

Somalia: Energy Sector Needs Assessment and Action/Investment Programme

Draft Final Report: June 2015

Federal Government of Somalia and African Development Bank

TABLE OF CONTENTS

<i>Executive Summary</i>	<i>Pages 6-13</i>
<i>Chapter 1: Introduction and Background</i>	<i>Page 14</i>
1.1 Introduction	Page 14
1.2 Objectives/Scope	Page 16
1.3 Brief Description of Current Situation of the Energy Sector	Page 16
1.4 Sector Organization and policies	Page 17
1.5 Reliance on the private sector	Page 19
1.6 Main 4 issues facing Somalia's energy sector	Page 19
• Shortage, lack of qualified personnel.	
• Limited access to and supply of electric power,	
• Excessive exploitation of biomass,	
• Low penetration of modern energy, especially in rural areas.	
<i>Chapter 2: Situation of Main Energy Subsectors</i>	<i>Page 20</i>
2.1 Subsector: Biomass/Household Energy	Page 20
2.2 Subsector: Electric Power	Page 22
2.21 Tariffs	Page 25
2.22. How high are tariffs, really?	Page 25
2.23 Somaliland/Puntland	Page 25
2.24 Southern Somalia/Mogadiscio	Page 26
2.3 Subsector: Petroleum products	Page 27
2.4 Subsector: Renewable sources of energy	Page 28
2.5 Sector-wide issue: Qualified personnel constraint	Page 29
<i>Chapter 3:Recent Developments and Donor Assistance</i>	<i>Page 29</i>
3.1 Recent developments	Page 29
3.11 Areas of Southern Somalia	Page 29
3.12 Areas of Somaliland	Page 30
3.13 Areas of Puntland	Page 31
3.2 Donor Assistance to the Energy Sector	Page 32
3.21 Background	Page 32
3.22 Recently Completed or Ongoing Projects	Page 33
<i>Chapter 4: Presentation of Action/Investment Programme</i>	<i>Page 35</i>
4.1 Felt Needs	Page 35
4.2 Existing PPPs: de facto relationships	Page 36
4.3 Energy Programme Principles	Page 37
4.4 Size of Programme	Page 38

Chapter 5: Training and TA at Ministries of Energy or similar bodies **Page 39**

Chapter 6: Expansion of Access to Electric Power **Page 41**

- 6.1 *Power Projects: Organization & Finance* *Page 42*
6.2 *Establishment of Somali Electrification Institute* *Page 42*
6.3 *Hybrid Minigrids* *Page 44*

Chapter 7: Programme to Substitute Biomass Fuels **Page 45**

- 7.1 *The big picture about biomass fuels* *Page 45*
7.2 *Charcoal consumption now* *Page 48*
7.3 *Recommendations about fuel substitution* *Page 51*

Chapter 8: Off-grid modern energy supply to rural and nomadic communities **Page 51**

- 8.1 *Lighting Africa* *Page 51*

Chapter 9: Concluding remarks **Page 54**

- 9.1 *Programme Summary & time profile* *Page 55*
9.2 *Public lighting* *Page 56*
9.3 *Implementation strategy and methods* *Page 57*
9.4 *Somali risks and specificities* *Page 58*

ANNEXES

<u>ANNEX NUMBER</u>	<u>Page No.</u>	
ANNEX I	Action/Investment Programme by time period, 2016-18 & 2019-25	60
ANNEX II	Installed Capacity, Connections and Power/Connection	61
ANNEX III	Standard Electrification Costs: Scalable Model	64
ANNEX IV	SE4All Electrification standards	67
ANNEX V	Minigrid Policy & Tariff Options for Minigrids	68
ANNEX VI	Bibliography	69
ANNEX VII	Meetings and Interviews	70
ANNEX VIII	Two recent estimates of Somali Population	71

DRAFT

Somalia: Energy Sector Needs Assessment and Action/Investment Programme

Draft Final Report: June 2015

Federal Government of Somalia and African Development Bank

Prepared by Michel Del Buono, Ph.D., Sr. International Consultant.

This Report is based on two missions to Nairobi and Somalia between October and December 2014. It includes data on electricity generation and distribution collected by our late colleague and friend, Engineer Musse A. Abdi, formerly Energy Advisor to the Ministry of Energy and Water of the FGS. The Report is in its second version (Draft Final Report) and is expected to go into a third one (Final Report) by July 2015. It was drafted between December 2014 and May 2015.

Executive summary
Somalia Energy Sector Needs Assessment and Action/Investment Programme

Introduction.

Somalia has been without an effective central or federal government since 1991 when the Somali State, born at independence in 1960 from the merger of the British Protectorate of Somaliland and the UN Italian Trusteeship Territory of Somalia, collapsed. Somalia lived through a tumultuous history of initial democracy, followed by dictatorship, and the shifting alliances of the Cold War. Which was not so cold for Somalia, as it squabbled with most of its neighbours and fought one large, disastrous war against Ethiopia in 1977-78. Most recently, Somalia has entered a new phase of gradual peace-building and recovery, following a recent political transition. A new Parliament and a President have been elected, leading to international recognition of the Federal Government of Somalia (FGS). A new Constitution has been adopted and new institutions are being put in place. The prospects appear more favorable than they have been for some time in addressing the country's immense challenges for a return to peace and eventually development. However, the situation remains extremely fragile as the armed opposition (al Shabaab, affiliated to Al Qaeda) has withdrawn from many areas but has not been defeated. The FGS intends to continue the peace process, with the financial support of its New Deal development partners and the military support of the African Union forces.

Somalia joined a group of fragile/post conflict countries that were determined to change their relationship with donors and try to make commitments to reform in exchange for greater certainty in development assistance within the framework of the New Deal for Engagement in Fragile States. Somalia was one of the first countries to complete its documents and discuss them with donors. Its New Deal Compact was endorsed in a meeting in Brussels on 16 September 2013 between the Federal Government of Somalia (FGS) and International Development Partners. The Compact enumerates the critical priorities under the five Peace and State Building Goals (PSBGs) endorsed as part of the New Deal principles and also includes a Special Arrangement for Somaliland. The Federal Government has also developed a two-year Economic Recovery Plan 2014-2015, presented together with the Compact, contemplating total investment of \$661.7 million, of which the highest priority Flagship Programmes amount to \$221.9 million.

The Federal Government of Somalia (FGS) intends to play an increasingly important role in attracting foreign development assistance and private investment, and to assist and facilitate the obtention of external support for the emerging regional administrations that will form the federal structure, in addition to the better established areas of Puntland and Somaliland. While assistance is required in all sectors, infrastructure is particularly important, as it is the base of all productive and social activities, and energy is key among infrastructural sectors because it directly improves the standard of living of people (better lighting, household appliances), their security level, contributes to stabilization, and permits increases in productivity.

Somalia is faced with the complex and pressing challenges of state building and reconstruction in the absence of endogenous sources of public revenue, and with hardly any institutional capacity. In this context, a number of key issues will need to be addressed, including infrastructure, a proper environment for private sector investment, the role of the dynamic Somali Diaspora, and the creation of income generating activities and employment opportunities, especially for the young.

The Federal Government's ability to provide the basic public goods (that define what a government is and does) is severely limited, and so, Somalia has a government that is improving its capacity to govern, but should not be asked to take-on too many complex or delicate tasks, i.e. avoiding

"excessive premature load bearing". Further, the country is divided into entities, with some claiming to be regions within a Federal Somalia, and one, Somaliland, that claims to be independent of the Federal Government. Ensuring the coordination required to permit sizeable investments in energy will be a laborious task, as will ensuring ownership by communities and authorities. It would therefore seem that an approach that builds a programme from the ground up (i.e. from the Regions to the Federal whole) appears to be the easier one. In any case, a number of other Regional Administrations, which should form the building blocks of the forthcoming federal state, are currently taking form and being strengthened.

As for the energy sector, in spite of the serious problems it faces, private parties continue to invest their own capital in power supply, as well as in the import and distribution of petroleum fuels. Everywhere, in Mogadiscio, Hargeisa, Bosaaso, Berbera, in the North and South, one can find distribution of petroleum derivatives, such as automotive fuels (diesel, gasoline), kerosene, and LPG. There is also a consolidation of small electricity generators, which are grouping together to be able afford to the high investments necessary to offer state-of-the-art power supply services. This process should be encouraged to continue if access to sustainable power in cities is to move beyond the current 'lifeline' (unreliable, weak, poorly managed, technically deficient) kind of electricity supply. With rare exceptions (Berbera, and in part, Bosaaso and Qardo), the entire energy supply system, based almost entirely on diesel generation and minigrids, is owned and operated by the private sector.

Objectives/Scope

This Energy Sector Needs Assessment and Action/Investment Programme (henceforth, the Programme, or A/I Programme) intends to identify critical areas of short-term assistance to maintain, rehabilitate and/or develop basic energy infrastructure. It will also research capacity gaps that need to be remedied, and institutions/institutional arrangements that need to be strengthened and modified, to create a more conducive framework for firms/investors to meet current demand and reduce the existing pent-up, unsatisfied demand of consumers for both electricity and modern fuels. This short-term period will encompass the years 2016-18. The Assessment will then identify medium to long-term needs and associated investments, for a seven-year period, 2019-25. These two periods together (the short-term action plan, and the subsequent medium/longer-term plan) define the ten-year Action/Investment Programme. The overall Programme will include critical investments, as well as further short-term activities (e.g. training, capacity-building, or studies) required to identify/prepare additional, future projects/programmes.

Results/Outcomes

The Action/Investment Programme resulting from this Assessment has two main objectives:

- i) To ensure the sustainability of the fuel supply (especially household fuels) by reducing pressure on the biomass resources (vegetative cover) of Somalia and through substitution of modern fuels, kerosene and LPG, for biomass fuels; and,
- ii) To improve welfare, productivity, and security by expanding access to grid-supplied electricity in cities (based on hybrid power generation, i.e. conventional fuels and renewables, mainly SolarPV) and promoting non-grid, modern energy services and products to poor rural and nomadic people.

The reaching of these objectives will also require attention to skilled human resources and institutional capacities, both of which are also addressed.

- To this end, the programme to reduce use of biomass fuels would assist 700,000 households cut biomass fuel use, and help convert perhaps as many as 10,000 people from charcoal producers to social forestry workers, who would protect the forests, extract products from them (without

cutting trees), and, in due course, administer the stumpage fee when trees need to be cut (e.g. for timber or sustainable charcoal). This programme might help cut charcoal use by 1 million tons over 6-7 years, roughly a quarter of estimated current consumption, noticeably reducing pressure on the threatened, dwindling, slow-growing, and precious vegetative cover.

- The electric power supply expansion programme, over the ten-year period, would result in the installation of close to 200 MW of power generation capacity, of which 40-50 MWp of renewable energy (mainly SolarPV), the creation/repair of 18 city grids (regional capitals plus Mogadiscio and Hargeisa), and a pilot project consisting of 10 rural hybrid mini-grids. It also contemplates the electrification of as many as 20 other urban centers. The higher scale of generation and the vastly more efficient grids would also help cut costs of supply and reduce average tariffs by about 50 % (from around \$1/kWh, to about 50 us cents/kWh). This programme would enable access to reliable and sustainable quality electric service for about 300,000 households.
- The off-grid energy products/services programme could help as many as 1.8 million people with improved lighting, and other domestic and productive uses of modern energy (battery charging; recharging of other appliances, such as telephones and computers; use of fans, radios, television, etc).
- The capacity-building and training programmes would create some new institutions and strengthen existing ones, at a minimum, the Federal Ministry of Energy and Water, the Somaliland Ministry of Energy and Minerals, and Puntland's PSAWEN (Puntland Authority for Water, Energy, and Natural Resources). These projects would also create a capacity to collect basic data/information on the energy sector, and for monitoring and evaluation.

Current situation of the energy sector.

The energy mix in Somalia is completely dominated by locally available charcoal and firewood as the main sources of energy, and the consequent, near-term destruction of the vegetative cover is the most important energy and environmental problem facing the country. In part, the dominance of biomass is due to the impossibility of large-scale imports of energy, partly because of low effective demand due to the drop in incomes after state collapse. Estimates of the energy needs met through firewood and charcoal vary between 80% and 90% over the whole country. As a consequence of the excessive reliance on biomass (in the form of firewood and charcoal) as a source of energy, biomass resources are being exhausted. The majority of Somalia's population, perhaps 80% to 90%, relies on traditional biomass fuels, wood and charcoal, for cooking. Annual consumption of charcoal is estimated at around 4 million tons per year¹, a rate that is quickly exhausting Somalia's few remaining forests. The prevalence of charcoal and wood for cooking also has some serious health impacts at the household level which will be mitigated by the proposed introduction of modern cooking fuels and cleaner, more efficient, and cost-effective end-use devices . The continuing illegal export of charcoal further contributes to the assault on the precarious and fragile vegetation.

A recent study, conducted by Habitat² for the EU surveyed the energy situation of Mogadiscio and provided revealing data as well as insights into possible actions. The demand for energy for cooking, lighting, powering household appliances and for productive activities is very high, strong, and costly (reportedly costing 30% of average incomes), but biomass supply is dwindling. Continued availability of biomass for cooking is not guaranteed as this fuel source is becoming

¹ Equivalent to about 400 kg/capita/annum. Quoted in many sources, earliest, World Bank; Somalia: *Issues and Options in the Energy Sector*, Washington 1985.

² UN-Habitat/SECIL; *Energy Baseline Survey* (for Mogadiscio), June 2013.

severely depleted near cities (actually, charcoal sold in Mogadiscio originates far from the city). The very poor in Mogadiscio now use waste paper, plastic, and other garbage as cooking fuels.

Electricity supply has suffered from over two decades of neglect including absence of investments, due to both widespread insecurity and the disappearance of public resources and public oversight (rule of law). Wanton destruction and looting, in addition to neglect have battered what little infrastructure there was before the collapse of 1991. The result has been a huge regression and substantial delay and backlog in access to affordable, modern sources of energy. And this holds for areas of Puntland, Somaliland, and Southern Somalia, all of which are now struggling to extend and improve energy supply, especially electricity.

Public supply of electricity ceased altogether after the state collapse as, chaos, looting, and destruction prevailed. Small firms emerged to supply power in their immediate vicinity at low voltage. These small private generators supply their clients' homes directly with wires without any transformation. This is still largely the only type of supply available, except for a few cities where grids have been rebuilt or were not destroyed. So, electric power is supplied under the most primitive and inefficient (costly) conditions, with wires going directly from the generating machines to the home of the customer. The distances are also often such that the tension (voltage) is noticeably lower upon arrival and appliances function badly while suffering damage (brownouts). Total installed and operational generating capacity in all of Somalia at this time (2014) can be estimated at about 80-85 MW, and there may be about 250,000 connections.³ If these numbers are broadly indicative of the situation, they would imply a capacity of about 300 W/connection at generation (much less at household level given the high distribution losses).

There is a significant potential in all Somali areas in terms of renewable and alternative sources of energy, such as solar and wind power, but so far, due to both security and funding problems, only very small, timid experiments have been conducted with solar and wind power. A systematic, in-depth evaluation of these resources needs to be conducted before large-scale projects can be designed to use these renewable resources for power generation.

Petroleum products, essentially for transport, electricity generation, and minor quantities for cooking and lighting, account for about 10% of total energy use. Electric power generation (almost entirely diesel-fuelled) accounts for about 2 of the 10 percentage points provided by petroleum fuels. Most of the rest is accounted for by transportation fuels (gasoline and diesel). Gasoline, kerosene, and LPG are already imported and widely available over most of Somalia. LPG is used for cooking by the better-off urban population, while about 5% of households use kerosene for cooking. Gasoline and diesel are said to be of poor quality and apparently lead to premature engine wear and breakdown, not to mention car exhaust pollution in cities. The absence of norms and standards or weak enforcement of them is certainly to blame. Prices of petroleum derivatives broadly follow world prices with rather limited taxation (\$ 6-7/barrel, equivalent to about 4 us cents/litre) on the part of Federal and/or Regional Administrations.

Four main energy sector issues

The four main issues described below are exacerbated by the perceived lack of security for people and property. Security is a pervasive, cross-cutting issue: it will be mentioned here but will not be repeated. The four issues are described below.

- **Shortage, lack of qualified personnel.** The most important, cross-cutting major set of issues is the extreme shortage, or absence, of qualified personnel, and the uncertainty regarding future supply of trainable persons, given a 24-year interruption of education processes.

³ As estimated through direct interviews, estimates by authorities, occasional written reports, and other pieces of information (collected in part by our late colleague Musse A. Abdi). Must be taken with a grain of salt: the numbers are probably overestimated, but they are presented here for want of better ones.

- Limited access to and supply of electric power. The extremely limited access of Somalis to modern energy, especially electricity, is a problem affecting the quality of life and constraining productive activities. Public supply of electricity in cities is limited in quantity, quality, and reliability, and dogged by drops in tension (voltage) and frequent failures.
- Excessive exploitation of biomass. The overexploitation of the biomass cover is a consequence of extremely limited access to modern energy and means that essentially the only source of primary energy in Somalia is biomass. In fact, about 90% of energy consumption in Somalia is firewood and charcoal, with resultant damage or threat to the very limited, scarce, ecological/environmental resources of the country.
- Low penetration of modern energy, especially in rural areas. There is a need to introduce modern energy, especially into the countryside. The lack of electricity/modern energy forces most Somalis to resort to poor quality lighting and to cook with biomass. The introduction of clean, modern energy is urgent for both lighting and cooking. The poverty and other characteristics (dispersion, movements) of the rural and nomadic populations are such that most probably only non-grid and portable solutions make technical and economic sense.

Characteristics of an Energy Sector Action/Investment Plan

For Somalia, any energy sector development programme, or action plan should: i) improve knowledge and build the capacity of institutions, by expanding and improving their staff, even if initially only through short-term, stop-gap measures, ii) expand access to modern energy, especially electric power, iii) reduce the consumption of biomass-based fuels and substitute away from them, iv) extend modern energy products and services for cooking and lighting to rural and nomadic communities, and v) economize on scarce trained/qualified personnel while taking measures to increase its supply sustainably, probably only in the longer term.

Size of the programme

At about \$ 800 million, the proposed A/I Programme is large but not unduly so. It responds to the concerns expressed by Somali leaders consulted for this Assessment. Leaders consulted by this Assessment are extremely conscious of the obstacles and difficulties of implementing energy projects in the country. Many of them expressed the wish to see an Energy Sector Action/Investment Programme that should, firstly, be credible and then, implementable; therefore, of modest dimensions. The main constraint is not access to capital as funds committed to the reconstruction in Somalia are plentiful because of the New Deal framework, which Somalia is part of. The true, binding constraint is the low the absorption capacity of Somalia, because of the many obstacles and difficulties to project implementation, including weak public institutions. So, this Programme is prudent, and avoids excessive optimism, either in terms of volume, or time. Since other programmes have often erred on the speed of implementation, this Energy Sector Action/Investment Programme will have a short/medium-term phase of 3 years but no emergency phase (because little can be implemented within less than 3 years), and an overall horizon of 10 years.

This Report suggests an aggregate Energy Sector Action/Investment Programme of \$ 803 million allocated as in the following table, and described more fully below.

Summary Table: Energy Sector Action/Investment Programme (2016-2025)

<u>Item</u>	<u>Dollar Million*</u>
<u>Training, copy-building and T/A (Policy-Making Bodies)</u>	<u>58</u>
<u>Somali Electrification Institute</u>	<u>10</u>
<u>Expansion Electricity Supply</u>	<u>580</u>
<u>Substitution of Biomass Fuels</u>	<u>95</u>
<u>Modern Energy for Rural/Nomadic communities</u>	<u>60</u>
<u>Total</u>	<u>803</u>

*Mission Estimates, at prices of 2015 (adjusted to account for Somali excess costs).

The Programme proposed in this paper is ambitious and farsighted: \$ 803 million over a ten-year period, making allowance for the difficulty of getting things done in Somalia, and for the inevitable delays to be expected when coming out of a conflict and chaotic situation of long duration. This programme is an estimate of what could be done if conditions were permissive and continuous progress were made in improving security and creating/strengthening institutions. The Programme is split between a short-term 3-year period, and a larger seven-year programme that follows it.

The A/I Programme consists of an immediate \$ 58 million programme of training, capacity-building and technical assistance to the main policy-making bodies of the Federal Government and the better established areas of Somaliland and Puntland.⁴ The other major interventions are: a \$10 million project to create an institution to manage and regulate electric power generation, (and distribution) the Somali Electrification Institute (or any other appropriate name); a \$580 million programme to expand access to electric power in cities; a \$ 95 million programme to substitute modern fuels for biomass, essentially in households (including small projects to: i) create alternative livelihoods for charcoal producers, and ii) construct modest storage facilities for liquid fuels); and, a \$60 million programme to introduce non-grid based modern energy products and services for nomadic and rural communities.

The average annual expenditure per year in the initial 3-year period is set at only about \$40 million, (versus about \$100 million for the rest of the period). If this modest spending target for the 3-year period were achieved, considering it is mainly for capacity-building, training, and technical assistance to Ministries of Energy and similar bodies, it would mean that many useful things were getting done. The Somali Electrification Institute has a slightly more ambitious spending target, above 50% of total within the first 3 years, considering it needs to be created within that initial 3-year period.

The most urgent tasks after the preparation of this Action/Investment Programme would be the actual preparation of the Technical Assistance Project, and the design of Somali Electrification Institute. The first component should be training and information/knowledge sharing about basic energy sector concepts and policies. This should be the first priority because in conducting research for this Report, it became evident that hardly anybody understands even basic energy sector management concepts (power, energy, peak demand, load curve, load factor, economic tariffs,...) and there are very few persons working on energy sector management.⁵ Energy and electricity are

⁴ As other federal units are created, then perhaps additional resources can be assigned to help them. At this time, it is not possible to predict their need for resources but this Action/Investment Plan assigns a sum of \$ 10 million to them. In any case, the Federal Ministry of Energy and Water has stated it will assist the emerging federal units with development of policies and institutions and when a program to assist these units is defined, additional funding can then be examined and committed.

⁵ Mentioned in EU Energy Sector Report of 2012, but interviews conducted by this author and by World Bank staff in Mogadiscio, Garowe, and Hargeisa confirm that these concepts are not clearly understood.

often confused, as are operations of electric utilities and energy sector policy/management. Given this state of knowledge (not to say ignorance) it seems obvious that training in simple energy sector concepts and management must be provided before Somalis and external development partners can conduct any meaningful dialog on sector development and policies, so that Somalis can more fully understand and own their energy sector development process. Among other priorities, setting-up an information/data collection system for the sector, a system to monitor developments in the energy sector, including the evolution of this Action/Investment Programme, and an initial analysis of the legal forms to adopt (e.g. PPP and joint ventures), given that most of the investment is to be carried-out by the private sector, supported by donors.

