying small towns and villages and they are options for urban environments where they can operate in an isolated fashion or connect to other microgrids or central grid systems.

Similar to household and commercial products, financial instruments to help IPPs and towns invest in renewable energy for microgrids by distributing the initial capital costs over an approximate five-year period can be both lucrative for investors and helpful in building momentum for energy access and use of renewable energy.[93] Investments in microgrids will not detract from future investments in unified grids as they can be connected to central grids as they are developed throughout the country. As a result, mixing renewable energy sources into microgrids can address immediate needs and fit into future systems.



Globally, microgrids have become one of the most dynamic and fastest growing renewable energy areas and investment in microgrids is projected to grow substantially by 2030.[94] In Somalia, microgrids and other small installations represent the best opportunity for improving electricity costs and supply, and indeed the most demonstrable progress to date. The smaller approaches are more versatile, robust, and likely to succeed. They represent a viable bottom-up approach, building a foundation for the country that is compatible with a long-term, more energy-efficient landscape.

Laying the Groundwork for Larger Renewable Infrastructure Projects in the Future

Many see large-scale infrastructure as ideal because it induces the greatest change on the quickest path possible. Yet, the current reality in Somalia is that many obstacles stand in the way of large projects. While larger infrastructure projects are the best way to make the most sweeping change, they require the most work in bringing together policy, technical capacity, and feasibility studies in order to attract sufficient financial support.

Obtaining financial support is the greatest obstacle for electricity infrastructure in developing countries generally. Yet, investment in infrastructure is particularly challenging for fragile and conflict-affected states.[95] There are several steps that could be taken now to get the country on a path that will be ready in the near future to attract investors to large renewable energy infrastructure projects.

First is the creation of transparent guidelines to help navigate PPPs. There is very little experience with PPPs in Somalia. Processes to ensure transparent decision making and competitive bidding are essential. Demonstrated success in creating fair, transparent, and successful PPPs in the short term will encourage investment in the future. Guidelines to ensure that PPPs are signed before projects are started can help to clarify responsibilities should projects encounter difficulties, such as connecting renewable installations to existing distribution grids.

Second, conducting feasibility studies on how to renovate and improve distribution grids and integrate renewable resources can address the ongoing shortage of actionable information needed for investment. Laying out plans for revamping the dilapidated distribution grids with associated costs can illuminate the steps needed to prepare the grids for more efficient arrangements in the future. When sizeable infrastructure investments become more likely, solid feasibility studies will help jump-start these projects.

Third, progress is needed in the areas of policy and regulation. Policy and regulation, as previously detailed, is the pivotal piece to enable investments in large-scale infrastructure because it sends signals to investors about the readiness of the country for large investments. Laws and regulatory bodies reduce risks for investors and minimize problems that can arise in projects. Large projects necessitate partnerships and are less likely to be demand-driven or initiated by local companies with capital for the project. As such, they demand clear policy frameworks to avoid miscommunications and structures to help navigate problems and breakdowns in partnerships.

Fourth, building technical capacity is necessary for bringing renewable energy to scale. According to Max Arte, a renewable energy specialist that has worked on several projects in Somaliland and other developing countries, as soon as projects move into the larger scales, they enter into an area that requires greater competency and more complexity in design, ordering parts, construction, and management.[96]

Lastly, larger projects are prone to supply chain issues. They run into problems with poor quality roads and limited access to heavy equipment. For example, the project to erect solar street lighting by Nordic International Support faced challenges in moving equipment to the recipient cities.[97] Wind projects in Somalia have also been significantly delayed due to access to cranes and equipment to move imported wind turbines from ports to project sites.

Ultimately, risks will continue to deter investment in large infrastructure. This dilemma is recognized by the international community and some efforts have been made at trying to bridge the infrastructure investment gap in fragile and conflict-affected states. For larger projects, infrastructure guarantees may represent one of the few mechanisms to usher in investment to Somalia. The World Bank recently released a synopsis of the challenges and possibilities for infrastructure guarantees in Somalia.[98] While such guarantees have

been rare in fragile and conflict-affected contexts, they represent an important mechanism for Somalia if the hurdles can be overcome. Some possible sources are Guarantco, a donor group that has created a guarantee facility for infrastructure support at local levels and the World Bank's Multilateral Investment Guarantee Agency (MIGA), which has provided guarantees to conflict-affected areas. MIGA has also created the Small Investment Program that targets investments needing insurance for up to $5 million.[99]

For energy projects of all magnitudes, there may be more funding sources available in the near future in Somalia as international organizations prioritize renewable energy across the world and as more organizations find tractable ways to engage in Somalia. For example, the AfDB has become more interested in renewables. It administers the Sustainable Energy Fund for Africa (SEFA) representing a potential source of financial support. It has funded projects including a $480,000-backed clean energy business plan competition in the Ivory Coast and $950,000 to develop a solar power plant in western Burkina Faso.[100] As part of SEFA, the AfDB very recently created the African Renewable Energy Fund (AREF) that aims to invest $200 million to support IPPs to invest in renewable sources of energy that are grid-connected.[101]