This Action/Investment Programme is not cast in concrete: it can be envisioned as evolving with developments on the ground, or be seen as an input into the energy sector policy-making and development reflexion by Somali authorities and their development partners. It would be presumptuous and premature to try to establish a rigid blueprint for a ten-year programme in Somalia. This Action/Investment Programme should also be subjected to continuous monitoring, so as to enable fact-based feedback, for redesign and fine-tuning. Another study could be considered and performed, say, at mid-stage in about 2020, to capitalize on the lessons learned from the monitoring activities, and to take account of the significant changes that will doubtlessly have taken place. And if implementation proceeds as projected in this Report, additional funding would need to be mobilized at that time.

Some comments on specific characteristics and risks of Somalia

It is possible, even likely that a number of the actions mentioned here will face enormous implementation difficulties and some may turn-out to be impossible to implement. This is because most materials and equipment must be imported, and there are few ports, and few international shipping lines serve them (in part because of high risks due to piracy and the impossibility of insuring ships/cargoes). Further, transporting valuable materials and equipment internally by road is equally risky, as convoys/vehicles can be attacked and robbed. And finally, lengthy delays are to be expected given the often poor condition of roads and vehicles. This means that the implementation of this programme should be attempted with all seriousness, but that difficulties should not be underestimated, lest the authorities and development partners, both, fall victim to discouragement. The very size of the programme is a bet that security, governance, and civic behaviour will progress over the coming years and make the programme more easily implementable.

Lack of easily available technical and skilled labour creates its own further delays and increases in costs (heavy rates of breakage, poor workmanship). It is also likely that the cost estimates given will prove wide of the mark. The cost levels in this Report (for grids, civil engineering, etc) are estimated at twice the costs in Europe, except for generating equipment which is priced at \$1500/kW for diesel-fuelled equipment, and \$ 8000/kWp for solarPV. In part this is due to the high costs of security, in addition to the inefficiencies/risks mentioned earlier.

Another risk is that the TA/training for needed qualified personnel may be very expensive, or even not available. Because it might also be difficult to find external experts willing to spend long periods in Somalia (Hargeisa is relatively comfortable, but even Garowe, and more so Mogadiscio, would be difficult places for expatriates to spend long periods). Compromises will be needed, perhaps on the specific quality of the expertise, on the level of remuneration, and on the length/frequency of rest and recuperation periods, or most likely, all three. Otherwise, greater recourse must be had to trained, expatriate Somalis by convincing them to return from abroad through proper financial and other incentives. And that has its own difficulties.

Still, Somalia is a fascinating country and Somali culture is vital and original.⁶ Working with Somalis is an exciting experience in getting to work with people who really do need the help. In spite of their misfortune, Somalis do deserve help from more fortunate societies and assisting them with new, modern sustainable sources of energy would enable them first, to improve their quality of life, and level of well-being, and enable them to fend for themselves more effectively, reducing their needs for assistance in future.

DRAFT

⁶*This remark is based on this author's acquaintance with Somalia which harks back to 1975 (as World Bank Country Economist for Somalia and Ethiopia until 1979), when the Somali state was at the apogee of its power. He later held the post of Director of the UN's Development Office for Somalia (UNDOS) between 1998 and 2002, including a period as Principal Economic Advisor to the TNG, and as UNDP-Somalia Sr. Economist. This assignment represents his third period of work on Somalia over 40 years.*

Chapter 1: Introduction and background

1.1 Introduction

Somalia has been without an effective central or federal government since 1991 when the Somali State, born at independence in 1960 from the merger of the British Protectorate of Somaliland and the UN Italian Trusteeship Territory of Somalia, collapsed. Most recently, Somalia has entered a new phase of gradual peace-building and recovery, following a recent political transition. A new Parliament and a President have been elected. This led to international recognition of the FGS. A new Constitution has been adopted. New institutions are being put in place. The prospects appear more favorable than they have been for some time in addressing the country's immense challenges for a return to peace and eventually development. However, the situation remains extremely fragile as the armed opposition (al Shabaab, affiliated to Al Qaeda) has withdrawn from many areas but has not been defeated. However, this may be a good time to provide support, in terms of stability, reconstruction, and improvement in livelihoods, as the public expects a peace dividend.

The Federal Government of Somalia (FGS) intends to play an increasingly important role in attracting foreign development assistance and private investment, and to assist and facilitate the obtention of external support by various administrations (Somaliland, Puntland, various Administrative Regions in Southern Somalia currently under formation). While assistance is required in all sectors, infrastructure is particularly important, as it is the base of all productive and social activities, and leads to an immediate improvement in living conditions. Energy is key among infrastructural sectors because it directly improves the standard of living of people (better light, household appliances), their security level, contributes to stabilization in cities, and permits increases in productivity.

Somalia is faced with the complex and pressing challenges of state building and reconstruction in the absence of endogenous sources of public funds, and with hardly any institutional capacity. Addressing the challenges in Somalia has become urgent, with the international community committed to scaling-up and coordinating its support to the Somali efforts. The goal is to make the current positive outlook irreversible. The new Federal Government of Somalia (FGS) has so far demonstrated commitment to deliver. It has articulated its priorities around six pillars including recovery of livelihoods and economic infrastructure. Urgent priorities will initially focus on Security, Justice and Public Financial Management (PFM), on which some progress has been made. However, given the gravity and duration of the crisis that Somalia has suffered, there are many other pressing challenges that need to be addressed simultaneously to rebuild the state and the economic base of the country. In this context, a number of key issues will need to be addressed, including infrastructure, a proper environment for private sector investment, the role of the dynamic Somali Diaspora, and the creation of income generating activities and employment opportunities, especially for the young.

Somalia joined a group of fragile/post conflict countries that were determined to change their relationship with donors and try to make commitments to reform in exchange for greater certainty in development assistance within the framework of the New Deal for Engagement in Fragile States. Somalia was one of the first countries to complete its documents and discuss them with donors. The Somalia New Deal Compact was endorsed on 16 September 2013 by the Federal Government and the international community. The Compact enumerates the critical priorities under the five Peace and State Building Goals (PSBGs) that have been endorsed as part of the New Deal principles for engagement in Fragile States, and also includes a Special Arrangement for Somaliland. The PSBG pillars are: (i) inclusive politics; (ii) security; (iii) justice; (iv) economic foundations; and (v) revenue and services. The Compact is expected to guide international support to Somalia over the three years 2014-2016. Development assistance will be mobilized and

channeled through a proposed new financial vehicle called the Somali Development and Reconstruction Facility which is expected to bring together several existing and new funds (World Bank managed fund, IMF managed fund, UN managed fund, AfDB managed fund) under a unified management and operating structure. In order to rebuild the Somali economy and provide better service delivery, the Federal Government has also developed a two-year Economic Recovery Plan 2014-2015, presented together with the Compact. The Economic Recovery Plan contemplates total investment of \$661.7 million of which the highest priority Flagship Programmes amount to \$221.9 million. It seems that a two-year planning horizon was somewhat short as there have been some delays.

In Southern Somalia, the Federal Government (FGS) in Mogadiscio continues to battle armed opposition and insurgencies while attempting to establish the rule of law and starting to implement policies for improving welfare and promoting growth. The Federal Government's ability to provide the basic public goods (that define what a government is and does) is severely limited, and so, Somalia has a government that is improving its capacity to govern, but should not be asked to take on too many complex or delicate tasks, i.e. avoiding "excessive premature load bearing". Further, the country is divided into entities, with some claiming to be regions within a federal Somalia, and one, Somaliland, that claims to be independent of the Federal government. Ensuring ownership by local people and authorities is necessary, and an approach going from the ground up (i.e. from the regions to the federal whole) appears most feasible.

Conflict has ebbed and flowed since 1991 when the Somali state collapsed. Certain periods permitted some reconstruction, some periods had some measure of government (e.g. during the tenure of the TNG, 2000-2003). Some periods were very conflictive and there was regression. However, since 2012-13, there is a tendency for life to return towards the normal with Mogadiscio undergoing a noticeable boom in re/construction. Many capital city streets have been repaired with the help of Turkey. Somali civil society, both Diaspora and locally-based, is investing in small enterprises producing both goods and services. Public services are being revived, and many cities (including in areas of Southern Somalia) are resuming normal life, with the opening of offices of district and regional public bodies (city halls, social services delivery points), police stations, and jails. District and regional courts currently being recreated and staffed, are about to reopen, making judiciary services available anew.

The above renaissance is being facilitated by the international community's assistance to the FGS and to other administrations. In many areas, schools, water supply, and sanitation facilities are being rebuilt, also using renewable sources of energy, especially solar. Neighborhood markets are being built and opened in many cities and towns, and streets are being lit with solar energy, though admittedly with external assistance.

The subsidiary regional administrations which should form the building blocks of the forthcoming federal state are currently taking form and being strengthened, not without difficulty (as evidenced by the vicissitudes of the South Western Region). And this popular will to restart expresses also the people's refusal to return to past chaos. Armed insurrection by Al-Shabaab rebels badly affects security. Although they have not really been defeated, they have been seriously weakened, and many believe that this weakening will continue. Since the loss of their fortress in Brava, Al-Shabaab have broken down into small groups which retreated to remote villages inhabited by their clans of origin, and they now lack physical and ideological/psychological cohesion. Meanwhile, the country's security forces are being reorganized, and some signs of improved efficiency are beginning to appear. Furthermore, the prospect of holding general elections in a year or so are encouraging, even if there still may be localized problems to the holding of elections, as certain areas are better prepared than others. Overall, however, prospects are good and positive.

As for the energy sector, in spite of the serious problems it faces (see below) there are new signs that private parties are prepared to invest their own capital in power supply, as well as in the import and distribution of petroleum fuels. Everywhere, in Mogadiscio, Hargeisa, Bosaaso, Berbera, in the North and South, one can find distribution of modern fuels such as kerosene, LPG and automotive fuels, a good omen for the future. There is also a consolidation of small electricity generators, which are grouping together to be able afford the high investments necessary to offer a state-of-the-art power supply services. Private investors, who may have profited from the war economy, now are valuing the security measures being taken, as they are planning to invest in many sectors in many places, and the rule-of-law will be of greater benefit to them than the previous state of disorder and lawlessness. The FGS has approved a law on private foreign investments which is reaping its first fruits, as foreign companies (two Turkish companies are running the port and airport of Mogadiscio) are taking their first tentative steps in Somalia. It is to be hoped that others will follow in their footsteps. These positive signs are likely to be strengthened and security will improve, especially if the international community continues its support, which should be more reliable within the New Deal framework.

Fortunately however, some areas, including those of Somaliland and Puntland have made substantial progress with security and safety relative other areas. They have also developed reasonably effective administrations, (Somaliland especially, but also Puntland) with some capacity to design and implement policies. For that reason, most donors have concentrated on assisting these two areas, and the trend is likely to continue for some time in broadly the same direction. Nonetheless, a number of nation-wide programmes are being proposed (e.g, city electricity grids, substitution of biomass fuels, TA to Ministries or other bodies responsible for energy) and will include Mogadiscio/Benadir and other regions in Southern Somalia, as, when, and where they are effectively created and security conditions permit.

1.2 Objectives/Scope

This Energy Sector Needs Assessment intends to identify critical areas of short-term assistance to maintain, rehabilitate and/or develop basic energy infrastructure. It will also research capacity gaps that need to be remedied, and institutions/institutional arrangements that need to be strengthened and modified, to create a more conducive framework for firms/investors to meet current demand and reduce the existing pent-up, unsatisfied demand of consumers. This short-term period will encompass the years 2016-18. The Study will then identify medium to long-term needs and associated investments, for a seven-year period, 2019-25. These two periods define the short-term action plan, and the medium/longer-term plan. These plans will include critical investments, as well as further short-term activities (e.g. training, capacity-building, or studies) required to identify/prepare additional, future projects/programmes.

1.3 Brief description of the current situation of the energy sector

The energy sector has suffered from over two decades of neglect including absence of investments, due to both widespread insecurity and the disappearance of public resources and public oversight (rule of law). Wanton destruction and looting, in addition to neglect have battered what little infrastructure there was before the collapse of 1991. The result has been a huge regression and substantial delay and backlog in access to affordable modern sources of energy, even when compared to other similar small, poor economies. But poor service, and minimal quantity, quality, and reliability of supply reduced the quality of life and welfare of Somalis and their productivity by constraining all economic and social activities. And this holds for areas of Puntland, Somaliland, and Southern Somalia, all of which are now struggling to extend and improve energy supply, especially electricity.

1.4 Sector Organization and policies

In Mogadiscio, the Federal Government of Somalia (FGS) has created a Ministry of Energy and Water Resources to define and implement overall energy sector policies and to regulate the sector. The Ministry has limited staff and limited budget. The Minister reported that budgetary resources are sufficient only for a skeletal staff and would need assistance with financial resources to make-up for this extreme budget stricture. The Energy Sector Management Department of the Ministry is poorly staffed with only a Director and a volunteer consultant. This situation is likely to evolve positively in the coming months, since an awaited new Government has recently taken office.⁷

The Ministry would like to develop a capacity to experiment with new and renewable sources of energy (NRSE), as well as to set policies and strategies for reaching ambitious energy supply and access goals. The Minister has mentioned a need for support with training, capacity-building, and Technical Assistance to ameliorate the staff shortage problem. The Ministry of Energy and Water Resources further intends to assist local governments (the future federal units) design energy sector development policies and projects. The FGS has little capacity to develop policies, and none are officially promulgated. There is no legislation governing electricity (except in the sense that current legal arrangements in Somalia, including both Somaliland and Puntland, stipulate that laws of the former Somali state which have not been specifically repealed remain in force).⁸ Nor is there any element of regulatory framework. On the other hand, the electricity industry is embryonic and would not justify extensive legal and regulatory bureaucracies which, further, would be impossible to staff with competent personnel. As in most of the country, there is a legal/regulatory vacuum and the industry is more or less self-regulating, as are many other economic and social activities.

As of end-2014, the FGS had not decided on any energy sector policy except in the most general terms, namely that there would be ample space for private initiative, unlike pre-collapse legislation which was centralizing and used the model of a state-owned, vertically integrated monopoly. However, in Somalia, decisions are never unequivocal and it seems that the FGS has appointed new management for the previous state-owned power company, Ente Nazionale Energia Elettrica (ENEE) within the Ministry of Energy. It survives also, vestigially, and mostly in name, in Qardo and Bosaaso where the partly publicly-owned power plants are still known under that name (ENEE, National Electric Energy Entity, in Italian; or its acronym in Somali, W.X.K.U.)

In the area of Somaliland, the Ministry of Energy and Mineral Resources has responsibility for energy sector policy and oversight. It was recently reorganized and water resources were transferred to another ministry. However, the Ministry of Public Works supervises the Somaliland Electricity Agency, SEA, because it was that Ministry which rehabilitated the power plant and grid. SEA owns and operates power plants and grids in both Hargeisa and Berbera. The only public generation and distribution utility, the Somaliland Electricity Agency (SEA) serves a small share of the electricity market in Hargeisa (perhaps 2%-3% of electricity customers), but a much larger share in Berbera. The Ministry of Energy has little qualified staff and so, limited capacity to manage the sector.

Further, in Somaliland, the management and control of natural resources including charcoal are the responsibility of the Ministry for the Environment. The Ministry of Environment finds itself under similar circumstances, with strictly limited budget, short of qualified staff and, consequently, with almost no capacity to oversee and regulate charcoal production and marketing which are part of its mandate. But there are also some overlaps, as the Ministry of Rangelands (of Somaliland) has

⁷ After several false starts, and months of political infighting after the destitution of a Prime Minister and the appointment of another, a new government passed a vote of confidence in early February 2015. In late March it is coming out with its program for its first 100 days of functioning.

⁸ The old law would not be useful in that it gives ENEE (Ente Nazionale Energia Elettrica), the former state-owned utility, a monopoly of generation, transmission and distribution. ENEE currently has a vestigial existence as a DG has been appointed recently by the FGS. To what end is unclear.

jurisdiction over the vegetative cover, and recently (in 2011) conducted a study of charcoal consumption together with UNDP.

Somaliland adopted its National Energy Policy in November 2010, as a result of the Somaliland Energy Policy Dialogue (SEPD) and Somaliland Energy Livelihoods Programme (SELP), both supported by the EU. A draft Somaliland Energy Electricity Regulations 2012 and Draft Somaliland Electrical Energy Act 2012 were prepared recently with support from the United States Agency for International Development (USAID). Both are suffering considerable delays, while awaiting discussion and possible adoption by the Parliament. The draft Electric Energy Act envisages the coming into being of a number of institutions including an Energy Regulatory Commission (ERC) and an Energy Trust Fund. Other institutions to be created to implement the Somaliland National Energy Policy include an Energy Inspectorate, and the Energy Laboratory. One can wonder whether the enactment of comprehensive legislation and setting-up of heavy regulatory bureaucracy in the face of an embryonic operating sector and extreme scarcity (lack) of trained, experienced personnel can really help accelerate access to modern energy. It has been suggested (by the World Bank) that down-to-earth regulations, (minimal quality and service standards) for those sector operations which are functioning, in addition to basic health and safety rules could be an easier to implement, more logical approach to electric power regulation at this early stage of its development.

The Puntland Administration has no Ministry of Energy, or water or natural resources. Instead, there is a Puntland State Authority for Water, Energy, and Natural Resources, or PSAWEN. It is an autonomous agency reporting directly to the Office of the President. PSAWEN has the mandate to oversee and regulate the electric power industry. However PSAWEN has no staff with adequate technical expertise on energy. A Ministry of Petrol and Minerals supervises the import of and trade in petroleum products and sets/collects taxes on them. The government has no energy policy, energy regulation or enforcement framework, and little capacity to design, let alone implement sustainable energy policies. This has created a vacuum in the rules governing production, transmission, distribution, and sale of energy, and quality and safety concerns are taken into account, as far as possible, only by the operating companies themselves.⁹

PSAWEN is loosely organized and contains Directorates for Natural Resources, Water, and Energy, though apparently, staff tend to work in more than one Directorate. The Water Directorate operates the Garowe water supply system and appears to have received some external financial and capacity-building assistance. The Natural Resources and Energy Directorates appear to be still in embryonic form. The Energy Directorate consists of the Acting Chairman (who used to be Director for Energy and kept his post) together with a few untrained persons. It also "contains" the Bosaaso and Qardo power plants which are ostensibly state-owned (see more below). This Directorate does not have a detailed mandate or TORs but only a letter from the President saying that PSAWEN has the mandate for Energy, Water, etc.

All these administrations mean well in wanting to do things as fast as possible, but may be falling in the trap of "excessive premature load-bearing", namely assuming too quickly responsibilities which they cannot possibly discharge.¹⁰ The only antidote is for partners to rapidly launch training and capacity-building actions, in advance of any serious policy discussion or project implementation, because basic knowledge of energy sector concepts required to hold even elementary dialogue/discussion of sector policies/development is lacking.

⁹ In fact, the Director for Energy at PSAWEN, now Acting Chairman, was really the general manager of the Bosaaso Power Plant. All other staff appear shared between electric power and water supply. Energy and electricity are often confused, as are operations of electric utilities and energy sector policy/management.

¹⁰ Concept adapted from: Copenhagen High Level Partnership Forum; *Financial Accountability, Transparency and Partnerships*; Discussion Paper1. Copenhagen, 16 Nov 2014 [by World Bank and Federal Ministries of Finance & Planning. Page 4.]

1.5 Reliance on the private sector.

It has been reported that a purely private firm cannot operate in Somalia: it must have some link with the administration, somewhere. This arose in a discussion of the private nature of a firm in Garowe. The electric power utility claims to be fully private, and to give the government free power (to mosques and police stations too). The government claims that it provided the generators and gets no free power. Also, the government claims it gives the utility free diesel to cover costs of free power to mosques and other public institutions. The government discourages other investors thereby helping to maintain the firm's monopoly... etc. In Hargeisa and Berbera, the administration owns (by now only part of) a power utility, and so, the "playing field" would not be level either in that the (partly) state-owned firm would obviously enjoy privileges not available to other truly private power generators. There is need for better codified PPPs or joint-ventures in all sectors, but most urgently in power supply, where there is a pressing need for creating the conditions for a competitive power generation industry.

There is in fact very little recent, reliable data about the private sector. Much of it is anecdotal and cannot be relied-on to form the basis on which to build an electricity industry, programmes to substitute away from biomass and into new household fuels, and to accelerate access to modern energy among rural and nomadic communities. This Study would suggest carrying-out some research on the business class in various Somali areas, in Kenya, and in Dubai, as in fact, a large share of the business class is based in the two last locations. The main unknowns to be studied include the outlook of main Somali economic agents towards sizeable investments in infrastructure (mainly but not exclusively in energy), and the kind of legal/regulatory framework that would give them the most incentive to invest, in addition to any government/donor support, meant to be shifted to consumers in the form of lower tariffs, once normal profits are earned by investors.

1.6 Main four issues facing Somalia's energy sector:

There are four main issues facing the Energy sector, and all four are exacerbated by the perceived lack of security for people and property. Security is a pervasive, cross-cutting issue: it will be discussed here but will not be repeated each time it might be required. In effect, there are limited access and low supply because insecurity makes earning income and investing more difficult and risky; the excessive exploitation of biomass is due to poverty (difficult to earn income), and to the difficulty of importing energy in bulk because of lack of security (e.g. cargoes cannot be insured.); low effective demand, the limited penetration of modern energy is due to poverty and lack of security for traders and for buyers of modern end-use devices, and; the shortage of personnel is due to insecurity as qualified people either leave Somalia, or hesitate to come, even when wages may be higher than elsewhere.

The four issues are listed below.

- Shortage, lack of qualified personnel,
- Excessive exploitation of biomass,
- Limited access to and supply of electric power, and
- Low penetration of modern energy, especially in rural areas.

The following paragraphs provide a more detailed description of these 4 issues, of situation of the energy sector, and also of the main subsectors, biomass/household energy, electric power, petroleum fuels, and renewables.

i) The most important, cross-cutting major set of issues is the extreme shortage, or absence, of qualified personnel, and the uncertainty regarding future supply of trainable persons, given a 24-year interruption of education processes. A related problem is that because of difficult security conditions, the supply of good quality technical assistance is constrained, and may only become

available at very high prices, reflecting the high risk *premia* due to these conditions. Recourse to the Diaspora could help resolve both parts of this problem. However, the Diaspora cannot be invoked as a *deus ex machina*, as it is not easy to ensure its contribution to resolving the skilled personnel shortage. While qualified personnel from the Somali Diaspora is less costly than external/expatriate technical assistance, its cost greatly exceeds local wages. Its employment is also subject to security considerations, though admittedly, in lesser measure than for expatriates. However, Diaspora Somalis face some problems which expatriates do not face, namely clan-related issues, which have become more apparent and frequent with the diminution of the (theoretically less clan-oriented) central/federal authority. If the building blocks of the Federation are clan-defined territorial entities (states, regions) then it may become difficult to have a free, open (Somalia-wide) labour market in skilled/qualified personnel unhindered by clan considerations.

ii) The overexploitation of the biomass cover is a consequence of extremely limited access to modern energy and means that essentially the only source of primary energy in Somalia is biomass. In fact, about 90% of energy consumption in Somalia is firewood (in the countryside and in cities) and charcoal (in cities), with resultant damage or threat to the very limited, scarce, ecological/environmental resources of the country. This calls for the introduction of substitute fuels for cooking, everywhere, in the city and the country.

iii) The extremely limited access of Somalis to modern energy, especially electricity is a problem affecting the quality of life and constraining productive activities. Grid-supplied electricity in cities (there is none outside cities) is very limited and what supply exists sometimes runs only some hours per day and is dogged by drops in tension and frequent failures. There is a small hydro potential, especially on the Juba River, but it has never been exploited (a project funded by the EU to build a dam at Bardhere had started shortly before the collapse of the state) and is unlikely to be harnessed, except in the long run, after the current situation is resolved. There is also a renewable energy potential which is still to be fully evaluated, (this is about to start)¹¹ and needs to be considered more seriously by energy planners for the medium term.

iv) There is a need to introduce modern energy, especially into the countryside. The lack of electricity forces most Somalis to resort to poor quality lighting (often kerosene), although it is reported that portable solar lighting products are rapidly gaining in popularity, and seem to have penetrated significantly in some rural areas. The introduction of modern energy is urgent for both lighting and cooking. The poverty and other characteristics (dispersion, movements) of the rural and nomadic population are such that most probably, only non-grid and portable solutions make technical and economic sense.

¹¹ World Bank proposing to include Somalia in its Eastern African scientific evaluation of renewable resources (Solar Wind Mapping of Ethiopia) which is being readied for implementation and will be extended to Somalia.

Chapter 2: Situation of energy sector and main subsectors

2.1 Subsector: Biomass/Household Energy.

There is no doubt that the destruction of the country's sparse and slow-growing vegetation to produce firewood and charcoal (especially for use in cities and for illegal exports) is the preeminent energy/environmental problem in Somalia (including the areas of Somaliland, Puntland, and all parts of Southern Somalia). It has been mentioned as the first priority by all policy makers in all areas: The Federal Minister for Energy gives priority to the search for alternatives to charcoal in all southern cities including Mogadiscio (charcoal supply to cities is the main culprit of massive tree cutting/destruction of vegetation). The Somaliland Minister for Energy as well as the Ministers for Planning and Environment of Puntland consider this their major problem, which needs to be addressed urgently and decisively. They consider the transition from biomass to cleaner sustainable fuels the most urgent and important task before them. They also have ideas as to how the problem should be addressed. In Somaliland, the Ministry of Energy proposes to launch a major campaign to promote the use of kerosene as a cooking fuel. In Puntland, the Ministry of Environment proposes an attempt to introduce subsidized LPG as a substitute to fuelwood and charcoal. In Southern Somalia, while the need for substitution is fully acknowledged, no decisions have been taken as to the precise course of action, given the large size of the problem, and its geographical extension, whereby no single recipe is likely to suit all situations.

The impact of the decades-long conflict is evident from the fact that the energy mix in Somalia is completely dominated by locally available charcoal and firewood as the main sources of energy. In part that is because large-scale imports of energy have not been possible, nor are they now. Estimates of the energy needs met through firewood and charcoal vary between 80% and 90% over the whole country. As a consequence of the excessive reliance on biomass (in the form of firewood and charcoal) as a source of energy, biomass resources are being exhausted because of the very slow growth of vegetation due to the dry climate. The majority of Somalia's population, perhaps 80% to 90%, relies on traditional biomass fuels, wood and charcoal, for cooking. Annual consumption of charcoal is estimated at around 4 million tons per year¹², a rate that is quickly exhausting Somalia's few remaining forests. The prevalence of charcoal and wood for cooking also has some serious health impacts at the household level. The illegal export of charcoal further contributes to the assault on the precarious and fragile vegetation.

While all areas with formal administrations have banned charcoal exports and there is a Security Council Resolution (No. 2036 of 2012) forbidding its export from Somalia, there is no doubt that this activity continues; and it can only be decisively banned when an effective government re-establishes control and legality over the whole area, including the coast-line. The illegal export of charcoal from all parts of Somalia is said to have dropped somewhat, and is now estimated at perhaps 40,000 tons/year.¹³ At the same time, areas close to borders, such as Hargeisa, import charcoal from neighbouring countries.

Since even urban consumers, especially the poorest, will continue to depend on biomass energy for decades to come despite incipient efforts at substitution, there is need to address both the supply and demand situations. There are indications, not precise data that demand for biomass fuels vastly exceeds supply (i.e. the natural increment/growth of biomass) and therefore this situation is not sustainable.¹⁴ The impact of charcoal supply to cities and for export, added to the historical factor of

¹² Equivalent to about 400 kg/capita/annum.

¹³ At the low charcoaling efficiency common in Somalia, producing such an amount of charcoal requires more than 500,000 solid cubic meters of wood, a huge quantity which explains the devastation of Somalia's forests (in Sanaag, Bay Region, and Trans Juba).

¹⁴ EU; *Energy Sector Report for Somaliland and Puntland States*, Oct 2012.

overgrazing (growing population, growing cattle herds)¹⁵ is having a serious impact on the vegetation cover and may accelerate the process of desertification, while making access to biomass fuels more expensive and more time-consuming, especially for women and children who are usually responsible for procuring them.

The results of an energy survey/analysis conducted in Somaliland in 2011(see below)¹⁶ show that biomass energy, particularly charcoal constitutes by far, the most important fuel. In Hargeisa and several other cities, over 90% of end users depend on it (charcoal and firewood) as the primary energy sources for cooking, heating, and baking. It is estimated (MinEnergy) that about a third of the charcoal sold in Hargeisa originates in Ethiopia. Even though the availability and affordability of fossil fuels improved to some extent in recent years, wood and charcoal prices continued to increase. These facts prove that there has been no fundamental change in the pattern of energy use, and that with increasing population, demand for biomass fuels grows and biomass resources become even more threatened (as compared to an earlier survey conducted in 2006 by ADRA). These results hold broadly also for Puntland, and the rest of Somalia, even though many of the studies are carried-out in Somaliland and Puntland which have better security and are thus more welcoming to researchers.

Another recent study, conducted by Habitat¹⁷ for the EU has surveyed the energy situation of Mogadiscio and has provided revealing data as well as insights into possible actions. The demand for energy for cooking, lighting, powering household appliances and for productive activities is very high and strong, but biomass supply is dwindling. Continued availability of biomass for cooking is not guaranteed as this fuel source is getting severely depleted near cities (so to speak: charcoal sold in Mogadiscio originates several hundred kilometers from the city). The very poor in Mogadiscio now use waste paper and plastic for cooking. All energy forms consumed in Mogadiscio are increasingly expensive and a typical household spends an average of US\$ 60 on energy, equivalent to about 30% of its average monthly income (of US\$190-220).¹⁸ The study suggests developing a strategy for trying to substitute away from biomass fuels, as is necessary everywhere else in Somalia.

2.2 Subsector: Electric Power

Just before state collapse, at the end of the Eighties, Somalia as a whole had installed power generation capacity of about 175-180 MW of which near 100 MW in Mogadiscio.¹⁹ Many cities had grids and service varied in quality according to the availability of fuel. Except for major cities (Mogadiscio, Hargeisa, Kismayu) that had conventional grids, other smaller cities and towns that had electricity relied on diesel generators and mini-grids much like those of today. Tariffs were low and level nationwide and so, high-cost isolated systems were subsidized by the main cities which tended to be less costly to serve (since all load centers were served by same utility, ENEE). According to historical estimates, electricity production in Somalia (in 2008) was 326 GWh or just 33 kWh/capita/year, compared to the world average of 2,777 kWh and the African average of 579 kWh²⁰. Electricity generation is entirely diesel-fueled and supply is through a large number independent, individual, mostly small power producers operating local, low-voltage mini-grids. Electricity is extremely expensive and inefficiently supplied, the absence of normal grids causing huge losses (technical, non-technical or economic) between generation and final use.

¹⁵ While it is not entirely a concern of this report, overgrazing and destruction of rangelands appear equally dangerous, and certainly contribute to the degradation of the vegetative cover, source of supply of all woodfuels.

¹⁶ UNDP-Somalia; *Energy Consumption and Supply Survey, Somaliland*, January 2011.

¹⁷ UN-Habitat/SECIL; *Energy Baseline Survey* (for Mogadiscio), June 2013.

¹⁸ UN-HABITAT/Secil; *Energy base-line Survey*, Mogadiscio, 2013.

¹⁹ *World Bank; Somalia, Issues and Option in the Energy Sector*, Washington, 1985.

²⁰ Per capita per annum.

Public supply of electricity ceased altogether after the state collapse as looting and wanton destruction prevailed.²¹ Small firms emerged to supply power in their immediate vicinity at low tension. These small private generators supply their clients' homes directly with wires without any transformation. This is still largely the only type of supply available, except for a few cities where grids have been rebuilt or were not destroyed.²² So, electric power is supplied under the most primitive conditions, with wires (at tensions as low as 200V, or lower depending on distance) going directly from the generating machines to the home of the customer. The distances are also often such that the tension (voltage) is noticeably lower upon arrival and appliances function badly while suffering damages (brownouts). It is not possible to improve efficiency in such a system. Further, the "tariff" is often based on the number of appliances at the home of the customer (so many light bulbs, TV, fan, etc)²³. Although it has been reported that most new electricity customers are now provided with meters, the cheapest Chinese mechanical meters appear prone to early breakdowns, as the Ministry of Energy in Hargeisa reported that about a third of meters were not functional. A rate of \$10 month (more or less a traditional price by now) for a 50 watt bulb (in use, say, 6 hours a day) is equivalent to more than US\$ 1/kWh. For comparison, tariffs in other similar countries were: 10-12 us cents/kWh in Burundi, 50-55 us cents in Liberia (Monrovia), 18 us cents in Kenya, and about 40 us cents/kWh in Uganda.²⁴

Several cities have small, generally dilapidated grids, and not always in use e.g. Garowe, Hargeisa, Bosaaso, Berbera, Qardo. Garowe has an 11kV line, while Hargeisa has a 15kV line²⁵. Only "real" grids (see below in footnote) would enable the competitive operations of several independent generators, and allow for measures to reduce losses and improve efficiency. And they can only be envisaged in places where security is such that expensive installations and equipment can safely remain on the streets. Most electricity generation is privately-owned and managed (Hargeisa, Garowe) but there are some instances of public electricity supply (e.g. with, until recently, minor publicly-owned utilities in Hargeisa, Qardo, Berbera, and Bosaaso, but now semi-public utilities in all four cities).

Installed generating capacity and connections: All Somali Areas*

Area	Installed Capacity (kW)	N° of Connections	Power per connection (Watts)
Mogadishu/Benadir	29,370	120,850	243
Central State	6,610	16,000	410
Hiraan & Lower Shabelle	3,050	8,115	370
South-West State	4,064	7,500	400
Jubba State	2,400	12,500	192
Puntland State	11,375	19,535	430
Somaliland State	46,535 ²⁶	85,500	540
Grand Total	83,404	270,000	310

* This table is the best the Mission could cobble together, although it is certain it represents an overestimate of connected households, especially in Mogadiscio and Hargeisa/Somaliland

²¹ Except in Bosaaso, Qardo, Berbera, and later Hargeisa.

²² Bosaaso, Qardo, Hargeisa, Garowe, Berbera.

²³ Reported to consultant by manager of El Mansoor private generation company in Hargeisa and by numerous consumers.

²⁴ Source: EU and World Bank project documents. The example of Burundi, however, should not be followed: the utility buys power from a private generator at 49 us cents/kWh and sells it at 12 cents/kWh, with the Ministry of Finance paying the difference (37 us cents/kWh) as a subsidy.

²⁵ The 15kV tension is a relic of the colonial period, as it was the standard Italian distribution voltage between the two World Wars, and it was introduced in Eritrea, Somalia, and Ethiopia. It has remained in use but is no longer frequently used or produced, and should be replaced by 11 or 33 kV. Further, the grid in Hargeisa is used only by SEA, serving a minute share of the market.

²⁶ The Ministry of Energy in Hargeisa mentions installed capacity of 70 MW in Somaliland but with actual availability at 50%. The number in this table was computed by our late colleague Eng. Musse A. Abdi based mostly on data from electricity generating companies (and it approximates actually available capacity).

Total installed generating capacity in all of Somalia at this time (2014) can be estimated at about 80-85 MW, and there may be about 250,000 connections.²⁷ If these numbers are broadly indicative of the situation, they would imply a capacity of about 300 W/connection at generation, which is little but sounds plausible. Table below illustrates the overall situation.

This table needs to be put in perspective (as also most of the data reported in this Assessment). These data must be taken with a grain of salt, broadly indicative of the likely situation, as opposed to a precise description of it. The number of connections in both Mogadiscio and Hargeisa is likely overestimated. The numbers are based on reported figures by Ministries of Energy and by some electric power supply companies, often as percentages of city populations (where neither the number of connections nor the number of households in the city is known). In fact, all these numbers are secondary data, as there are no surveys of access to electricity in large cities. Interpreting this table would therefore suggest that there must be between 200,000 and 250,000 household with access to electricity in Somalia as a whole (say, 1.5 million people out of 9.5 million overall population, or 16%, not too unlike a number of African countries in years past, abstracting from quality of service and quantity of power available).

The generation figures reported are also subject to interpretation: in fact, in most places, available generating capacity is estimated at half of installed capacity (name plate capacity).²⁸ If so, then the capacity (at generation) available to each household would be about 160 W (rather than the 310 W computed in table). But that is not the whole story yet: most generators report 50% grid losses (losses are usually based on energy, but can be understood by analogy when related to power), and therefore, the computed 310 W, later reduced to 160 W, now drops further to, effectively, 80 W/connection.

At present, access to quality electricity supply is limited, and the level of supply per connection (wattage) is also very low. Supply is reported to often cover 24 hours/day, but with frequent and long outages. Drops in tension (voltage) are frequent and long, and at times, supply is limited to 5-6 hours per day. Since distribution is at low tension (480/220 V) over sometimes long distances, declines in tension and technical losses are very high (most small generators report losses in the 40% to 50% range, which is to be expected). However, the proportions of people with access to electricity appear high especially in the North, with coverage in Hargeisa reported at near 80%, and 60%-70% in Garowe. Mogadiscio is reported to have about 2/3 of households with access to electricity. While substantial numbers of people have access to electricity, especially in cities and in the North, the producers are unregulated and meet neither service nor quality or safety standards, as there are no effective policy/regulatory authorities to set and enforce standards (see above paragraphs describing the available data). However, with so many connections reported in relation to low capacity (installed and available), power/connection must be extremely low (100 Watts/household ?) powering only lighting. In short, this apparent high level of access in cities is offset by the low quality of the service (voltage, power cuts) and the limited power available. Approximately 40% of households²⁹ use battery-powered torches/flashlights for lighting, some are reportedly using solar powered lanterns, while many others use kerosene.

Taking these factors into account explains why "access" appears high, but is really rather low (see above). This apparently "high" access means that a fairly high number (or proportion) of city households are able to turn on a light bulb at night. Hardly what electrification means, and hardly enough to enable electricity to contribute to productivity.

²⁷ As estimated through direct interviews, estimates by authorities, and other pieces of information (collected by Mission staff).

²⁸ The HABITAT-Secil Baseline Study of Mogadiscio suggests that 10MW of the 29 MW belong to AMISOM, meaning that they are not available for public electricity supply.

²⁹ If so, that would mean that these 40% do not have access to electric lighting, and only 60% do, contradicting the earlier statements that 80% have electricity. Confirming also the earlier claim that access to electricity is overestimated.

2.21 Tariffs

In the regional centres like Hargeisa, served by the Somaliland Electrical Authority (SEA, in addition to more than a dozen private generators of every size), Garowe (in Puntland), and in several other regional cities, customers are billed through meters and the charges are (a) US\$0.65-0.80/kWh for three-phase supply; and (b) US\$ 0.60-1.2/kWh for single-phase supply (with larger consumers paying the lower-tier tariffs). However, across the nation, the average charge per kWh of electricity used is US\$0.80-1.2. In many parts of the country, hospitals, mosques, schools, public clinics, recreation centres/community halls and streetlights are charged US\$0.50 per kWh. Some suppliers do not charge some of the institutions mentioned. In addition, in some regions, government-owned buildings are connected to government-owned power stations and do not pay for electricity (Bosaaso, Qardo). What is proposed about tariffs in this Report is that, in accordance with the most recent best practice of electrifying rural areas of Africa, donors are agreeing to cover a substantial part of investment costs, and requiring that consumers cover the rest of investment costs and all operation and maintenance. The introduction of renewable energy (with negligible operation and maintenance costs) in electricity generation has permitted this development. In broad terms, the proposal is for donors to finance 75% of investment costs, with the remaining 25% required of the private investor to be repaid by users through the tariff, together with Operation and Maintenance of the systems. This should permit a substantial fall in tariffs and thereby allow a much larger number of households to afford electricity. Rough calculations suggest that a hybrid system (with 75% diesel and 25% solarPV generation) under above described terms, could lead to tariffs in the range of 60 to 70 us cents/kWh.

2.22 How high are tariffs, really, in Somalia?

Much has been written about the high costs of power supply in Somalia and debates rage about the profitability of power generation. Since all generation in Somalia is diesel-fueled, it might be useful to examine the costs of diesel generation.³⁰ Efficient diesel generation at a reasonable scale, say, above 5 MW costs about US 50 cents/kWh (there are many examples: Liberia, Burundi,...). Adding average losses of 50% (maybe more in Somalia) makes it 75 us cents/kWh. Adding-in other cost disadvantages (small scale of imports, lower scale of generation, bad/worse maintenance, etc) can easily add another 25 us cents/kWh, thereby showing that \$1/kWh in Somalia is more or less justified by costs. New generating plant would be temporarily more profitable. If and when donors agree to subsidize capital costs (say, by 75% as in the Mali Project mentioned below) for hybrid systems, with diesel (or HFO) for baseload and renewable energy for the rest, electricity tariffs could drop to below US 50 cents/kWh. Furthermore, should oil prices stay relatively low, the cost of efficient diesel generation could drop by another 5 us cents/kWh. That could expand the potential household demand for electricity by a substantial amount (larger businesses already pay closer to 60-70 us cents/kWh, so the drop in tariffs would be less marked). These greater sales would help make the operations of larger utilities, operating at optimal scale, financially feasible.

Therefore it would seem that under Somali usual conditions, the profitability of electricity generation and distribution is not excessive. The conditions which make it so are: old and poorly maintained generation plant (generators, actually); expensive and dirty diesel fuel; and primitive distribution system, with undersized and damaged conductors of excessive length causing losses of 40-50% of the energy injected into them. Most probably, generators earn only modest profit, akin to economist's concept of "normal profit", i.e. the profit needed to keep generators in business with the size of the industry needed to cover the effective demand. Consequently also, those few firms that happen to have invested in new generators (or maybe in better maintenance) probably earn a small,

³⁰ See the cases of Burundi and Liberia (EU, *Energy in Fragile States*) where electricity is generated at costs of 50-55 US cents/kWh. See also the case of Mali (World Bank/IDA, *Mali Renewable energy project, Project appraisal document for a rural electrification hybrid system project in Mali*, November 15, 2013).

temporary premium (until they generators age..) analogous to Ricardian Rent (tariff is set to cover costs and allow earning of normal profit by normal generators, i.e. those with old and poorly maintained plant, and so, generators with better plant earn a small surplus, since their costs are, maybe temporarily, lower.

2.23 North: Somaliland and Puntland areas

Somaliland claims that total installed generating capacity is about 70 MW (Ministry of Energy, Wakaladda Korontada/SEA), but the share of generating capacity actually available is not known. The Assessment's own data collection shows about 46 MW. In Hargeisa, according to the state-owned utility SEA (and Ministry of Public Works), perhaps 80% of households (out of an estimated 120-130,000) are said to have access to electricity, of which 5000-6000 are/were served by SEA. In Hargeisa, SEA, a publicly-owned, vertically-integrated utility (owning generation plant and the 15kV medium-tension line), competes with a host of private generators, who deliver power to their customers at low voltage directly with their own wires.³¹ In Hargeisa, only the SEA uses the 15kV grid, private generators do not.

The installed capacity in Puntland is not known accurately (see table above) but Bosaaso and Garowe together have about 10 MW of installed capacity of which probably not more than half is available³². According to the utility NEC in Garowe, they serve 6000-7000 customers, growing by about 500 each year (in a city with about 10,000 households) suggesting that 60% to 70% of households have access to electricity. In Bosaaso, a city of perhaps 700,000 inhabitants (more than 100,000 households), there are only 12-13,000 connections. There is only one supplier, a descendant of the previous state-owned firm ENEE, but the private sector is attempting to break into the market. In Garowe, there is only one generating company and competition in generation is discouraged by the authorities.

2.24 Southern Somalia and Mogadiscio

Before the collapse, Mogadiscio had installed capacity of 80-100MW in two power plants, and a well developed medium-tension (medium voltage) grid serving the whole city.³³ The city was not interconnected with any other load/generation center. In comparison, the recent SECIL/HABITAT Benchmark study of Mogadiscio estimates total installed generating capacity at 39 MW in 2013 with effective available capacity at less than 50% of installed capacity. Considering that Mogadiscio has more than one million inhabitants, perhaps 300,000 households (of which over 60,000 are IDPs), and perhaps as many as 100,000 electricity connections (from micro-data of private generators), generation per connection must be minimal. There is no modern grid in use and all generators supply in low-tension (low voltage) with wires to each customer's house. About 65% of households in Mogadishu are reported to have access to electricity supplied through private mini/micro grids, but this seems obviously overestimated and contradicts the data collected from private generators.

In other parts of Southern Somalia, conditions are similar to those of Mogadiscio, namely, generating capacity available is about half of installed (name-plate) capacity, distribution is at low tension (low voltage), generally at 400-220V, but a times, e.g. Belet-Weyn, distribution tension is as low as 220V-150V. At those tensions, losses must be extremely high as soon as the conductors (which are frequently undersized and rusty) reach a few hundred meters. Other cities in Southern

³¹ It would be better to restrict the use of the word "grid" to those cases where power is transformed to a higher tension to be transported, and then back to lower tension when brought near the consumer, for distribution.