The World Bank has also become more committed to renewable energy. It initiated a Renewable Energy Mapping Program, backed with an $11.6 million initial budget, which seeks to provide localized data on renewable energy resources so that governments understand how to best allocate resources in the development of renewable energy. The World Bank also allocated $3.6 billion for renewable energy investment throughout the world in 2012, which was 44 percent of its energy financing and a 430 percent increase from the 2007 amount.[102] Similarly, the IFC is a funding source that is highly committed to renewable energy. In their fiscal year ending in June 2014, renewable energy projects accounted for more than 70 percent of their energy investments.[103]

Section 6: Conclusion

The durability and strength of the Somali recovery from over twenty years of conflict depends on the degree to which foundational elements of the economy and state can support economic expansion, investment, and the provision of basic services. Electricity is one such foundational element. With affordable access to electricity, businesses can expand productivity and compete in markets. Without affordable access, businesses will continue to be forced to curtail activities and face difficult decisions including closing and moving to other more amenable countries. Electricity is also a basic service that profoundly affects the productivity of households and the cost of living. Investments in the electricity sector can pay both social and economic dividends.

This report has particularly focused on the prospects of renewable energy to address the problems Somalia faces in regards to energy. Renewable energy is already a budding market in the country due to the plentiful endowments of wind and solar sources and the increasing affordability of renewable energy products.[104] It is an important tool to address the serious concerns of limited energy access, rapid deforestation related to charcoal use, and the high prices of electricity that are suffocating businesses and households.

The burgeoning number of renewable energy projects in the country provides important lessons for investors, governments, and entrepreneurs. First, they signal the viability of investments in renewable energy. Successful projects, such as the new wind farms in Oog and Aynabo, demonstrate the potential of renewable energy to transform communities in the country. Renewable energy can play a critical role in building manufacturing, supporting agricultural needs, and supplying the fishing industry with necessary refrigeration and lighting capacity.

Second, existing projects show that key challenges remain that if unaddressed will slow down progress and inhibit the strength of economic recovery in the country. As the report above outlines, policy and technical gaps exist that have proven difficult to circumvent for past projects. The most paramount issue around which broad-based collaboration and problem-solving are needed is that of the establishment of energy goals, laws, and regulatory capacity in the country. This will not only provide a signal for investors that the Somali energy sector is a more secure investment opportunity, but also address extreme inefficiencies in the current energy sector that merit attention. These include poor transmission and distribution systems that are unsafe and highly inefficient; the inability to monitor energy generation and use; and the social, financial, and infrastructural obstacles to synchronizing generators and grids.

The energy sector merits concerted funding efforts to support projects at all scales. Financing infrastructure is a challenge for all developing countries and is particularly difficult for fragile and conflict-affected states. Facilitating financing options for Somalia is especially critical for securing growth and recovery. Financing smaller, privately backed renewable initiatives merits as much or more attention as do large-scale infrastructure projects that typically garner more attention.

Building technical capacity is yet another challenge that lies ahead. The overall awareness of renewable energy and the hard skills to assess the feasibility of projects and design and maintain systems is lacking throughout the country. While developing a renewable energy training center may be helpful in this regard (a supply-side approach), a promising tactic that has been demonstrated by completed renewable projects is to focus on demand-driven training through renewable projects that require (and financially support) the hiring and training of new young professionals.

A major gap for progress in the country continues to be the lack of feasibility studies, assessments, and market studies about the specific costs and needs of transforming the existing electricity infrastructure and the possible demand for energy services into the future. It is clear that the existing infrastructure is deeply flawed

but the most technically efficient solutions to revamping the current systems need to be specified and explored. Support is needed in identifying the costs and steps for IPPs to begin incorporating renewable energy sources. These studies and assessments should provide additional opportunities for training and developing Somali technical capacity for renewable energy.

Finally, this report identifies important opportunities for investors and entrepreneurs in the energy sector. The opportunities include investing in smaller-scale projects that are more resilient and feasible given the country's weak infrastructure (such as cranes and roads), financing options, lack of strong institutional frameworks, and limited technical capacity. Smaller-scale projects could focus on investing in smaller cities that have little to no access to electricity and collaborating with IPPs to increase the mix of renewable energy in existing systems. There is clearly demand from households and businesses to invest in renewable options but the upfront capital costs continue to constrain development of this market. A viable option to support renewable energy development would therefore be to invest in mechanisms to allow customers to pay as they go and pay in installments.

Overall, the electricity sector, and renewable energy in particular, holds exceptional promise as an investment area that can simultaneously yield private and public returns. As the overall Somali economy develops over time, more Somali companies and households will need access to electricity, which underscores the huge potential of the market. Meanwhile, cheaper and more readily available electricity will support business growth, public services like health and education, and households. Addressing the challenges that constrain the energy sector, such as policy and regulation, are onerous tasks but such efforts will facilitate investment and promote economic growth and good governance in the country.

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