³² Garowe has 3 MW installed but has difficulty covering the 1.6 MW evening peak. See table above for best estimate of capacity in Puntland.

³³ Another source shows Mogadiscio with about 70 MW in 1987. The World Bank shows total installed capacity in the country at about 135MW in 1985, and capacity in Mogadiscio at 55-60 MW (*Issues and Options in the Energy Sector*, Washington 1985). Even the historical data is not easy to establish.

Somalia also have minimal capacity per household (from about 200 Watts to 300-400 Watts) with significant interruptions and voltage drops.

The weaknesses of the energy sector, in the case of electricity supply, include limited access and small-scale diesel generation which result in excessively high costs leading to high tariffs, ranging between US\$ 0.80 and US\$ 1.50 per kilowatt hour.³⁴ This means that only a small segment of the Somali population can afford grid-delivered energy services and consumption remains minuscule (perhaps 20 kWh/capita/year in cities). This high price also explains why electricity is used almost exclusively for lighting. Lower tariffs, higher capacity per connection, and more reliable supply would be important prerequisites to using electric power for productive activities.

It is possible also, that (almost) all who can afford electricity in Somalia are supplied, because at 1-1.5 \$/kWh, not many people can afford it. Therefore, expansion of demand (and of supply, naturally) is thus strongly conditioned by increasing efficiency and lower tariffs that should lead also to higher consumption, to make the running of larger utilities financially feasible. Some of this can happen by using cheaper fuels (HFO), and by adding small measures of (donor funded/subsidized capital costs) renewable energy. But serious savings (efficiency gains) can only be achieved when diesel generation reaches optimal scale (significant renewable generation can then be added) and real grids permit, say, a halving of distribution losses (which may exceed 50% under current physical distribution arrangements). The fact that a large share of population lives in cities makes electric power supply in cities a priority as a necessary improvement in standard of living, as a contribution to stabilization and improved security, and to expand opportunities for productive use of power.

2.3 Subsector: Petroleum products

Petroleum products (essentially for transport, electricity generation, and minor quantities for cooking and lighting) account for about 10% of total energy use. Electric power generation (almost entirely diesel-fuelled) accounts for about 2 of the 10 percentage points provided by petroleum fuels. Most of the rest is accounted for by transportation (gasoline and diesel). Gasoline, kerosene, and LPG are already imported and widely available over most of Somalia. LPG is used for cooking by the better-off urban population and kerosene is used mainly for lighting by the less affluent urban and rural population. Gasoline and diesel are said to be of poor quality and apparently lead to premature engine wear and breakdown. The absence of norms and standards or weak enforcement of them is certainly to blame. Prices of petroleum derivatives broadly follow world prices with rather limited taxation (\$ 6-7/barrel, equivalent to about 4 us cents/litre) on the part of Federal and Regional Administrations. This may be a good strategy, for if taxes were higher, the incentive to evade would also be stronger, and with limited enforcement capacity, the administrations might collect less revenue than with lower taxes (which make the cost of compliance modest).

Consumption of LPG in Somaliland has grown very fast in recent years and will continue to do so with imports in bulk about to start. Plans by a major LPG importer indicate consumption expected at about 800 tons/month (10,000 t.p.y.), given that prices are expected to drop by about 30% with bulk imports saving on both gas costs and freight.

LPG consumption in Puntland is markedly lower, at perhaps 10 tons/month.³⁵ A study by an NGO called ADESO funded by the EU claims consumption in 2014 may have been 400 tons, or 33.33

³⁴ It is reported that large users are able to negotiate discounts from the published tariffs. And many enterprises report paying tariffs of US cents 60-70/kWh. Obviously, a more desirable load can be served at lower costs. Furthermore, in late 2014 several generating companies had reduced tariffs to below \$1/kWh in response to falling diesel prices. A barrel of diesel fell from \$170 in 2013 to \$140 in recent months (to just under \$1/liter).

³⁵ Estimate based on information from LPG importer/distributor. See also: *ADESO Presentation LPG Nairobi*, 9 Nov 2014. After reviewing this preliminary report/presentation, it would seem this study suffers from some methodological problems. Samples of households analyzed by this study

tons/month. About a year ago, it was reported that LPG was not available for public sale in Mogadiscio. It now appears that it has become available, but there is no way of estimating in what quantities. As to kerosene, a small number of people already use it for cooking, about 5% of urban consumers, and perhaps a few rural consumers. Some small businesses also use kerosene for process heat and for institutional cooking. If plans to ease pressure on Somalia's vegetation cover through substitution of cooking fuels away from charcoal are to be effective, then perhaps LPG and, more likely, kerosene will have to supply greater shares of the (cooking) energy mix, especially in cities. This substitution is one of the most important tasks to be carried-out over the next 10 years, as the survival of Somalia's vegetative cover, and of all that depends on it, (i.e. livestock and people), is at stake.

2.4 Subsector: Renewables

There is a significant potential in all Somali areas in terms of renewable and alternative sources of energy, such as solar and wind power, but so far, due to both security and funding problems, only very small, timid experiments have been conducted with solar and wind power. Shortages of technical staff, lack of accessible knowledge, the small scale of existing generation, and primitive distribution systems further limit the immediate practical application of renewables to power generation in most of Somalia. The solar energy potential ranges from 5 to 7 kWh/m²/day with over 310 sunny days in a year (sometimes reported as about 3000 hours of sunshine per annum, but 2500 hours seems closer to the mark). These are very high values (Germany has less than 100 days/yr; Sicily, as one of the best solar energy zones in Europe has only about 150 days of sunshine/yr). However, the use of solar energy has been rather limited in Somalia because of lack of information, lack of access to end-use devices, and poverty which prevents purchase of appropriate generating and end-use equipment.

Somalia is also characterized by strong wind regimes with annual average speeds of 1.5 to about 11.4 m/s.³⁶ Many organizations are starting to monitor wind speeds and sunshine hours in hope of developing renewable energy projects in the near future. There is a small hydro power potential in Somalia, estimated to be around 100-120 MW, along the Shabelle and Juba rivers, but remains it untapped, for obvious reasons, namely lack of security for building or operating a costly hydroelectric facility.³⁷ In Northern regions, there are deposits of coal and lignite but only a little artisanal exploitation has occurred, even discontinuously so far. And with a coastline exceeding 3000 km, Somalia has a huge potential for wave and tide-based power, which can eventually be developed, once the technologies are proven. In any case, the systematic use of renewable sources of energy requires more and better evaluation and mapping of these resources

An experimental project is under implementation in Garowe, to add small amounts of wind energy or solar PV or both, to a renewed, diesel-based system. The power utility NEC³⁸ in Garowe has been monitoring wind speeds for the past three years, as it plans to add wind/solar generation to its diesel plant.³⁹ It is probable that with the support of donor funding, the creation of hybrid small grids in a number of cities could increase supply of/access to electric power.⁴⁰ Further, if tariff policy is based on recovery of only operating and maintenance costs (and only a small share of capital costs, the

show very high access to electric power in northern cities, 85% in Puntland cities, and 94% in Somaliland cities, suggesting these samples may be skewed towards higher income households. More commonly accepted, if still optimistic, figures for access to electricity are quoted in preceding paragraphs and they range in a band around 70%.

³⁶ Sustained wind speeds in excess of 6-7 meters/second, which are needed for wind generation, are very frequent; and solar PV potential, at 5.8 to 6 kWh/sq.meter/day is the average insolation in Somalia.

³⁷ Should conditions improve to make construction of such a plant feasible, studies funded by the EU in the 80's could quickly be updated and implemented. However the economics of this scheme were always marginal, and there is the added complication of the Juba being an international river with most of the active watershed in Ethiopia.

³⁸ Nugaal Electricity Company, NEC

³⁹ The project costs \$3-4 million, as it includes replacement of the diesel-fueled generating capacity.

⁴⁰ Existing diesel-based grids, e.g. Hargeisa and Garowe, could be complemented using solar/wind generation, with some reduction in expensive diesel generation, so that the weighted average costs (based on tariffs covering operation and maintenance only) could drop, allowing some reduction in tariffs. Technically, however, these microgrids are not easy to manage.

rest of which to be covered by donors), then the proportional reduction of diesel power generation could lead to a reduction in tariffs, making electricity affordable to greater numbers of urban consumers.

In recent years, a number of small projects have been implemented in various parts of Somalia, and some solar generating capacity does exist, but it is in the kilowatt range rather than in Megawatts. It must be kept in mind, however, that discontinuous sources of energy (such as SolarPV and wind) cannot alone serve to feed a grid, and that conventional generation (perhaps even with the help of rather un-green HFO, especially in the larger cities) must still provide the base-load power injected into any city (sizeable) grid, wishing to offer reliable service to its customers.

2.5 Sector-wide issue: Qualified personnel constraint

Another pervasive and cross-cutting problem affecting all of Somalia is the fact that education processes have been at least partly interrupted since 1991 and a supply of educated (young) persons, suitable for further training, cannot be taken for granted. For example, a recent study of Somaliland states there is only one person knowledgeable about energy issues in the sector Ministry.⁴¹ Recent interviews conducted in Puntland for this report show there is not one single person in PSAWEN (Puntland State Agency for Water, Energy, and Natural Resources) who understands energy sector management concepts (power, energy, peak demand, load curve, load factor...) and there is not one person working solely on energy sector management.⁴² Energy and electricity are often confused, as are operations of electric utilities and energy sector policy/management. Given this state of knowledge (not to say ignorance) it seems obvious that training in simple energy sector concepts and management must be provided before Somalis and external partners can conduct any meaningful dialog on sector development and policies.

Since additional qualified labour will be needed both to staff operating enterprises and public bodies, and local supply is limited, donors and Somali administrations should already start to consider ways and means of attracting young persons from the Diaspora to return and work in the sector, as well as starting long-term programmes to train suitably prepared/educated young people, especially for higher level qualifications (e.g. high-level specialized technicians, engineers, planners, accountants and financial analysts, energy economists, etc). In this context, the quickest action could be for donor countries (within the New Deal group) to set-up scholarship programmes for Somali young persons in their universities and technical training institutions. The search for appropriate technical assistance to staff the first training/capacity-building interventions should also begin immediately, so that this activity can start and make some progress in the first three-year period. This issue will be mentioned several other times, in different contexts.

⁴¹ EU, *op.cit.*

⁴² Interviews conducted by this author in Mogadiscio, Garowe, and Hargeisa confirm that these concepts are not clearly understood.

Chapter 3: Energy Sector- Recent Developments and External Donor Assistance

3.1 Recent developments

3.11 Areas of Southern Somalia

It has been reported that major telecoms investor/operator HORMUUD (ex-Barakat) has offered to construct a medium-tension distribution grid in Mogadiscio and reportedly would be ready to pay a fee of \$ 4 million to the FGS for the privilege. Such a transaction would give a complete monopoly to this group as they would own both the generation plant and the distribution system. However, groups of small generators are reportedly trying to form cooperatives or similar joint-ventures in order to make the heavy investment required to ensure proper electric power supply (presumably including a proper distribution grid in medium tension). Alternatively, the government could build the grid (with donor funding) and make it accessible (for a modest fee) to all generating companies that meet the technical requirements. Unbundling may find a more propitious home in Somalia than in Europe.

The Malaysian firm Pollaris is seeking a license to explore for hydrocarbons (mainly natural gas) and in exchange is said to offer to build a power plant of 80MW (2X40MW) capacity in Mogadiscio, initially diesel-fuelled but eventually converted to natural gas (naturally, if and when such gas is found). Whatever the merits of this proposal, 80MW appear at this time to be vastly in excess of effective demand for electric power in Mogadiscio.

Ethiopia, Somalia, and Kenya signed a Memorandum of Understanding (in November 2014) to build a hydroelectric power plant on a watercourse flowing near the tripoint where their borders meet.⁴³ Kenya, Ethiopia and Somalia have agreed to construct a multi-purpose dam and a hydropower station on the Dawa River in the border town of Mandera. The river appears to be intermittent and the power plant is expected mainly to save diesel fuel during periods of high river flow as opposed to creating firm power capacity. The economics of such an investment are highly sensitive to the price of diesel fuel, which happens to be at a historical low at present. The decision came during a three-day meeting in Nairobi organized by the Intergovernmental Authority on Development (IGAD) to discuss co-operation in the management and sustainable development of the river. During the meeting the three countries also proposed the construction of a bridge to link Kenya and Ethiopia, which will promote cross-border movement across the seasonal river. The three countries formed a technical team, which will be steered by IGAD, to conduct a feasibility study of the proposed projects and share the findings.

⁴³ *The Standard* (Daily) Nairobi, 14 November 2014.

Recent Developments:

Mogadiscio/Southern Somalia

- Hormuud Group offers \$ 4 million for privilege to build grid and power plant in Mogadiscio.
- Pollaris Co. offers to build 80 MW power plant in exchange for gas exploration license.
- MOU signed under IGAD auspices to build power plant on Dawa River (Ethiopia/Kenya/Somalia).

Somaliland area

- Semi-privatisation of Somaliland Energy Agency (State-owned Power Utility).
- Berbera Corridor: Ethiopia undertakes to supply more electricity to border areas of Somaliland.

Puntland area

- Renewable Energy Power Generation of 1000kVA being installed in Garowe power plant.
- Private Financial Group building 6 MW diesel/HFO power plant at Bosaaso.

3.12 Area of Somaliland

Major change is under way at Somaliland Electricity Agency. In March 2013, a newly-appointed management team at SEA was busy trying to improve financial performance (billing and collections) and was apparently making good progress by September 2013⁴⁴. However, in March 2014, the entire generation capacity of SEA broke down and they were unable to serve their near-6000 customers. The management team was therefore dismissed, and a local business group was persuaded to intervene and purchase generators (by Dec 2014, totaling about 6 MW). The number of customers supplied dropped from 6000 to about 3000 but appears to be growing again in late 2014, as the generating capacity continues to grow.

SEA is now under temporary management by the Ministry of Finance because the private investors (a company called "Independent Power") are poised to take control imminently. When the restructuring plan is completed, late in 2014, Independent Power will own a share of about 67% of total assets worth \$7-8 million, including both the power plant and the grid, as against the Government's 33%. Total private investment was about \$4.5 million (of which \$ 1.5 million to repay debt owed by SEA). It seems that this opportunistic privatization (or rather conversion of a publicly-owned enterprise into a joint-venture, or PPP) is being extended to Berbera, where a subsidiary of SEA is the main power supplier, and there have been consumer protests rejecting the proposed privatization. SEA charges slightly lower tariffs for its power, reportedly \$ 0.90 /kWh, as opposed to the \$1- 1.20/kWh charged by private generators. This development has positive and negative aspects. Positive in that it turns a hereto publicly-owned power supplier into a privately-managed company, with attendant productivity gains, but it may also privilege this private company at the expense of the many other private power suppliers that operate in Hargeisa (especially now that external funding may become available for optimal size, state-of-the-art generation plant).

⁴⁴ When this author first met with the SEA.

Somaliland signed a Memorandum of Understanding (MOU) with a high-level Ethiopian delegation in November 2014 covering transport (roads and port facilities of the so-called Berbera Corridor), shipping and logistics, and an increase in the volume of electricity supplied by Ethiopia to border towns in Somaliland.⁴⁵

3.13 Area of Puntland

The managers of the Garowe privately-owned utility NECsom (Nugaal Electricity Company, Somalia) reported that their project of adding renewable energy to their diesel generation capacity is almost completed: they have replaced their aging diesels with new sets, 4x 650 KVA, and are adding 500 KVA of Solar/PV and 500KVA of wind turbines. This was achieved through an expansion of the capital base, contributed by new partners. The equipment has already been procured and delivered. It is awaiting installation by an Italian engineering concern at the beginning of 2015. The renewable energy capacity appears somewhat large in relation to the conventional (base-load) power capacity and might lead to some system management problems in case of unusual wind or solar events (prolonged cloudiness or lack of wind). Furthermore, it is unclear whether they will have the capacity to maintain their wind-turbine as the needed skills are not currently available in Somalia.

The power plant at Bosaaso is ostensibly publicly-owned. It has continued in operation since before the collapse of 1991. However, it operates as an independent company in that it receives all revenues and effects all expenses directly (without the intermediation of the Ministry of Finance). Until some years ago, it managed to cover the demand peak (about 1.6 MW) by using the old, original generators. It paid its workforce from its collections. In more recent years, except for one machine, the original generators are out of order. In order to continue to serve their customers, the workers of the plant collected funds and purchased replacement generators, in absence of funding from the government. They are now therefore, *de facto*, part-owners of the plant. The financial arrangements are not known, but in previous years, collections were barely sufficient to pay the wage bill and diesel fuel. Therefore, a previously state-owned enterprise has now become a joint-venture or PPP, without any formal agreement or legislation to refer to. A similar situation apparently prevails at Qardo.

Independently of all this, a private investment group has built a 4 MW plant (to be expanded to 6 MW) on the outskirts of Bosaaso to run on either diesel or HFO. The partners do not have a grid, and discussions with the state-owned plant (which owns the grid) have been unsuccessful. Unless power tariffs were to be drastically reduced, demand for such quantities of power appears inexistent in Bosaaso. Furthermore, there are no facilities to import HFO into Somalia. This plant is therefore stranded for the moment, though it could survive as a self-producer (or as a captive generator for any future nearby plants/factories).

3.2 Donor Assistance to the Energy Sector.

3.21 Background

There is not a great deal of activity from external development partners in the energy sector. In part, this is due to the perceived general insecurity, given that many energy systems are grid-based and thus vulnerable to banditism, vandalism, and looting. All types of energy supply systems also require the installation of costly equipment, sometimes in the open. Also, the existing electric power industry has vested interests, and cannot just be swept aside, thus making new investments more difficult to plan and more uncertain. The industry is also fragmented (generation/distribution units limited in size by the losses that can be tolerated with distribution at low tension), with large numbers of firms, especially in the larger cities, but often more than one generator even in

⁴⁵ Ethiopian newspaper *Capital*, 23 November 2014. This may include the interconnection of the city of Borama, located very near the Ethiopian border, with the Ethiopian power grid.

small/medium-sized cities. The role of governments is minuscule, almost absent, and external donors tend to want to deal with governments, especially if ODA is involved, as the international donor subsidy must go to the collectivity, or to communities, rather than to private firms or businesses.

The main recent or current donor activities are listed in the table below:

SOMALIA ENERGY SECTOR: RECENT DONOR ASSISTANCE		
Agency	Project Scope/Name	Funding (\$ Million)
UNDP	i) PROSCAL, Charcoal Substitution w modern fuels.	20+ (?)
	ii) Solar Initiative/JAPAN: installing solar panels on hospitals in South and North (4 x 25 kW).	1.0
European Union	i) Somaliland Energy Policy Dialogue, T/A (SEPD).	4-5
	ii) Somaliland Non-State Actors, T/A (NSA).	
	iii) Somaliland Energy Livelihoods Project (SELP).	
	iv) Millennium Initiative (mainly Puntland areas), also known as Rangelands Project and Charcoal Substitution Project with an LPG component (Euro 23 million)	26-27
	v) Somalia Energy Transformation Project (SETP); fuel substitution and non-grid energy services/products all over Somalia (Euro 2.7 million).	3.0
USAID	Wind Generation Pilot project/legal assistance	0.5
World Bank	i) Somalia Power Master Plan (mostly Northern Somalia)	1.0
	ii) Mapping of Renewable Resources	n.a.
	iii) Power Interconnection with Ethiopia, and transmission/distribution project	n.a.
AfDB	Somalia: Infrastructure Needs Assessment and TA	1.0

Administrations themselves (Federal, Regional, Somaliland, Puntland, etc.) have had limited capacity and resources to address energy sector issues. They have also mostly allowed private investors to enter electricity generation informally, (as there is no legislation governing private investment in the energy sector). In a few instances, governments have either continued supplying electricity from State-owned facilities (pre-state collapse), or resumed partial public electricity service. In general, they have allowed the private sector to continue supplying cities with petroleum products and charcoal, taxing them for revenue. Governments have also sought to ban charcoal exports, with limited success.

Until recently, donors have intervened mostly on humanitarian problems, and rightly so. However, especially in areas where security has improved, donors have timidly started to conduct small-scale projects in various parts of the energy sector. And it appears several donors are now beginning to consider greater involvement in it. The ratification of the "New Deal" with more predictable donor support for infrastructure should permit a jump in such projects, at least where security conditions have improved and permit new investment in costly electric power grids. In recent years, the EU and in lesser measure, the UN System (with donor funding) have been the major donors/implementors in the energy sector. The World Bank and the AfDB are poised to enter soon. The main donor efforts (in the pipeline, ongoing, or recently completed) are indicated in the table below.

3.22 Recently completed or ongoing projects

Assistance by donors to Somalia's energy sector is minimal, and limited mostly to the Northern regions. The EU, UNDP (with donor funding, Japan, Norway, etc.), and USAID have been the most active donors though even their efforts have been limited. Several projects, conducted in recent years or still ongoing, aimed at improving the efficiency of use of traditional fuels, primarily charcoal. UNDP has conducted a modest, Somalia-wide project that included an experiment with improved charcoal stoves, as well as the introduction of improved charcoaling methods. UNDP is also implementing a US\$ 1 million pilot project, the Japan Solar initiative, that proposes to equip hospitals with solar facilities for electricity and water heating (one each in Puntland, Somaliland, and two in Central and Southern Somalia). It also included the training of 100 technicians in installation and maintenance of new and renewable energy equipment. This project was being successfully completed at the end of 2014. It seems the firm⁴⁶ that installed the solar units in hospitals has obtained a number of other, private sector contracts for similar units.

UNDP is implementing also a programme intended to be large-scale, nation-wide, to substitute away from charcoal, together with some reforestation, under initial external seed-money funding. This larger-scale project has broadly similar objectives to earlier pilots, namely efficiency in traditional energy use and transformation (charcoaling), and search for alternative cooking fuels.⁴⁷ Though this project (PROSCAL) has been ready since late 2013, donors have not rushed to finance it (its design size was for \$20+ million). The reason appears to be that donors have decided to await the development of the new financial architecture before agreeing to fund this project.⁴⁸

USAID has been supporting various parts of Somalia, though principally the North, with assistance in drafting legal and regulatory texts. It has also supported a pilot project of wind energy (5 small wind generators at Hargeisa Airport, costing \$ 350,000)⁴⁹ which became operational in late 2014 and were linked to the grid. However, the Minister of Energy decided to halt their operation because he found that the required maintenance cannot be effected, and to avoid their inevitable breakdown, he decided to mothball the wind turbines until such time as proper maintenance can be carried-out. This is another manifestation of the shortage of skilled personnel, and of the difficulty of maintaining equipment that mixes electronic with mechanical components, like wind power generation does. However, wind energy is raising enthusiasm, and a number of other units are being considered, with some at various stages of implementation in the whole of Somaliland. One wonders whether in this case also, fools rush where angels fear to tread.

The European Union has become one of the most active donors in Somalia. Already in the period 2007-11 it financed two medium-sized projects, larger than pilots but not large enough to significantly modify the fuel mix: Somaliland Energy/Livelihoods Project and the Somaliland Non-State Actors Project (until 2012). Both projects aimed to reduce the consumption of biomass fuels and to introduce new technologies and renewable forms of energy. They were implemented by the international NGO, ADRA. The projects were active in both Puntland and Somaliland and resulted in the distribution of about 20,000 improved charcoal stoves. The projects included training to craftsmen to produce the stoves, and some small firms are still manufacturing and selling them.⁵⁰

⁴⁶ The Danish firm GARSTEN installed 4 units of 25 kVA in each hospital, in Burco, Garowe, Baidoa, and Galkayo. These were turnkey contracts costing US\$ 150,000. each. The firms reports having several other contracts for similar units from Mogadiscio private parties. This is about \$ 7500/kW. This report uses \$8000/kW to cost solar PV generation projects.

⁴⁷ UNDP-Somalia; *Program for sustainable use of charcoal and alternative livelihoods" (PROSCAL), first phase, 2013-15*, funded by Sweden and EU and implemented by UNDP, UNEP, and FAO.

⁴⁸ So, a perverse result: the expectation of a multi-donor trust fund is inhibiting bilateral funding of a prepared and ready project. Further, this project, though with intended national coverage, appears heavily tilted towards the Federal Government, and hardly mentions Somaliland and Puntland, where project activities are bound to be easier to carry out. This may create some implementation problems.

⁴⁹ *IPS Hargeisa*, April 22, 2013.

⁵⁰ For example, the small private firm, Solar Energy Consulting and Construction Company (SECCCO) in Garowe, and also a number of small firms in Hargeisa/Somaliland.

Improved stoves are available in the market in both Somaliland and Puntland. They cost about \$10 dollars, and even though they repay themselves rather quickly from the charcoal savings, the cost is a barrier to their more widespread adoption (especially by poorer households who need them most). They have imported good quality kerosene stoves as an experiment as well as solar cookers. They also did research towards the use of coal briquettes. They also experimented with non-grid modern energy by importing and distributing solar lanterns, and provided PV electricity generation to a small number of schools. Lessons learned from these projects show that many of the pilot ideas were feasible, that there is room for large-scale improved stoves programmes (both charcoal and kerosene), and for a programme to promote the use of kerosene for cooking.

In 2013, the EU has started implementing a major project in Puntland, *The Millennium Initiative*, (also known as, Rangelands Projects, or Charcoal Replacement Project) with a budget of Euro 23 million, implemented by several NGOs and UN agencies. The main project objective is to consolidate food security through the sustainable use of rangelands. Among other components, one aims at reducing urban demand for charcoal by substituting charcoal with other fuels (passive solar, LPG, improved wood stoves, solar cookers, wind, kerosene). The project is expected to test (“pilot”) all these alternatives, but project management had already decided to carry-out a feasibility study of importing larger quantities of LPG (in bulk). The feasibility study has recently been completed (Nov 2014) and is being evaluated by the EU.

A similar semi-private project, importing LPG in bulk and bottling it locally, is currently under implementation in Somaliland under a PPP approach (funded in part by the owners of the private LPG import/distribution company SOMGAS, and in part by credit from an international small-loan facility for businesses). Expected cost savings, from buying in bulk and shipping larger volumes, will permit a 30% price cut, and the supply firm intends to target the top, richest 30% of households in cities. Project was in final stages of completion at the end of 2014. The similar project under study mentioned above, in Puntland would also target highest income urban households, but these might be few, and their switching LPG might not induce a significant cut in charcoal consumption in Puntland, let alone Somalia as a whole. In any case, the Hargeisa-based company above, SOMGAS is also active in the Bosaaso LPG market.

Another EU funded project is the recently approved (through the October 2013 Call for Proposals) Somali Energy Transformation Project (SET) which was presented by ADRA-Germany and proposes to increase and improve access to sustainable, affordable, and appropriate energy services to 100,000 energy-insecure households in rural and peri-urban areas of Somaliland, Puntland, and Southern Somalia. It intends to substitute modern/commercial fuels for charcoal and introduce non-grid based energy devices/services for relatively poor populations far from existing or proposed power grids. It has a budget of Euro 2.7 million (\$ 3.0 million) and should begin implementation in 2015. A project of this size is not small but neither is it large enough to make a significant improvement in increasing access to modern energy in Somalia, or in reducing consumption of biomass fuels. Therefore, there is room for replication, scaling-up with similar but larger projects.

The World Bank which has been heavily involved in the New Deal (together with the EU, AfDB, and other donors) is also preparing to enter the energy sector and has reportedly approved the funding of a substantial technical assistance activity to define an electricity subsector Master Plan, to involve initially Somaliland and Puntland, and then other areas, as and when conditions permit. This Master Plan is expected to cost about \$ 1 million, and should start in 2015. The WB is also about to initiate the study of an interconnection between Ethiopia and Somalia, at a cost of about \$2

million.⁵¹ The WB has also decided to start building electric power grids in a few cities in advance of Master Plan findings in an effort to change the reality by improving things on the ground. In parallel with a project in Ethiopia to map solar and wind resources, the WB is extending project coverage to Somalia. This will provide reliable information on which to base investments in renewable energy.

The African Development Bank has defined a small programme of support to the energy sector also, consisting initially of about US\$ 1 million in studies and technical assistance and several million dollars in technical and feasibility studies for future projects. More sizeable investment projects are expected follow these studies. The AfDB is considering extending financing for technical assistance to public bodies in charge of energy in all Somali areas, including training in basic energy concepts so as to facilitate a policy dialogue between Somalis and their development partners. Since this is a precondition, it is appropriate to carry-out this project soon, and in advance of any other intervention, which would otherwise happen in a vacuum, with Somalis unable to understand, and thus unable to "own", the development of their own energy sector.

DRAFT

⁵¹ At the moment there is no sizeable agglomeration in Somalia/Somaliland with a distribution grid suitable for interconnection, and so, there would be nothing to interconnect. The reason for establishing a few city distribution grids in advance of studies, which the World Bank proposes to do, would be to create some load centers to interconnect. In this optic, expanding the Hargeisa grid would be priority. Other cities might be accessible to a line from Ethiopia and might together constitute a load of perhaps 50-70 MW. This load might be more certain to materialize if tariffs could be expected to fall into the 50-60 US cents/kWh, from current levels of \$ 0.90 - 1.0 /kWh. Still, these modest loads would probably not justify a HV line from, say, Jigjiga to Berbera, of more than 300km (passing through Hargeisa and Sheikh). For border electrification, Borama is the obvious choice as it does not need a long line from Ethiopia but might need some investment for a grid.

Chapter 4: Introduction of the Action/Investment Programme for the Development of the Energy Sector.

A quick overview of major donors' ongoing projects was presented above, and it is not substantial. As it stands now, the pipeline of projects under preparation by donors appears rather limited. This reflects basically two facts: the difficult conditions for preparation and implementation of projects generally but also specifically in the energy sector, and the intractability of Somalia's main energy-cum-environment problem, which defies simple solutions and must be addressed holistically, on all fronts.

4.1 Felt needs and other background materials

The needs for development of the energy sector, as expressed by Somali leaders, or policy makers, consulted in recent months, emphasize mostly short-term needs. Revealingly enough, all Somali leaders consulted for the purposes of this report expressed virtually the same needs for short-term assistance.⁵² They basically pleaded for technical assistance and capacity-building. As the energy sector is mainly in private hands, these public leaders have also asked for assistance with the formation of PPPs. This makes eminent sense, and deserves to be responded to favourably by international partners. For the rest, while they have ideas about the longer term, these are general ideas about access, coverage, and sector characteristics (relative roles of the public and private sector, type of energy, conventional or renewable, etc.). Two other priorities also emerge immediately: i) the need to improve and increase access to electricity, especially in cities, possibly through the use of renewable energy and, ii) the need to substitute modern fuels for biomass in households. There is little doubt that with the help of technical assistance and training, their ideas and vision would gain in precision, clarity, and depth, enabling them to evaluate better even the proposals made in this Report, as well as those coming from other partners. This would also make possible the ownership by Somalis of this arduous process of recovery and reconstruction of the energy sector and other infrastructure.

By and large, Somali leaders understand that in the energy sector, the time of state-owned monopolies is past and the private sector will have to play a much more important role. Thence a change in the role of the state, from operator of utilities to grantor and supervisor of the licenses or contracts with private independent generators, and perhaps as regulator of grids open to many competing generating companies, under "open access" principles. The same for trade in petroleum derivatives, with common or joint terminals being used by all bulk importers.

4.2 Existing PPPs: de facto relationships

Somalia, however, has certain peculiarities, in that things are always more complicated than they seem. PPPs exist in fact, without the benefit of any enabling legislation, simply *de facto*. In general, the PPP implies that the local, regional authority gives something to the utility (some fuel, some support with initial investment in generators, some market protection...) in exchange for, e.g. free power for public buildings, government offices, mosques, schools, public lighting, etc. The values exchanged are very difficult to evaluate and measure, and so, it is not always possible to determine whether the flows are fair, or may represent a net, unjustified transfer in one direction or the other.

Existing PPP really imply a privileged relationship between the authority and a private firm. Therefore, almost by definition, it cannot be extended to other firms. The point was made by a high official that a truly private firm (i.e. without any relationship to an authority) may not be feasible,

⁵² The most senior people consulted consist of: the Federal Minister for Energy and Water, the Somaliland Minister for Energy and Mineral Resources, the Puntland Minister for Planning, the Chairman of PSAWEN, the Somaliland Minister for Public Works, and the DG of the Puntland Ministry of Environment.

may not be able to operate in Somalia. Resolving this problem, by helping establish a simple but operational PPP framework is required to materially expand access to electricity in Somalia.

The current PPP relationships defies a clear definition: in Garowe, the utility claims to be entirely private, and that the government only gives it fuel for the free electricity they provide certain users (govt, public buildings..). In fact, various ministries reported that they do not get any free electricity, while others reported that the "private" utility had received government help in buying generators. In Hargeisa, the soon-to-be new owners of the formerly state-owned SEA are obtaining a great position from which to enter the electricity business at large scale and will also control the formerly publicly-owned grid, leading to a monopoly position like NECsom in Garowe. Therefore, a simple and operational PPP law or regulation is urgently needed, and it should be the first order of priority for the Ministries and other bodies regulating energy (and within the initial work programme of the advisory/training/T.A. services being provided to these organizations as the most urgent intervention in the energy sector). Not that it would solve many problems but would, at least, simplify the process through a more systematic, codified approach, and start bringing the electric power industry under the rule of law, little by little. But simplicity should be of the essence as complex approaches have no chance of working.

While the TORs for this Study require the identification of an "emergency" programme, it would be preferable to settle on a 3-year short-term one (not exactly emergency, but meant to be implemented fast), as things in Somalia tend to move slowly and any planning horizon shorter than 3 years is likely to be always overtaken by events. This initial period would hopefully lead to the full implementation of the capacity-building and technical assistance activities proposed for the normative/policy-making bodies.

An effective way of starting this Action/Investment Plan for Energy would be to propose for quick implementation all those capacity-building, training, and technical assistance activities that important sector leaders (ministers, chairmen...) insist they require. So, the first three years of the Action Plan would concentrate on these activities, the identification and preparation of other important sector projects (that could be used also as training opportunities for the staff of the sector management organizations), and on measures designed to augment the supply of trained personnel (training and study programmes for young people, domestically and abroad) needed for the development of the energy sector. These activities would also begin conceptualizing the policy changes needed to effect the transition to sustainable household energy (especially for cooking and lighting). Actual investments could also start, but would need to leave some time for the sector authorities the get ready with their technical assistance and for the roll-out of some basic regulatory framework/principles, notably some sort of simple PPP legislation/regulation (to be used for the new/future electric power projects).

4.3 Energy Programme Principles

Any substantive, meaningful, principled programme to expand access to modern energy in Somalia must take into account the needs as seen by Somali decision-makers and leaders (first the training and capacity-building of their own institutions) and deal with the two main issues raised earlier, namely: low access to (grid-supplied) modern energy in cities and excessive consumption of firewood (in countryside) and charcoal (in cities), a thoroughly unsustainable state of affairs. A fourth major set of issues to be addressed is the extreme shortage (lack? absence?) of qualified personnel, and the uncertainty regarding future supply of trainable persons (given 20-year interruption of education processes). So any energy sector development programme, or action plan should: i) improve knowledge and build the capacity of institutions, improving their staff, even if initially only with short-term, stop-gap measures, ii) expand access to modern energy, especially electric power, iii) reduce/ the consumption of biomass-based fuels and substitute away from them,

and, iv) economize on scarce trained/qualified personnel while taking measures to increase its supply sustainably, probably only in the longer term. This essentially means that administrations, or public bodies should not engage in "premature excessive load-bearing", and let the private sector take the lead, rather than trying to re-establish state control by attempting to regulate everything (without the required competent staff or financial/budget resources).

In terms of priorities, however, it is the considered opinion of most leaders consulted for this study, and of experienced staff of the UN System, the EU, and the World Bank (and of this author) that expanding access to modern energy in cities (esp. electricity) has highest priority, to improve the welfare of people, their productivity, and contribute to socio/political stability in this most fragile state.⁵³ Almost equally important is making sure that everyone has continued access to affordable and sustainable household cooking fuels. Last but not least, a prerequisite for making those programmes feasible is training and capacity-building for institutions responsible for the energy sector which strongly feel their own inadequacy to face and resolve major sector issues, or foster its effective development. Eventually, this initial training and capacity-building should lead to the creation of some policy analysis capability and regulatory ability in the regional/local and federal governments. Both these elements should also be supported by efforts to increase the supply of trained personnel, which is extremely scarce. This component, training, capacity-building, and promoting the supply of trained personnel should be implemented first, as it conditions the feasibility of the rest of the programme.

4.4 Size of the programme

All Somali leaders consulted are extremely conscious of the obstacles and difficulties of implementing energy projects in the country. As a result of this, many of them expressed the wish to see an Energy Sector Action/Investment Programme of modest dimensions, but with good probability of being implemented. The main constraint is not access to capital: funds committed to reconstruction in Somalia are plentiful, especially because of the New Deal framework, which Somalia is part of. The true, binding constraint is the low the absorption capacity of Somalia, because of the many obstacles and difficulties to project implementation. So, most national leaders have cautioned against excessive optimism, either in terms of volume, or time. Therefore, this Energy Sector Action/Investment Programme will have a short/medium-term phase of 3 years, and an overall horizon of 10 years, including the 3-year phase, but no emergency phase, because little or nothing can be implemented within less than 3 years. Projects can obviously be STARTED, but probably not completed.⁵⁴

This Report suggests an aggregate programme of \$ 803 million; of which \$ 58 million for training, technical assistance, and capacity building; \$ 10 million for the creation of the Somali Electrification Institute and its operations over 5-6 years; \$ 580 million for expansion of electricity supply, especially in cities; \$ 95 million for reducing/substituting the consumption of biomass fuels; and, \$ 60 million for promoting off-grid energy services/products to rural/nomadic communities.

⁵³ While poverty reduction is the global priority, in fragile/conflict affected countries, an element of importance would be increased stability and better security, both of which can be furthered by greater availability of electricity, hence this high priority to electricity supply in cities.

⁵⁴ This why it is hard to understand how knowledgeable institutions could, in September 2013, subscribe to a two-year Economic Recovery Program for 2014-2015! After more than one year, political wrangling has been the main occupation of the FGS and very little else has been achieved except for (finally!) the approval of a cabinet: that was predictable.

Summary Table: Energy Sector Action/Investment Programme (2016-2025)

<u>Item</u>	<u>Dollar Million*</u>
<u>Training, copy-building and T/A (Policy/Regulatory Bodies)</u>	<u>58</u>
<u>Somali Electrification Institute</u>	<u>10</u>
<u>Expansion Electricity Supply in cities</u>	<u>580</u>
<u>Substitution of Biomass Fuels</u>	<u>95</u>
<u>Modern Energy for Rural/Nomadic communities</u>	<u>60</u>
<u>Total</u>	<u>803</u>

*Mission Estimates

A programme to address the above major issues over the next 10 years would need to cover the four main activity clusters below:

- Training and TA at level of Ministries of Energy or similar bodies (Somaliland, Puntland, other Regional/Federal Units to be formed in future, and Mogadiscio/FGS), including training in basic concepts of energy sector management, together with short-term measures to increase supply of trained/trainable persons for sector enterprises and institutions.. Prepare for long-term solution to the skilled personnel shortage. Though briefly summarized earlier, the content of these programmes would be further defined when ready for approval. They should be carried-out, or started, within the initial 3-year period.
- Expansion of access to electric power in cities, hopefully accessible (affordable) to large segments of the middle classes. The programme should start as soon as possible, and should include all regional capitals, in addition to major cities such as Mogadiscio and Hargeisa. Programme to be completed within the 10-year period. As more modern, efficient electric power supply systems are created (and investment costs subsidized), tariffs should gradually descend to the US \$ 0.50/kWh range, at least in cities. This should add a good chunk to effective demand for electric power and make (assisted) private investment possible and financially sustainable (donors cover large share of investment costs; investors the rest share; and consumers cover the private investors' share of investment costs, plus operations and maintenance costs through the tariff).
- Programme to reduce charcoal consumption and to seek substitutes for household energy sources (especially for cooking) for welfare, efficiency, and environmental reasons, both in urban and rural areas. This substitution will require campaigns to explain and promote the new fuels and the new required end-use devices. Programme should also include design of projects to create alternative sources of income for charcoal producers (or some of them). This is the first priority in all Somali areas and, in some form, on the agenda of all administrations. And, finally,
- A programme to expand off-grid access to modern energy, especially lighting, among (poorer) urban, suburban, and rural households, and to provide additional modern energy options for businesses and better-off rural inhabitants (e.g. larger capacity off grid appliances, and modular solar home systems).

Chapter 5: Training and TA at Ministries of Energy or similar bodies.

As mentioned above, all the institutions nominally in charge of the energy sector have requested immediate technical assistance and training for their staff, as a first step to build their capacity to understand, and eventually manage the energy sector. This is an emergency need, as under the current state of knowledge of energy sector management principles and concepts in all Somali areas, even a basic dialog on energy sector development policies would be very difficult, if not impossible. Therefore, the most urgent task after the definition/approval of this Programme should be the fuller identification and preparation of this Project.

A basic project should be designed, prepared, and implemented immediately, to support the 3 bodies in existence which have responsibility over the energy sector, namely, the Federal Ministry of Energy and Water; the Puntland Authority for Water, Energy, and Natural Resources or PSAWEN; and the Ministry for Energy and Mineral Resources of the Somaliland area. Some allowance should also be made for emerging regional/federal entities that are now under establishment. The project should consist of a simple module: 2 senior consultants for 3 years (one technical, one economic), together with a small budget to hire expertise *ad hoc*. The senior experts would train the staff of these organizations, and also hire specialists for more specific training. Most likely, these experts will be expatriates, though Diaspora Somalis could serve if appropriately qualified, and/or in areas where expatriates might have difficulties.

These experts would also advise the Minister or Chairman based on their research (critical review of sector problems and development prospects) and accumulated knowledge and experience. They could also together with the staff being trained, conduct experimental, demonstration, and pilot projects in various fields of energy. They could start creating a system for data and information acquisition for future sector regulation/oversight and for M & E. They could also create and start operating a system to do continuous monitoring of the implementation of this Action/Investment Programme (and any others that might be active). They could also support the sector authorities in their initial dialog with external partners.

The experts assigned to these activities should also start work on concepts for a very simple electricity law, permitting private investment including through PPPs, and setting out main parameters for service quality and safety. This would help in mobilizing private investment in electric power, as there is an urgent need to define the modalities of joint-ventures, or Public Private Partnerships (PPPs as they are known now). They would also begin setting the stage for a more active role for these organizations in promoting the public good through appropriate guidelines and policies for the development of the energy sector. They could also start preparing other priority projects under the guidance of the institutions they support.

The Federal Ministry of Energy might be granted somewhat greater resources in view of its coordinating role (once its capacity to do so is established thanks also to this initial technical support). This assistance would cost approximately \$3.0 million for each of Puntland and Somaliland areas, and \$4.0 million for the Federal Ministry of Energy, a total of \$10.0 million for an initial period of 3 years (see below). Funding for this project should be extended for a further 3-year period, with appropriate modifications dictated by lessons learned over the first 3-year implementation period.

There may be need to support the development and operations of other Ministries whose work also extends to the energy sector. This list could be very long, but the line must be drawn somewhere, and for this sector, it would be desirable to limit the list to Ministries of Environment and those responsible for Hydrocarbons (oil, gas, fuels). Ministries of Finance could be considered also for

this inclusion, but they are typically assisted by the Bretton Woods Institutions (IMF, World Bank). Ministries of Planning also work on energy, but their strengthening is usually handled in connection with the strengthening of central economic management, again mostly conducted by the World Bank and IMF, and this would argue for excluding them from a sector-focussed Programme such as this one. However, the pricing and taxation of petroleum fuels as well as contracts with electricity generators will require intervention by Ministries of Finance, and so, a small amount for such ministries is included under the TA/Technical Assistance Project (US\$ 1 million/year), with the understanding that major technical assistance and capacity-building for these organizations is expected to come from the World Bank and International Monetary Fund.

For indicative purposes, this Programme would include some funding for the strengthening of the above mentioned Ministries: \$1 million per year for each Ministry/Agency, a total of \$ 9 million over 3 years, for Ministries of Environment, Hydrocarbons, and Finance. This would be used to procure technical assistance and expertise (including Diaspora Somalis) for improving those functions related to energy that are discharged by these Ministries. In total, technical assistance and capacity-building would therefore require about \$ 19 million for the first three years, and another \$ 19 million for a further three years. US \$ 10 million are budgeted for each 3-year period for training, technical assistance, and capacity-building for other federal/territorial entities expected to be created in the near future.

TECHNICAL ASSISTANCE TO ENERGY SECTOR POLICY-MAKING BODIES (for 6 years)

<u>Assistance to Federal Ministry of Energy & Water (FGS)</u>	
Two senior experts (72 staff/months)	\$ 1.8 million
Short-term specialized expertise (12-15 staff/months)	\$ 0.5 million
Materials and other training costs	\$ 0.7 million
<u>Costs of coordination/support to other regions</u>	<u>\$ 1.0 million</u>
Subtotal	\$ 4.0 million
<u>Assistance to PSAWEN (Puntland area)</u>	
Two senior experts (72 staff/months)	\$ 1.8 million
Short-term specialized expertise (12-15 staff/months)	\$ 0.5 million
Materials and other training costs	\$ 0.7 million
Subtotal	\$ 3.0 million
<u>Assistance to Ministry of Energy and Minerals (Somaliland area)</u>	
Two senior experts (72 staff/months)	\$ 1.8 million
Short-term specialized expertise (12-15 staff/months)	\$ 0.5 million
Materials and other training costs	\$ 0.7 million
Subtotal	<u>\$ 3.0 million</u>
GRAND TOTAL, T.A. to ENERGY AGENCIES	\$ 10.0 million
<u>Assistance to Min.Environment/Hydrocarbons/Finance</u>	<u>\$ 9.0 million</u>
<u>For future Regional Administrations</u>	<u>\$ 10 million</u>
GRAND TOTAL T.A. PROJECT (3years x 2)	\$ 29.0 million (x2)= \$ 58 million

Chapter 6: Expansion of access to electric power in cities

The standards of service of electric power supply are extremely low. The significant expansion of access and improvement in quality of supply predicated on this programme require the creation of state-of-the-art, new grids, because even where they exist, they are small, dilapidated and may have the wrong technical characteristics. There is also need to upgrade, expand, and improve generation, which is overwhelmingly in private hands and uses old, poorly-maintained generators. Establishing state-of-the-art electric power supply in cities requires agreements between the public authorities and the private generators to the effect that the former will provide a grid for use by all generators, and the latter will reorganize themselves. The generators will agree to use the grid to deliver electricity to their customers and to consolidate their plants into generating units of larger sizes and greater efficiency with help from the authorities and donors. They also will agree to generate with technical characteristics that enable them to wheel or deliver power through the grids. Basically, base-load generation will continue to be diesel-fuelled (or perhaps HFO fuelled as tentatively suggested by the Ministry of Energy in Hargeisa), but generators will also be assisted to add complementary generation based on use of renewable sources of energy. They will also need to be assisted to consolidate so as to be able to invest the larger sums needed for efficient generation capacity scale.

The medium voltage grids should be standardized and abandon the old Italian colonial standard of 15kV medium voltage which is still in use in Ethiopia, in favour of 11kV (or perhaps 33kV where needed for either distances or volume of energy to be transported). At times, especially if funds are not a constraint, it may pay to build in advance of needs, e.g. building at 33kV standard but operating at 11kV. At present, Garowe, Burao, and Borama have 11kV grids while Hargeisa, Berbera, Bosaaso, Qardo, and Galkayo have 15kV grids. Berbera, Borama, and Garowe have grids that cover almost the whole central cities; Hargeisa's grid is small and covers only a part of the city, serving perhaps 5%-6% of consumers. Mogadiscio has no medium voltage grid at all.

6.1 Electric power supply projects: organization and finance.

Electricity grids would be entirely funded by donors, and the grids would be held as collective property of the region, municipality, or county or province. Grids could be rented-out for operation by some private concessionaires (or run by a state-related agency) as system operator. The grids would become community property but run as commercial enterprises with revenues (from the wheeling of electricity) sufficient to cover operation and maintenance. As for generation, examples from some projects in countries similar to Somalia suggest that a subsidy element of about 75% on capital/investment costs, with 25% provided by the owners of the generation plant could markedly lower tariffs (only 25% of capital costs would need to be covered by tariffs, in addition to operation and maintenance). These percentages have been decided after reviewing the experience of several countries such as Morocco, Senegal, Mali, Tanzania (World Bank and/or SE4All programmes).

6.2 Establishment of a Somali Electrification Institute

The Somali Electrification Institute

This institution should have a Central Branch in Mogadiscio (or Nairobi?) to serve Southern areas and Puntland, and a Northern Branch located in Hargeisa to serve Somaliland areas. Its role would be to evaluate, eventually approve power generation projects, and license them for public electricity service. With/through this approval, it would disburse a share of the cost of generation equipment (conventional, solar, wind), possibly directly to the suppliers of the machinery. It would also manage the donor funding for the construction, repair, and expansion of distribution grids. It should acquire expertise to negotiate and supervise public power supply contracts. It would have the status of a public body but not be under the direct line authority of any Ministry. It could report to some Committee of the New Deal (since it would help disburse New Deal funds) or perhaps to a body under the IGAD which could be given authority similar to a Management Board. It would need a mix of Somali and foreign staff, paid competitive salaries and fairly stable working conditions (to avoid the temptations of corruption or get-rich-quick actions). Its operations could start possibly as soon as the Technical Assistance to Ministries and similar policy-making bodies becomes effective and donors agree to its rules and regulations (statutes, responsibilities, authority) and its links to the Financial Vehicles intended to manage funding under the New Deal (the various funds, soon to be operating jointly). The budget would need to be worked-out in greater detail but might require about \$ 1 million/annum for each of the two offices. Security costs would be additive. A notional sum of \$ 10 million is budgeted for this institution for its creation and start-up, and its first 4-5 years of operation. Its creation is vital for the implementation of the electrification program. In future, it might charge something for its services, e.g. a license fee for operating a power plant. If so desired by the Somalis themselves, this institute could be extended to cover some other infrastructure sectors.

An organization would be set-up centrally to manage funding for these investments (and set service norms, standards and metrics, as well as basic safety and security regulations for workers and customers). Since the donor subsidy is meant essentially to cover a major portion of generating capacity investment costs (generation equipment), these public offices could disburse funds directly to suppliers of equipment, avoiding the need to disburse large sums in Somalia itself. Regional offices could be created also to spread information and facilitate relations with existing and/or potential investors.

The programme of expanding electricity supply in cities would invest in rebuilding the grids and improving generation in a number of agglomerations, say, all regional capitals. There were 18 administrative entities with capital cities in pre-collapse Somalia, including the two main cities, Mogadiscio and Hargeisa. The two largest agglomerations merit a lot of attention and well-defined tailor-made projects to create new grids. The other 16 are small- to medium-sized cities where a standard project package (or perhaps standard project packages in 2 or 3 sizes) could be designed and implemented.⁵⁵ The standard projects could involve hybrid generation capacity of between 1 MW and 3 MW, together with medium and low voltage grids able to distribute such a load among say, between 1000 and 10,000 connections (with power of 300 W to 1 kW/connection). Standard package might be similar to that described in footnote below.⁵⁶

The first cities to be considered for this programme would be those whose status is currently defined as safe and where work could start "soon". These cities are likely to include Hargeisa,

⁵⁵ Some of this preparation work could perhaps be done through the soon-to-start World Bank Electricity Master Plan.

⁵⁶ Standard Package could be as follows:

Generation: 1.5 MW to 2 MW thermal and 500kW solar;

--Medium Tension Sub-transmission Grid: 20km of 11kV lines;

--Low tension distribution grid: 100km of 440/220 lines with transformers;

--Materials for 5,000 connections. Power per connection 400W-500W.

This module can be estimated to cost approximately \$14 million including materials for house connections (\$ 800/connection).

Garowe, Berbera, Bosaaso, Qardo, possibly Mogadiscio, etc. Other suitable cities would be identified in due course, jointly with the authorities and the communities themselves.⁵⁷

The World Bank has mentioned the desirability of starting to build grids and improving generation in the first 3 or 4 cities immediately, before the end of planning studies. This could be considered within the initial phase, though it is likely to take more than 3 years to carry-out. A second phase of the programme would include another dozen cities or so, leading to a situation where all district capitals would have reasonable electric power supply by 2025, at the end of the ten-year Infrastructure Action Plan. Other large agglomerations which may not be regional capitals could also be added to this list (e.g. Qardo, Hoby, Harardere, Gabiley, Las Anod, Bhdan, Tieglow, Bur Hakaba, Khansadhere, Dinsor, Berdale, El Bur, Bulu Burti, Wanle Weyn, Afgoy, Quorioley, Balad, Jilib, Jamame). While this is a desirable programme, its feasibility would be hostage to local conditions and circumstances, which might vary often, making it difficult to programme works in what may be narrow windows of opportunity. The other matter would be to find investors willing to invest their share of the costs of the generating plant (most likely from among those people currently producing and selling electricity in these cities/towns).

The cost of the investment programme to electrify all regional capitals, other large cities, and a number of smaller centers (via minigrids) could be estimated at about \$580 million as shown below. This investment would imply installing close to 200 MW of generating capacity, of which 30-40 MWp of mostly solar PV. The programme includes a pilot project consisting of 10 hybrid minigrids serving about 5000 rural/village households. The programme would bring good quality electric power supply to approximately 300,000 households and have the capacity to expand, as demand grows (thanks to lower tariffs) and improved efficiency due to the use of state-of-the-art sub-transmission/distribution grids.

However, this programme is intended to be "permissive", i.e. it is an outside envelope/estimate of what would be needed: not necessarily what can be actually implemented. Implementation would require some analysis (e.g. through some project preparation facility perhaps attached to the Electrification Institute) and some decision/determination that the city to be electrified is safe and secure enough for works to be constructed there. Also, private investor(s) need(s) to be identified as able and willing to invest in generation, under the terms and conditions determined by the Authorities through the Somali Electrification Institute (or similar organization). The programme should begin construction of grids in cities that are safe and where there are investors willing to enter power generation under the established rules, and given the overall level of security.

Further, the feasibility of this Programme rests largely on the ability of Somalis and external development partners to set-up, fund and support an effective and fully operational Somali Electrification Institute, or similar institution. It cannot be implemented if the federal state or the other areas/regional administrations expect to play central roles. They need to relinquish some of their authority to an operational, externally-funded and supported organization that will greatly empower the electric power industry.⁵⁸ The authorities could be represented in a supervisory body or Board, together with the main donor groups and share the responsibility of setting general guidelines for the Institute's activities. Nevertheless, the Institute should enjoy substantial operational autonomy within its mandated activities.

⁵⁷ The inclusion of additional cities should be conditioned on further improvements in their security situation and the willingness of private investors to accept the terms of the agreement regarding acquisition of generating capacity.

⁵⁸ The Congo DR has a similar office which it created under a World Bank project and still operates. Office is called BCECO, Bureau Central de Coordination, whose original mandate it was to prepare/implement/monitor projects to make-up for the weaknesses of the Government. In this case, this organization would only implement projects in the energy sector.

SOMALIA: ELECTRIFICATION OF URBAN CENTERS 2015-25

5 cities with 5, 000+ connections	\$ 14 million x 5=\$ 70 million
10 cities with 10,000 connections	\$ 25 million x 10=\$ 250 million
3 cities with 50,000 connections (Mog, Har, Bos?)	\$ 50 million x 3=\$ 150 million
TOTAL (over 10 years)	\$ 470 million
Twenty other urban agglomerations (1000- 5000 Connections)	\$ 100 million
10 Minigrids (100kVA xdiesel+100kWpPV)	\$ 10 million
GRAND TOTAL --- Urban Electrification	\$ 580 million*
(Memo: Creation of a Somali Electrification Institute \$ 10 million)	

* The generation component, about 50% of total, would receive a capital contribution of 25% by the private investors. Except for minigrids, where the capital contribution would need to be related to both generation and grid, which are not unbundled. These figures are indicative only as the LV distribution grid is the most costly element (together with generation) and it (unlike generation) depends entirely on local, site-specific characteristics of population density and dispersion.

6.3 Hybrid Minigrids and Electricity Supply

<u>MINIGRID ACCORDING TO SE4ALL POLICY BOOK*</u>	
System	<ul style="list-style-type: none"> • 100kWp SOLAR PV + 100KVA diesel (max/peak generation about 150 kW???) • 3.5 Km LV GRID • WITH BATTERIES (560kWh) AND INVERTER (60 kW, AC/DC system) • Diesel cost valued at Euro 0.70/liter.
Financing plan:	20% Equity, 30% Debt, 50% Grant.
	Total investment is estimated at Euro 520,000 by SE4All (in 2013)

*From: *MiniGrid Policy Toolkit*.
 EU-RECP, EU-EI, REN21.
www.euei-pdf.org/sites/default/files/files...../RECP_MiniGrid_Policy_Toolkit

An additional amount should be added for the electrification of cities which are fairly large but are not regional capitals. There are about 20 such cities which could justify a grid able to serve 1000 to 5000 connections. The total investment would reach about \$100 million. Since most of these cities already have private providers of electricity, they could perhaps be persuaded to invest in better, newer, hybrid generation by a 75% subsidy provided by donors. The absorptive capacity might not be so constraining, if the authorities were able (perhaps with help?) to set-up offices of the proposed Somali Electrification Institute to counsel and assist private investors, by approving the proposed investments/business plans, and establish procedures to disburse the subsidy (possibly directly to the foreign suppliers of the generation equipment).

The use of minigrids could be considered for areas that are too small or too poor to be tied to a large grid or, very far from a city. In these cases, the SE4All technology should be considered, and some resources should be set aside for a number of interventions to be identified in the course of

the preparation of the Power Master Plan by the World Bank. The Box above shows a typical minigrid system in line with SE4All definitions and policies.

However, the figures in the Box underestimate costs in Somalia. A similar system in Somalia would cost at minimum \$ 1.2 million, including a small grid (which would not be unbundled in such small systems, the same investor/company would own generation and distribution). Above system reportedly breaks even at tariff of Euro 0.43/kWh with sales of 420 kWh/day (hence revenues of Euro 181/day).⁵⁹ Example does not say number of customers served, but at TIER 3 electrification level (200W-500W/customer)⁶⁰, it could serve as many as 400-500 customers (given daily sales of 420kWh, sales/connection would be about 1 kWh/day, which seems a bit low). Adaptation for Somalia would require a simpler financial structure (like the one proposed by World Bank for Mali rural electrification described above). Proposal would be to require 25% equity contribution by investors, eliminate debt part, and give a grant of 75% of investment cost (generation + distribution). Tariff for this modified system in Somalia might therefore be slightly higher (less debt, but higher share of investment costs), say, US\$ 0.60-70/kWh (noting also that diesel is more expensive in Somalia, \$ 0.80-0.90/liter after recent price fall. A notional amount of \$10 million is added to the investment programme for electrification through minigrids, to finance about 10 such small systems, considering that investors would provide 25% of total costs (about \$ 2.5 million).

DRAFT

⁵⁹ Tariff would be about \$13/month, equivalent to the minimum tariff charged by SEA in Hargeisa. but since SEA charges 90 us cents/kWh, a payment of \$ 13 implies half the energy supplied to average user by minigrid (about 500 Wh/day)

⁶⁰ EU, *Minigrid Policy Toolkit*. There are 5 Tiers of electrification ranging from TIER 1 (1-20 Watts/connection) to TIER 5 (> 2 kWatts/connection).

Chapter 7: Programme to reduce consumption of biomass fuels (wood and charcoal)

7.1 The big picture about biomass fuels and cookstoves:

Nearly 2.9 billion people – more than India and China put together—still use polluting fuels like wood and charcoal to cook and heat their homes, at a huge cost to the society, in terms of health, environmental, and economic costs, estimated at over US\$123 billion every year. These numbers underline the urgent need to accelerate the adoption of clean, efficient cooking stoves and fuels, which can save millions of lives and help reach sustainable energy goals by 2030. In spite of intensifying efforts, access to clean and improved cookstoves and fuels still remain limited in much of the developing world with a devastating impact on people’s health. Each year, it is estimated that 4.3 million people die prematurely due to indoor air pollution. And if the effort to offer clean, efficient fuels continues at the same pace as today, 57 percent of the world’s population will still not have access to clean cooking in 2020, making it all the more difficult to reach universal access to modern energy services by 2030, as mandated by the SE4All initiative.⁶¹

The issue of clean cooking crosses so many sectors—health, gender, environment, technology, poverty and energy. The challenge is to replace old cookstoves with newer, cleaner, and more efficient ones. To solve this issue will require the creation of a thriving global market for clean cooking solutions. There must be sustained efforts to stimulate demand for and adoption of cleaner and more efficient cookstoves and fuels, as well as to develop a robust pipeline of enterprises that can meet growing consumer demand and supply products of high quality that customers value, at prices they can afford.

Authorities in all Somalia areas visited for purpose of this Assessment are acutely aware of the unsustainability of Somalia's energy consumption mix. Many voiced an urgent concern to act on this issue. There are initial efforts (see above in section on ongoing/recently completed projects), but many are on pilot or demonstration scale, aiming to show that the problem can be addressed successfully, rather than aiming at resolving the problem. Many projects do show that solutions are available and can be generalized. And while some projects are larger than pilots, their scale is not sufficient to make a serious dent in the consumption of biomass fuels. Therefore, there is space for replicating successful experiences.

The Ministry of Energy and Minerals in the Somaliland area has been studying the problem for some time and has reached the conclusion that it should seek funding and launch a major project to promote the use of kerosene for cooking, especially in cities (because they are massive users of charcoal the making of which causes deforestation, while rural households tend to use dry branches and normally do not cut trees *en masse*). A small number of people and businesses already use kerosene for cooking both in cities and in the countryside.

The advantages of kerosene are already well-known in relation to both wood/charcoal and LPG. In comparison with wood or charcoal, kerosene is more energy dense (packs a lot more energy per unit volume or weight), and generally enjoys higher efficiency (more heat under the pot), and better conversion, especially with improved stoves. As compared to LPG, it is less expensive (imported liquid, in barrels or larger containers); infinitely divisible, a family can buy only what is necessary for cooking one meal; and has no important cost barriers, other than a moderately priced stove that can be financed through a number of mechanisms. The stove could be distributed free the first time, because it could serve to offset the artificially low price of wood and charcoal which do not pay the

⁶¹ These paragraphs inspired from World Bank/ESMAP and Global Alliance for Clean Cookstoves. They estimate that households in the developing world spent more than \$100 billion across all cooking fuels in 2010 alone, with one-third of the amount spent on charcoal, coal, and wood.

resource cost of the trees ("stumpage") used to make the fuels. Giving away the kerosene stove for free could also be justified on the benign environmental effect of using kerosene for cooking, which leads to a reduction of tree cutting, thereby protecting the vegetative cover which is threatened.

Betting only on LPG as a cooking fuel to replace charcoal, (as proposed recently for Puntland), is an uncertain proposition and is unlikely to make a significant dent in the excess use of charcoal.⁶² Cheaper LPG will undoubtedly become affordable to larger numbers of wealthy urban households, but the broad Somali middle class will not be able to afford it. Kerosene will be attractive to such consumers and could be affordable by this "middle" income class. Also, kerosene is the most feasible, likely alternative to charcoal for cooking as compared with LPG, electricity and solar and wind energies (which are not so good for cooking). There is room for actions to encourage its wider use and to slow/reduce the demand for firewood/charcoal which threatens deforestation.

A number of analysts (including Ministers in Mogadiscio, Garowe and Hargeisa, and the present author) consider that kerosene is the most likely candidate to substitute for charcoal in a country as poor as Somalia (areas of Somaliland, Puntland, and Southern Somalia.). In any case, a successful campaign to markedly reduce charcoal demand would have to harness the power of all potential substitute fuels. Theoretically both the UNDP project PROSCAL and the EU Millennium Initiative intend to analyse all potential fuels and compare and implement pilots. However, the EU project has already decided it will promote LPG, and the UNDP's will not have the scale required to make a significant dent in charcoal demand.

In any case, a major information campaign would be necessary, as with all new products, there is instinctive fear and mistrust of this new fuel (as there is for LPG). An intensive, well-designed, and massive awareness and advocacy education campaign would be essential to inform the public about the characteristics, advantages, and safety of using kerosene. And to explain the economic and environmental reasons justifying its promotion, namely to make cooking faster and easier, and to reduce pressure on the country's vegetation cover, so as to preserve its environment threatened with desertification.

Unlike other potential substitute energy sources, kerosene (also called paraffin in some countries) has well functioning supply/market structures and it is available in substantial quantities at all times. Kerosene has multiple uses and it easily divisible (unlike LPG).⁶³ For households with cash constraints, the ability to buy kerosene in small quantities is attractive and empowering. However, the higher cost of kerosene stoves compared to (unimproved) biomass ones and the relatively higher cost of kerosene could present some barriers to the wider use of kerosene for low-income end users (who are a majority of biomass fuel users). However, once people are comfortable spending \$ 10 for an improved charcoal stove, they should have less difficulty buying a kerosene stove. The better conversion efficiency of an improved kerosene stove should also help mitigate the higher cost of the fuel.

On the demand side, a significant number of larger end-users (household and commercial enterprises) are currently using kerosene either as the primary energy for cooking or as a supplementary energy source (as observed throughout the surveyed towns by ADRA and UNDP).⁶⁴

⁶²It is perhaps a bit unrealistic to expect Puntland inhabitants to convert to LPG cooking "en masse", given the well-known costs and indivisibilities of LPG, and the low incomes of Puntland households. It is probable that a larger number of better-off households will be able to afford LPG should its price fall visibly (20%-30%) and that could help in some measure to reduce overall charcoal demand, but not significantly.

⁶³A Canadian colleague distributing propane in Quebec has informed me that there are now ways of filling cylinders with any measured quantity of LPG. Perhaps the divisibility issue is about to be resolved, but there is still the entry cost barrier of having to purchase cylinder, hoses, valve, and stove).

⁶⁴As many as 5% of urban consumers use kerosene for cooking, according to some surveys (UNDP, ADRA).

So, kerosene is not altogether an unknown fuel. The demand from these customers is expected to increase gradually and they are more likely to use kerosene instead of charcoal because the latter's price has been rising, while the price of kerosene has dropped over the past year.

Another ally in the fight to reduce charcoal demand/consumption could be the system of incentives. As hinted earlier, charcoal is cheaper than it should be because of a market failure which ignores the intrinsic value of the trees cut to produce charcoal. A sort of "tax" on charcoal (or charging a "stumpage fee" on the trees felled to produce charcoal) would have the effect of raising its price, and thus making alternative fuels relatively less expensive. The tax on charcoal could be used to subsidize kerosene cooking stoves or improved charcoal stoves (making it an optimal environmental intervention: a tax-cum-subsidy scheme designed to counter a market failure). It may be impossible to do such a thing in Somalia, or it may be possible through the empowerment of former charcoal producers through some projects similar to classical "Social/Sustainable Forestry", whereby they collect the stumpage fee as payment for their services as protectors of the forests. In any case, some measures able to raise the price of charcoal would make the penetration of kerosene easier. If charcoal prices cannot be raised (and kept high), then it would mean that all of the adjustment would have to be borne by the prices of substitutes (or rather, by subsidies, to be determined and funded, on the prices of substitute fuels and/or end-use devices).

As substitution proceeds, it will be necessary to monitor charcoal prices to keep them from dropping too much (there may well be a very inelastic supply, as charcoalers have no alternate source of income and their reaction to a price drop could be an increase in supply). A successful programme to substitute away from charcoal would therefore have to include measures to create alternative sources of income for charcoal producers (see paragraph above). Also, as its price drops, charcoal becomes more attractive again as a fuel in competition with LPG and kerosene. Therefore, its supply must be reduced (to prevent price drop) and this again requires some alternative livelihoods for artisanal charcoal producers, within the fuel substitution project/s. Moving to sustainable charcoal (sold at economic cost-covering prices) would ensure a high enough price to prevent a return to charcoal.

While taxation of petroleum fuels is low in Somalia, a case could be made to remove even the low taxes levied on kerosene. A simplification of import rules and regulations could facilitate imports and would help to ensure competitive behavior in markets (monopolization would need to be avoided), so the benefits of lower costs accrue to people rather than importers.

A small petroleum products storage project could be implemented *pari passu* with the kerosene promotion project. Again, the storage of products could be licensed to private operators willing to contribute a fraction of the investment costs, and with rules and regulations allowing shared use of the facilities. A more "official" storage and distribution system might give some possibility of monitoring the quality of fuels, an issue that remains unaddressed, unresolved until now. Automotive fuels are reported to be of bad quality and result in premature breakdowns and excessive wear and tear of engines. Some element of training and technical assistance could be included in this small project, as well as in tandem with the training and capacity-building of the Ministries in charge of import and distribution of petroleum products (often ministries in charge of trade rather than those of energy).

7.2 Charcoal consumption now

Overall consumption of charcoal in Somalia is said to total about 4 million tons *per annum*. It is not possible to disaggregate this total. It looks plausible because about 400kg/capita/annum, for 8-9 million people comes close to this number. It is often reported (World Bank, *Issues and Options*;

EU Needs and Opportunities in the Energy Sector for Economic Growth). More recent figures show that the average monthly charcoal delivery into Hargeisa markets reaches 1,200 tons; Burao 1,000 tons; and Borama, about 600 tons⁶⁵, as estimated by the Regional Directors of the Ministry of Livestock, Environment and Pastoral Development, of Hargeisa. About 98% of households in both Hargeisa and Burco, and 79% in Borama use charcoal for cooking (even people of middle and high incomes). Currently, the demand vastly exceeds supply (natural incremental growth of wood in existing forests/trees) and the biomass energy production is unsustainable. So much so that 35% of Hargeisa's charcoal supply is reported to originate in Ethiopia.

Assuming that kerosene contains about twice the energy of charcoal, has a density of 0.8, and has a higher conversion (25% as opposed to less than 20% for an improved charcoal stove, or 15% for an unimproved one), it would take about 400 kg of kerosene (500 liters) to replace one ton of charcoal. To replace half the monthly charcoal consumption of Hargeisa would therefore require distributing about 240 tons/month or 300 cubic meters (300,000 liters, or 30 medium-sized tanker trucks carrying 10 cubic meters each, one/day).

Projects of this size could be implemented in Somaliland and Puntland, where security conditions are acceptable; and a somewhat larger one for areas of Southern Somalia (though feasibility remains aleatory given level of insecurity). Carrying-out projects of this nature and size might well require 5 years, starting during the initial 3-year period. It would appear, however, that the import of kerosene for some reason has stopped in Puntland and may have stopped in Southern Somalia. Many interests now centre on importing LPG. On the other hand, last year (2013) it was reported that no LPG was available for public sale in Mogadiscio, while it appears it is available now (late 2014).

⁶⁵ *Energy Consumption and Supply Survey of Somaliland, 2011*, by UNDP and Somaliland Min Livestock. Charcoal consumption numbers are contradictory (when estimated by sack and by truckload) by a factor of 10. Also, the survey is based on rather small samples that could easily be biased. The results tend to exaggerate the consumption, and therefore I have used the lower estimates of consumption which appear more logical and plausible).

Kerosene promotion program: Somalia, area of Somaliland 5-7 years

Stoves (improved, kerosene) imported	200,000x \$30+=	\$ 6 million*
Materials to produce 200,000 stoves	200,000x \$15+=	\$ 3 million
Publicity, information and promotion campaigns(including materials):		\$ 3 million
Training of craftsmen and initial stocking of materials: approx		\$ 3 million
Social Forestry project (for ex-charcoal producers)		\$ 5 million
<u>Investments in storage and distribution (common carrier)</u>		<u>\$ 5 million</u>
<u>Sub-Total</u>		<u>\$ 25 million</u>
<u>Extension for 3 years (to end of program period)</u>		<u>\$ 5 million</u>
<u>Total (8-9 years) Somaliland area</u>		<u>\$ 30 million</u>
<u>Puntland area</u>		<u>\$ 30 million</u>
<u>Southern Somalia areas</u>		<u>\$ 35 million</u>
<u>Grand Total</u>		<u>\$ 95 million</u>

*Estimates by project staff

It is possible that some fuel importers, in order to make sure they sell the imported LPG which is more expensive, (and maybe more profitable, as there are higher barriers to entry of other suppliers), may have decided not to import a competing product (kerosene). Since there are no public bodies in charge of protecting consumers, such behavior is eminently possible in Somalia. It may also be that, if the statements heard in Mogadiscio, that almost no-one uses kerosene for lighting, are correct, (they have switched to solar power/lanterns), it may be that demand for kerosene has fallen, prompting some importers to curtail or stop importing it. In any case, the import of kerosene could easily be resumed, were it to become profitable again to do so, and a massive information/promotion campaign in favour of kerosene for cooking would definitely make its import worthwhile.

The costing for these charcoal substitution projects is less firm than those for electric power, as there are more imponderables and fewer machines and buildings involved. Each project would cost about \$ 30 million and require the import/procurement, and eventual (free?) distribution, of perhaps 200,000 improved kerosene stoves (more would be needed, but after the first year or two, local manufacturing would have been started) and materials to produce another 200,000, together with small social forestry projects in the main charcoal producing areas. Two other projects, one for Puntland (same size: \$ 30 million) and one for Southern Areas (larger: \$ 35 million) should be budgeted for. These projects would be able to help perhaps about 700,000 households (4-5 million people) switch from charcoal to kerosene for cooking over a period of 5-7 years. This project would also attempt to create alternative livelihoods for charcoal producers: since they tend to live in treed areas, perhaps they can be reconverted to "forest guardians" through the development of "social forestry", whereby people will make a living from protecting the forest and charging the stumpage fee that will raise the price of charcoal and facilitate its substitution. Former charcoal producers (or their teenage children) might also be trained to produce the new stoves, for which there would be a sustained demand. These projects, once in full swing, might also save perhaps as much as 1 million tons of charcoal/year (about 25% of current consumption). These are large, significant figures.

The import of kerosene is commercially viable and so, may not require direct intervention. Only consumers may need a subsidy for the purchase of the first stove. The import and distribution of

LPG is more expensive and cannot be considered without a sizeable subsidy. However, the infrastructure needed, especially ports and jetties (for both kerosene and LPG) is expensive and beyond the capability of Somali private businessmen.⁶⁶ While storage tanks and tanker trucks are less expensive, some credit mechanism may have to be set-up to encourage such investment. Some funds are budgeted for storage and distribution above, and may be used either for PPPs or for public sector-built facilities (that could then be turned-over to private parties for operation), and to finance the purchase of tanker trucks.

A number of recommendations were made, especially for Mogadiscio, but widely applicable everywhere, by the HABITAT study referred to earlier. They are relevant to this programme to substitute away from biomass fuels, and all make good sense (except that references to cooking with electricity were removed). Adapting them to the whole country, and updating them to reflect developments in the last two years, they would read as follows:

7.3 Recommendations about fuel substitution

- support the development of an urban energy strategy to provide a framework on how to transit cities from biomass (solid fuels), to liquid and possibly, gaseous fuels, (in Hargeisa decision to substitute with kerosene already taken);
- support development of energy kiosks; offering limited energy services/products to poor people
- support capacity-building initiatives in both conventional and renewable energy technology design, installation, and management, especially targeting technicians;
- support the import and then local assembly, distribution, and marketing of off-grid modern lighting/charging products powered by solar energy, which meet Lighting Africa standards.
- support production, commercialization and marketing of energy efficient cook stoves using all available fuels (charcoal, kerosene, LPG).

⁶⁶ Ports and jetties are covered under the Transport Sector, and so will not be included here, though storage is included.

Chapter 8: Programme to introduce off-grid modern energy in rural and nomadic communities

LIGHTING AFRICA PROGRAM: WORLD BANK/ESMAP

Lighting Africa, a joint initiative of IFC and the World Bank, accelerates the development of markets for clean off-grid lighting products in sub-Saharan Africa. The program mobilizes the private sector to build sustainable markets to provide people not connected to grid electricity with clean, affordable, quality lighting products, most of which are solar powered. A majority of Somali people have no access to grid electricity and rely on polluting and dangerous sources of lighting such as kerosene lamps, candles, and battery-powered torches. Further, fuel-based lighting is generally of low quality and expensive. The Lighting Africa program was launched in September 2007 with the goal of catalyzing markets for clean, modern off-grid lighting products to light-up the homes and businesses of 250 million people by 2030. The program, is active in 10 countries across Africa, including Liberia, Mali, South Sudan, Kenya and Ethiopia, countries both comparable to Somalia and close to it. It is funded by the US, the Netherlands, Italy, Denmark, ESMAP, the GEF, and AFREA (Africa Renewable Energy and Access Program).

Modern technology has evolved and brought out new products that are useful to people who cannot be linked to a grid or whose way of life is nomadic. Somalia's population may be one third urban, one third rural, and one third nomadic. The rural and nomadic populations are widely dispersed and scattered over a large area. Solar lighting products have already made inroads into rural/nomadic markets. The evolution has been haphazard, unplanned, unregulated (like everything else in Somalia). A programme can be envisaged to monitor and try to regulate the import and distribution of these new products: i) solar home systems (SHS) either for sale or on the basis of fee-for-service system, ii) smaller solar systems (with light points and rechargers), iii) solar lanterns of various types, and iv) solar rechargers for batteries or telephones.

8.1 Lighting Africa Programme

An easy way to do this could be the entry of Somalia into the Lighting Africa Programme of the World

Bank/IFC. This programme sets standards and draws rules and regulations for importing quality solar equipment. Somalia's development partners could agree to ask Lighting Africa to work in Somalia and fund its work there.

Should it not be possible to get Lighting Africa to intervene directly in Somali areas, an agency could be created (perhaps also attached to the Somali Electrification Institute) to establish norms, standards, and operational modalities similar to those of Lighting Africa. It would try to inform the business community about the norms and standards to be met by the authorized products, and about the manufacturers of equipment that meets these standards. Often the good quality products are no more expensive than those which do not meet the standards. Therefore, the price level of these end-use devices can be maintained, especially if the trade is kept competitive, and monopolies are avoided.

Costs are hard to define, but an amount of about \$10 million/year for 5-6 years could significantly improve access to quality lighting for rural inhabitants and nomadic populations. The procurement of equipment would use part of these resources and some would be used for the management of the

trading networks and to spread information and publicity about the quality products. Since the communities to be reached are among the poorest populations of all Somali areas, it is expected that some end-use devices will be supplied for free, at least initially, until the users are better informed and appreciate more fully the better quality of the new equipment. The users will initially pay only for recharging the devices. The savings from no longer having to purchase traditional lighting products could finance the replacement of the first solar end-use device distributed free. Eventually, the procurement and distribution system will move towards a commercially feasible model, with perhaps only a bit of help from the public authorities. Further, in some cases the organization of small businesses to provide energy (or just lighting, depending on the consumers' demand) on a fee-for-service basis could also be encouraged.

<u>Off-grid lighting and other energy goods and services for rural and nomadic areas</u> (Six-year program)		
Procurement of equipment	\$ 4 million/yr	\$24 million
Information and promotion campaigns	\$ 2 million/yr	\$12 million
Technical Assistance/Training	\$ 1 million/yr	\$ 6 million
<u>Other (goods and services)</u>	<u>\$ 3 million/yr</u>	<u>\$ 18 million</u>
Total	\$ 10 million/yr	\$ 60 million

This type of project requires a large quantity of actions, and the coordinated activities of many groups of people (project managers, importers, local traders, entrepreneurs/providers of services under fee-for-service arrangements, users of equipment, local administrations...). As such it is extremely complex to manage. This is the reason why the intervention of Lighting Africa was mentioned early on, as they have these procedures well defined and have practice implementing them. Carrying-out such a project without them would therefore be a complex task, but it can be done. It will require a selection of the appropriate managers and also some flexibility on the part of the administrations, as they see a large, complex commercial project evolve almost without any reference to public powers. Still, the rewards are large, as a number of people who are generally ignored can partake of the benefits of technology appropriate to their resources and lifestyles (namely, relatively poor rural and nomadic families).

Chapter 9: Concluding remarks, and some words about implementation

The programme proposed in this paper is ambitious and farsighted: \$ 803 million over a ten-year period, making allowance for the difficulty of getting things done in Somalia, and for the inevitable delays to be expected when coming out of a conflict and chaotic situation of long duration. The programme is split between a short-term 3-year period, which is the shortest period that one can consider when thinking of investment and/or policy changes in a Somali area, and a large seven-year programme that follows it.

The programme consists of an immediate programme of training, capacity-building and technical assistance to the main policy-making bodies of the Federal Government and the better established areas of Somaliland and Puntland. As other federal units are created, then perhaps resources can be assigned to help them. At this time and stage of their development, it is not possible to predict their need for resources. In any case, the Federal Ministry of Energy and Water has stated it will assist the emerging federal units with development of policies and institutions. It would then be a matter of the Federal Ministry making a programme to assist these units, and its funding can be examined at that time. In any case, this Action Plan is not cast in concrete: it can be envisioned as evolving with developments on the ground, or be seen as advising Somali authorities and their development partners as the process of implementing development programmes starts. If so, then another study could be considered and performed, say, at mid-stage in about 2020 and at that stage, additional funding could be programmed. In any case, it is presumptuous and premature to try to establish a rigid blueprint for a ten-year programme in Somalia.

What can be decided at this stage also is some idea of the basic institutions that will be needed in the immediate, starting years of the programme/action plan. It is obvious that there will be tremendous learning in the initial implementation of even just the first projects, and that change will be a constant feature of such a process. The Action Plan as identified at this stage is an attempt to address the major issues faced by the Somalia population. To repeat: lack of skilled human resources, weak/nonexistent public institutional capacity; lack of reliable supply of modern energy, especially electricity in cities; excess, unsustainable consumption of biomass fuels by households (and need for substitution); and the low availability of modern, off-grid products for poorer urban, suburban, rural, and nomadic groups/communities.

Needless to say, these issues can be addressed in several ways, this Report chooses to address them through these four groups/clusters of actions, namely:

- Institutional strengthening via TA, training, and capacity building of Policy-making bodies;
- Creation of needed institutions;
- Expansion of access to quality electric power supply;
- Substitution of biomass fuels with modern, cleaner fuels and more efficient stoves ; and
- Expansion of supply of modern energy services into the countryside and to poorer disadvantaged groups, including nomadic communities.

9.1 Programme Summary and Time Profile of Estimated Programme Expenditure

The A/I Programme is summarized in the table below and more details are shown in Annex Tables:

<u>Item</u>	<u>Dollar Million*</u>
Training, capacity-building and T/A (Policy-Making Bodies)	58
Somali Electrification Institute	10
Expansion Electricity Supply	580
Substitution of Biomass Fuels	95
Modern Energy for Rural/Nomadic communities	60
Total	803

*Mission Estimates, at prices of 2015 (adjusted to account for Somali excess costs).

The table below gives some idea, a projection of what the disbursement profile might ideally be for the five project clusters proposed in this Action/Investment Programme. This profile is sanguine: it assumes that security and quality of life continue to improve in Somalia and dares to think positive. Absolutely crucial in making this profile something more than the arithmetic dream of this researcher, is the capacity-building and technical assistance to ministries and similar bodies, and the creation of an institution, dubbed Somali Electrification Institute in this Report, able to vet, approve, and oversee electricity generation projects and approve licenses for public electricity supply, within the parameters agreed by the authorities and the development partners (apologies for repetition: this is of vital importance).

<u>Actions</u>	<u>2015 US \$ Dollar Million</u>											
	<u>'16</u>	<u>'17</u>	<u>'18</u>	<u>'16-'18</u>	<u>'19</u>	<u>'20</u>	<u>'21</u>	<u>'22</u>	<u>'23</u>	<u>'24</u>	<u>'25</u>	<u>'16-'25</u>
Capy-Bldg & TA to Policy Bodies	4	10	10	24	12	11	11					58
Somali Electrification Institute	2	2	2	6	4							10
Electric Power	1	25	50	76	80	80	80	100	80	80	4	580
Subst. Biomass	1	2	3	6	20	30	30	9				95
Off-grid energy	1	2	2	5	10	15	15	10	5			60
Totals	9	41	67	117	126	136	136	119	85	80	4	803

9.2 Public lighting

This A/I Programme does not propose public lighting projects as such. These projects present a difficulty in that they are useful, but experience shows that there arises the problem of who should pay, and how. State-owned utilities can afford public lighting, often expected to be paid by municipalities, who are always starved of resources and generally do not pay. But their losses are at some point covered by the public purse (the Ministry of Finance or similar). This would not be the case when generation, as proposed here, is fully private. Still, some public lighting could be introduced within the licenses for public electricity supply, for instance, by allowing a small surcharge over the consumers' tariffs (especially for large consumers or businesses, keeping in mind that the surcharge should be small or it would drive away large consumers, who are the least costly to serve and hence the most profitable for the utility). Suitable arrangements for public lighting (to be officialized in the license for public electricity supply) can be found and agreed between the investor in generation, the communities served, and the licensing authority. In fact, many such arrangements already exist, for free or reduced tariffs to schools, mosques and/or other public or community facilities. The administrations, through the licensing authority could also give some incentives for public lighting (e.g. tax breaks on diesel, eventually breaks on profits tax, etc).

9.3 Implementation strategy and methods.

The programme summarily described in the table above, estimated to cost \$ 803 million over a ten-year period, is almost impossible to execute in a country where the government is at an early stage of formation and contends with an almost total absence of human and financial resources. While some areas have slightly better developed structures of government, these constraints exist and are binding everywhere. Also, the absence of a good and satisfactory level of security means that programmes may have to be implemented in what may seem disorderly fashion: conditions may allow a project to be implemented in one town, but not in the next one. So, the programme may appear discriminatory while in fact, it must be selective to be effective. It must choose selectively where the conditions for successful implementation are present and concentrate on those places. It is hoped that the progress being made in all Somali areas will continue and so, in what may seem a complex path, all areas can receive investments in state-of-the art electric power supply and distribution.

A *sine qua non* condition for a successful start of all programmes is support (training, technical assistance, and capacity-building) to Ministries and similar bodies in the various areas. So far, there are three such agencies that have been identified: the Federal Ministry of Energy and Water, the Ministry of Energy and Mineral Resources in the Somaliland area, and PSAWEN in the area of Puntland. The strengthening of these agencies is absolutely necessary, on pain of there being no-one with whom to discuss and exchange views, let alone come to an agreement on energy sector development and expansion issues. In addition to these, assistance to the agencies in charge of Environment (rangelands, charcoal, forests), Hydrocarbons (import and marketing of petroleum products), and Finance (to assist in dealing with power generation licenses and pricing and taxation of petroleum fuels) should also be started immediately.

Another important requirement for a successful start to the energy sector programme or action plan is the creation of an institution able to evaluate and approve electricity generation and distribution projects. These projects would be approved when presented by a private business person or group (possibly already in the electric power business) willing and able to invest an amount equal to 25% of the costs of the generating plant, which should be of an appropriate size to serve the population willing to pay for electricity (perhaps identified through a previous survey estimating the expenditures on energy and comparing them to the proposed tariff and consumption). This report

has called it Somali Electrification Institute, it can be called by other names but its functions and functionality must be clear and it must be given authority to approve projects including their financing, and to license electric power generators, once the plants have been completed.⁶⁷

Even before playing this role, it could/should/might help the existing electric power generators to consolidate (not necessarily into one group, but into as few groups as possible, especially in the larger agglomerations) so that they can invest in generating plant of optimal scale. This would give the generated power the specifications to enable it to transit through a grid that would probably not be the property of the generators singly (but could be the property of the association of generators). In fact, a better option might be to make the grid into the collective property of the city, province or community. Public ownership in this case might be acceptable to Somali private generating companies, as an alternative to having some (one or several companies, their rivals...) own the grid. A new grid would permit the reduction of (currently) massive distribution losses, and enable the inclusion of renewable energy generating capacity, leading to lower tariffs given the proposed subsidy to investment and the vastly more efficient grids. This unbundling would not occur with minigrids which would be owned by the generators, given the modest size of the generation/distribution investment and the small dimension and cost of the minigrid (without transformation or medium voltage lines).

Donors, operators of the Trust Funds, or development partners generally should agree to fund the projects vetted by the Electrification Institute. They would agree to finance 75% of the costs of private generation projects (that include both conventional and renewable energy), and 100% of grid projects (especially in major cities). These agencies would also agree to finance 75% of the total costs of hybrid minigrids (generation based on both diesel and solar PV and the LV distribution grid), while the private investors would have to contribute 25% of the cost of the entire minigrid system (generation and distribution).

Given these important powers to be given to the Electrification Institute by donors, it seems obvious that such an institution cannot not report in some fashion to the donors (in addition to the authorities of the various Somali areas). It was earlier suggested that this organization report either to some of the New Deal Committees (or to bodies created by the New Deal donors), or to some Committee created by IGAD. It could also be headed by a Board of some sort on which both donors and Administrations could be represented. Ideas would need to be exchanged among donors and Somali area authorities in order to arrive at a consensus over the roles, duties and mandates of the Electrification Institute and its *modus operandi*. Enabling documents (statutes, rules and regulations, procedures) would then need to be prepared and suitable staff identified and appointed. Fully describing the policies and procedures of such an institution is beyond the scope of this programme. But these should be taken-up when the implementation of the project is contemplated (some sort of feasibility study).

9.4 Risks, specificities of Somalia.

Somalia is a complex reality, things have a way of happening by themselves and time is a relative concept. Somalis are extremely dynamic and often unpredictable. They can also have very original points of view about the relative importance of things like electricity or improved stoves, as for the past 22 years, they have lived within a system outsiders can never fully understand (without the basic public goods most people take for granted: rule of law; legality/safety/security; representation

⁶⁷ It has been suggested this Institute could deal with all infrastructure, but all infrastructure services do not require the level of supervision of electric power, nor do they share its monopolistic elements. However, if the Institute functions well, some other sectors could be added to its purview.

in international bodies; representative, responsible government; international travel, including passports; and postal services;... etc). This should always be kept in mind by the analyst or planner.

It is possible, even likely that a number of the actions mentioned here will face enormous implementation difficulties and some may turn-out to be impossible to implement. This is because most materials and equipment must be imported, and there are few ports, and few international shipping lines serve them (in part because of high risks due to piracy and the impossibility of insuring ships/cargoes). Further, transporting valuable materials and equipment internally by road is equally risky, as convoys/vehicles can be attacked and robbed. And finally, lengthy delays are to be expected given the often poor condition of roads and vehicles. This means that the implementation of this programme should be attempted with all seriousness, but that difficulties should not be underestimated, lest the authorities and development partners both, may fall victim to discouragement. The very size of the programme is a bet that security, governance, and civic behaviour (including a pluralistic sense of society/polity) will progress over the coming years and make the programme appear more easily implementable.

Lack of easily available technical and skilled labour creates its own further delays and increases in costs (heavy rates of breakage, poor workmanship). It is also likely that the cost estimates given will prove wide of the mark. The cost levels in this report (for grids, civil engineering, etc) are estimated at twice the costs in Europe, except for generating equipment which is priced at \$1500/kW for diesel fuelled equipment, and \$ 8000/kWp for solarPV. In part this is due to the high costs of security, in addition to the inefficiencies/risks mentioned earlier.

Another risk is that the TA/training for needed qualified personnel may be very expensive, or even not be available. Because it might also be difficult to find external experts willing to spend long periods in Somalia (Hargeisa is relatively comfortable, but even Garowe, and more so Mogadiscio, would be difficult places for expatriates to spend long periods). Compromises will be needed, perhaps on the specific quality of the expertise, on the level of remuneration, and on the length/frequency of rest and recuperation periods, or most likely, all three. Otherwise, greater recourse must be had to trained, expatriate Somalis by convincing them to return from abroad through proper financial and other incentives. And that has its own difficulties.

Still, Somalia is a fascinating country and Somali culture is vital and original.⁶⁸ Working with Somalis is an exciting experience in getting to assist people who really do need the help. In spite of their misfortune, Somalis do deserve help from more fortunate societies and assisting them with new, modern sustainable sources of energy would enable them first, to improve their quality of life, or level of well-being, and enable them to fend for themselves more effectively, reducing their needs for assistance in future.

⁶⁸This remark is based on this author's acquaintance with Somalia which harks back to 1975 (as World Bank Country Economist for Somalia and Ethiopia until 1979), when the Somali state was at the apogee of its power. He later held the post of Director of the UN's Development Office for Somalia (UNDOS) between 1998 and 2002, including a period as Principal Economic Advisor to the TNG, and as UNDP-Somalia Sr. Economist. This assignment represents his third period of work on Somalia over 40 years.

ANNEXES		Page No.
ANNEX I	Action/Investment Programme by time period, 2016-18 & 2019-25	60
ANNEX II	Installed Capacity, Connections and Power/Connection	61
ANNEX III	Standard Electrification Costs: Scalable Model	64
ANNEX IV	SE4All Electrification standards	67
ANNEX V	Minigrid Policy & Tariff Options for Minigrids	68
ANNEX VI	Bibliography	69
ANNEX VII	Meetings and Interviews	70
ANNEX VIII	Two recent estimates of Somali Population	72

DRAFT

ANNEX I:
SOMALIA: ACTION/INVESTMENT PROGRAMME BY TIME PERIOD

Activity	SUMMARY of INVESTMENTS: SOMALIA ENERGY ACTION PLAN	16-'18	19-'25	TOTAL
	DESCRIPTION	\$ million	\$ million	\$ million
TA & CAPY BLDG TO POLICY BODIES	Technical Assistance and training	24	34	58
	Assistance to Energy Ministries & similar	10	10	20
	Assistance to Ministries of Environment & Petroleum & Finance	9	9	18
	To be identified	5	15	20
CREATION OF SOMALI ELECTRIFICATION INSTITUTE	Agency to vet and approve electric power projects (gen & distr)	6	4	10
EXPANDING ACCESS TO ELECTRICITY IN CITIES	Expand access to electric power esp. in cities	76	504	580
	Cities with 5000 connections (5)	14	56	70
	Cities with 10000 connections (15 district capitals)	25	225	250
	Cities with 50000 connections (3)	30	120	150
	Twenty other urban areas (1000-5000 connections)	5	95	100
	Hybrid Minigrids (10 minigrids 200-1000 connections)	2	8	10
SUBSTITUTING FOR BIOMASS FUELS	Promotion of kerosene as cooking fuel	6	89	95
	Areas of South (equipment and TA)	2	33	35
	Area of Puntland	2	28	30
	Area of Somaliland	2	28	30
OFF-GRID MODERN ENERGY	For urban/suburban/rural poor and nomadic communities	5	55	60
	Equipment		24	24
	Info and Promotion campaigns	3	9	12
	TA/Training	1	5	6
	Other goods and services	1	17	18
Grand Total		117	686	803

ANNEX II.

SOMALIA: INSTALLED CAPACITY, CONNECTIONS AND POWER / CONNECTION**Mogadiscio/Benadir**

Company Name	Total Power installed (MW)	Number of Customers	Average Power (kW)
Somali Power & Water	9	42000	
Somali Energy	7.8	40500	
Somali Electric	7	27,500	0.236
Mogadishu Power	0.72	6,700	0.107
Ramadan Electric	0.5	3,000	0.16
Boqoljirow Electric	0.5	1,150	0.43
Medina Electric	0.65	X	X
Partial Total	26.17	120850	0.21
Self-Producers*	3.2	X	X
Total Mogadishu	29.37	120850	0.243

* Strictly speaking these should be excluded: they are not supplying the public.

Galguduud & Mudugh Region (Central State)

City	Installed capacity kW	Customers	Customer Power kW
Galgudud			
Dusamareeb	670	1000	0.67
Abudwaq	600	1200	0.50
Guri-Eel	620	1100	0.56
Adado	520	1400	0.37
Total (Galguduud)	2410	4700	0.512
Mudug			
Galcaio 1	3X640=3200		
Galcaio 2	2X500=1000		
TOTAL (Mudugh)	4200	11300	0.37
Grand Total	6610	16000	0.41

Middle Shabelle & Hiran Regions

Company	Power Installed (kW)	Customers	Customer Power (kW)
Middle Shabelle			
Jowhar	1100	3000	0.33
Balad	500	1500	0.33
Partial Total	1600	4500	0.33
Hiran			
Beled/Weyne1	850	2500	0.34
Beled/Weyne2	600	1115	0.54
Partial Total	1450	3615	0.40
Gran Total	3050	8115	0.37

BAY & Lower Shabelle Regions (South West State)

Company	Power Installed (kW)	Customers	Customer Power (kW)
Bay			
Baidoa Power Station	2580	3000	0.86
Partial Total	2580	3000	0.86
Lower Shabelle			
Afgoie	440	4500	0.1
Merka	680	X	X
Barawe	184	X	X
Qorioley	180	X	X
Partial Total	1484	4500	0.1
Total	4064	7500	0.4

Jubba Interim State (Kisimayo)

Unit	Power kW)	Customers	Average Power/ Customer
WESCO	2X700=1400	8000	0.175
SOMTEL	2X500=1000	4500	0.222
TOTAL	2400	12500	0.192

Puntland

City	Installed Power (kW)	Customers	Average Power Per Customer (KVA)
BOSASO	6,295	15,000	0.42
QARDO	2,080	4354	0.47
Garowe	3,000	7000	0.43
Gran Total	11,375	26,354	0.43

Somaliland

City	Installed Power (kW)	Consumers	Power Per Consumer (kW)
Hargeisa	30000	60000	0.5
Berbera	5100	3200	1.6
Borama	3735	9000	0.415
Burao	7500	12,500	0.6
Erigavo	?	?	?
Las-Anod	?	?	?
Grand Total	46'535	85'500	.54

INSTALLED AVAILABLE CAPACITY: ALL SOMALI AREAS

Area	Installed Capacity (kW)	N° of Connections	Power per connection (Watts)
Mogadishu/Benadir	29370	120850	243
Central State	6610	16000	410
Hiraan & Lower Shabelle	3050	8115	370
South-West State	4064	7500	400
Jubba State	2400	12500	192
Puntland State	11375	19535	430
Somaliland State	46535	85500	540
Grand Total	83404	270000	310

Data collected by Musse A. Abdi and Michel Del Buono; estimates, from not always reliable sources.

ANNEX III

STANDARD ELECTRIFICATION COSTS: SCALABLE MODEL (developed with assistance of Electricity of Portugal, DG, Mr. Joao Baptista)

GENERATION: 2MW: 1.5 MW THERMAL, 500 kW SOLAR.PV. Cost of Generation: 1500 kW @ \$1500/kW = \$2.25 million plus 500kW @ \$8000/kW = \$4.0 million. TOTAL= approx. \$ 7 million.

GRID:

Maximum load : 2 MW

Consumers: 1,000-5000 (400W - 2kW/connection)

Maximum contracted power per consumer: 2 kW (2MW=1,000 * 2)

Length of 11 kV aerial lines: 2 lines x 10km/line = 20 km (assuming very dispersed population and generation/substation at one end of the city)

Typical capacity of 11kV/LV transformer: 100 kVA (pole mounted on 11 kV poles)

Number of 11kV/LV transformers required: 2,000 kW/100 = 20 transformers

Number of outgoing LV feeders from each transformer: 3 feeders (normal situation)

Number of consumers connected to each transformer: 1,000 consumers/20 transformers = 50 (could be more numerous if power/connection were lower).

Total number of LV feeders: 3 x 20 = 60 LV feeders outgoing from 20 transformers (3 from each transformer)

Number of consumers supplied by each LV feeder: 50/3 feeders = 17

Maximum load supplied by each feeder: 17consumers x 2 kW = 34 kW (or larger number with lower power each).

Total length of 11 kV lines: 20 km

Total length of LV lines: 20 km (assuming dispersed location of consumers)

Unit cost of 11 kV lines: 21000 Euro/km (including poles)

Unit cost of LV lines: 8,000 Euro/km (either mounted on poles or in bundled conductors attached to houses)

Unit cost of 100 kVA Transformer: 8,000 Euro/PT

Total cost of 11 kV network: 20 x 21,000 = 420,000 Euro

Total cost of LV network: 20 x 8,000 = 160,000 Euro

Total cost of Pole mounted Transformers: $100 \times 8,000 = 800,000$ Euro (including LV fuses and connections to 3 outgoing feeders in each transformer)

Total cost: $420,000 + 160,000 + 800,000 = 1,380,000$ Euro (= \$ 1.5 million). For taking into account Somali conditions and costs, this estimate will be multiplied by 2: \$3.0 million.

Cost of materials for 5000 connections: \$800/connection: approx \$ 4 million.

COST OF ELECTRIFYING A TOWN/VILLAGE WITH 5000 CONNECTIONS

Summary		
Generation:	2MW (hybrid: 3/4 Diesel, 1/4 SolarPV) = \$ 7 million	
Grid:	5000 connections	= \$ 3.0 million
Materials for house connections	5000 connections	= \$ 4 million
Total:	Approx	= \$ 14 million in round numbers

Generation: Diesel, \$1500./kW; Solar, \$ 8000/kW;

Medium Voltage Grid (11kV): \$42,000/km, LV Grid incl. MV/LV transformers, \$ 300,000/km, depending on the number of transformers needed, which depends on the load and the number of connections (50 connections/transformer, perhaps more if power per connection is low). In Somalia, grids estimated to cost about twice the cost in Europe. Materials for house connections: \$ 800-\$1000, as estimated in a WBank project in Liberia).

This cost is for very dispersed households, therefore it can accommodate up to 5000 connections with small increase in costs (mainly for transformers, and low voltage grid). Strictly speaking, for 1000 connections less than 1 MW would be enough (say 500 kW diesel and 250 SolarPV) and fewer transformers (20 transformers, 10km 11kV lines, 10 km LV lines, and might need a smaller grid if houses not overly spread-out). So total cost would be \$2.8 million for generation, \$1.0 million for the grid, and \$ 1 million for materials to connect houses. Total cost for 1000 connections = approx \$ 5 million, in round numbers.

The total costs do not rise with number of connections because this size/capacity grid is sufficient for many more connections. What is required is more generation and more transformation, as well as more materials for house connections themselves. The \$800/house estimate comes from a WBank project in Liberia.

Standard 50,000 connection electric power project.

Total generation: 50 MW, of which 40MW thermal and 10 MWp Solar PV.

Capital cost of generation: Thermal: \$ 60 million; SolarPV, \$ 80 million.

Grid: 100 km @ 11kV; 300 km at LV;

Hybrid City Grid with 1000 connections

The standard project to establish a grid and connect 1000 customers might be as follows: generation could be about 750 kW (say 500 kW diesel and 250kWp SolarPV), or about 600-700 W per household, and grid could be 10km of 11kV lines, 10 km LV lines, and 20 transformers (smaller grid could be sufficient if houses not overly spread-out). So total cost would be \$2.8 million for generation, \$1.0 million for the grid, and \$ 1 million for materials to connect houses. Total cost for 1000 connections = \$ 4 to \$ 5 million, in round numbers. There are many dozens of towns and villages that could justify this type of system. Say, all towns with around 50,000 people could be considered for this programme

ANNEX IV:

SE4ALL: ELECTRIFICATION STANDARDS

from: SE4All

TIER 1: 1-20 WATTS, TASK LIGHT + PHONE CHARGING (2-4 HRS/DAY)

TIER 2: 20-50 WATTS, GENERAL LIGHTING, TV, FAN (2-8 HRS/DAY)

"TIER 2.5": 50-200 WATTS (2-6 HRS/DAY, this power level not shown in SE4All document)

TIER 3: 200-500 WATTS, ADDITIONAL APPLIANCES (2-8 HRS/DAY)

TIER 4: 500 WATTS - 2 kW, PLUS MEDIUM POWER APPLIANCES (4-16 HRS/DAY)

TIER 5: >2 kW; ALL APPLIANCES (4-22 HRS/DAY)

MINIGRID ACCORDING TO SE4ALL POLICY BOOK

System

- 100kWp SOLAR PV
- 100kVA DIESEL
- 3.5 Km LV GRID (max generation about 160 kW???)
- WITH BATTERIES (560kWh) AND INVERTER (60 kW, AC/DC system)
- Diesel cost valued at Euro 0.70/liter.

Financing plan:

- 20% Equity
- 30% Debt
- 50% Grant

Total investment is estimated at Euro 520,000.

This is badly underestimated. Similar system in Somalia would cost at minimum \$ 1 million.

System reportedly breaks even at tariff of Euro 0.43/kWh with sales of 420 kWh/day (revenues of Euro 181/day). Book does not say number of customers, but at TIER 3 electrification level (200W/customer), it could serve as many as 700-800 customers (given daily sales of 420kWh, sales/connection would be about 600Wh/day, which seems a bit low).

Adaptation for Somalia would require a simpler system (like the one proposed by World Bank for Mali rural electrification). Proposal would be to require 25% equity contribution by investors, eliminate debt part, and give a grant of 75% of investment cost (gen+distr). Tariff for this modified system in Somalia might therefore be slightly higher (less debt, but higher costs), say, US\$ 0.50-60/kWh.

ANNEX V:

MiniGrid Policy Toolkit. Possible Tariff Options for Hybrid Minigrids

Published by: European Union Energy Initiative Partnership Dialogue Facility (EUEI PDF) c/o Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) P.O. Box 5180 65726 Eschborn, Germany info@euei-pdf.org www.euei-pdf.org www.africa-eu-renewables.org

Currently the EUEI PDF is financed by the Netherlands, Germany, the European Commission, Sweden, Austria and Finland.

Place and date of publication: Eschborn, 2014

Authors: Michael Franz (EUEI PDF), Nico Peterschmidt (Inensus), Michael Rohrer (Inensus), Bozhil Kondev (GIZ) Contributors: Rana Adib (REN21), Catherina Cader (RLI), Andrew Carter (Aphelion Energy), Peter George (GVEP), Henry Gichungi (Kenya Power & Lighting Company), Mark Hankins (African Solar Designs), Niklas Hayek (EUEI PDF), Mahama Kappiah (ECREEE), Simbarashe E. Mangwengwende (independent consultant)

Tariff Structure for Mini-grids

Most tariffs can be divided into energy-based, power-based or fee-for service tariffs.

Energy-based tariffs depend on the actual electricity consumed and are thus based on measured kWh. For example, one PV diesel hybrid mini-grid in Bangladesh has a connection fee of c. 47 EUR and an operational tariff of c. 0.28 EUR/kWh (Philipp, 2014).

Power-based tariffs are based on the expected power consumption, which in turn determines the maximum power available for the consumers. These tariffs are calculated on a Watt basis. A basic tariff would limit consumer consumption to e.g. 60W and charge each consumer 5.54 EUR each month (ESMAP, 2000). It might also be linked to the number of light bulbs and appliances that the consumer proposes to use.

Fee-for service tariffs charge for services provided and not per unit of energy. The tariff is based on kg, hour, liters or other units of service, e.g. TV service: 0.68 EUR per hour per person (Philipp, MicroEnergy international, 2014). The price of services is often determined around the avoided cost of kerosene/diesel. These tariffs can be either pre-paid or post-paid.

Pre-payment tariffs give both mini-grid operators and consumers more planning security. In Africa, these prepayment systems are also viewed positively because of the good experience with a similar payment scheme for mobile phones. Tariffs can further be distinguished between breakeven tariffs or profitable tariffs (free-of-charge tariffs are not discussed here).

Break-even tariffs are designed to ensure cost-coverage (often used in community mini-grids).

Profitable tariffs, which are usually higher, are designed to generate sufficient return on investment to appeal to private sector investors, typically cover all system costs, and are flexible and can be revised.

Other tariffs which can be energy-based, power-based, or on a fee-for service basis, as well as either breakeven or profitable, include:

Customer class tariff regime: sets diverse tariffs according to consumer group, e.g. residents, institutions and businesses. It is mostly used to cross-subsidize residents. U-Stepped tariff regime: includes different tariffs depending on consumption level of the consumers.

With progressive tariffs, consumers pay low tariffs for the first kilowatt-hours (or Watts) and higher tariffs for further consumption (cross-subsidization). It may also include a lifeline tariff, which basically is a subsidized tariff providing basic electricity needs.

With regressive tariffs, larger consumers pay a lower unit price.

Flat-rate tariffs: fixed tariffs that do not depend on electricity consumption, and only need a load limiter as a metering technology.

Time-based tariffs: variable tariffs based on the time of day. They are mostly applied for commercial and industrial consumers and are also used for load scheduling (Demand Side Management).

Flexible tariff structure: includes tariffs that change according to electricity demand or power demand, providing incentives for electricity usage when surplus energy is available. Here advanced metering systems are needed.

BIBLIOGRAPHY: SOMALIA

- UNDP-Somalia; *Energy Consumption and Supply Survey, Somaliland*, January 2011.
- EU; *Energy Sector Report for Somaliland and Puntland States*, Oct 2012.
- EU; 10th *EDF Supplementary Funding, Economic Growth Programmeme Identification Study*. FED/2011/267190, Final report, Bruxelles, February 2012.
- EU; *Puntland and Somaliland, Needs and Opportunities in the Energy Sector for Economic Growth*, final report, Nov. 2011, Annexes 8, 10.
- Somaliland Electricity Agency; *Somaliland Energy Sector Background*, (Hargeisa, WakaladdaKorontada 2013).
- Republic of Somaliland, Ministry of Mining, Energy and Water Resources, *Somaliland Energy Policy*, Nov. 2010.
- EU; *Action Fiche for Infrastructure and Energy for Economic Development, Somalia*, March 27, 2013
- UN-HABITAT (SECIL); *Energy base-line survey of Mogadishu*, June 2013 (funded by EU).
- Tatiana Nenova, World Bank; *Private sector response to the absence of government institutions in Somalia*, Draft, July 30, 2004.
- UN; *Joint Programmeme for Sustainable Charcoal Production and Alternative Livelihoods, 2013*
- UNDP/Japan; *Introduction of Solar Applications to Improve Energy Security in Somalia, 2013*.

ANNEX VII

MEETINGS AND INTERVIEWS

Persons met and Institutions visited.

October 2014

H.E. Mr Jama Ahmed Mohamed "Ooday", Minister of Energy and Water Resources, FGS, Rome, 13 October 2014.

Mr. Paolo Toselli, EU staff member (NBO Delegation) in charge of major project in Puntland, Monday 20 Oct 2014. Tel: +254 20 280 2000 Email: paolo.toselli@eeas.europa.eu

Ms. Mandy Woodhouse, Interim Country Director for Somalia, ADESO-Somalia (NBO). 23 Oct 2014. Agency implementing EU project Millennium Challenge in Puntland which has a large energy component (LPG, substitution of charcoal).

Mr. Abdullahi Ga'al, EU staff member (NBO), Somali economist. 18 October. Monitoring and Evaluation Advisor, European Union Delegation to the Federal Republic of Somalia Tel: +254 2 2802000 mobile +254 722 229515 Email: abdullahi.ga'al@ext.eeas.europa.eu Web site: www.eu-somalia.eu

Mr. Abdul Qadir Rafiq, UNDP Somalia (Gigiri), meeting on 27 Oct. 2014). In charge of UNDP energy sector projects; abdul.qadir@undp.org

Ms. Alessia Riccardi, Italian Embassy NBO, in charge of development cooperation with Somalia. Meetings on 29 October, 5 December 2014. Tel: +254 20 319193/9 Mobile; +254 705 266255 Email: somalia.nairobi@esteri.it Web site: www.nairobi.cooperazione.esteri.it@CoopNairobi

November/ December 2014

Federal Government of Somalia (FGS)

H.E. Mr. Abdi Dirshe, Ministry of Planning, Permanent Secretary, FGS
Tel: +252 616999904 Email: adirshe@mopic.gov.so/ dirsheabdi@gmail.com

Dr. Mohamed Ali-Nur Hagi, Sr. Resource Economist, Ministry of Petroleum and Mineral Resources, FGS Tel: +262 618474946(Somalia) +254 719 476557(Kenya)+447950329967
Email: mhagi@mopetmr.so/ mohhaggi@gmail.com

Eng. Ahmed Jimale, Energy Advisor to Ministry of Finance, FGS
Tel. +252 6 1 222779 Email: info@sunsomenergy. com/ jaffjimale@gmail.com
Website : sunsomenergy. com

SOMALILAND

H.E. Mr. Hussein Abdi Dualeh, Minister of Energy and Minerals, Republic of Somaliland (and his senior staff); Office +252-63 528766; Mobile +252-63- 4240056;
Email: minister.moem@somalilandGov.com

Mr. Abdirizak Khalif Ahmed, Minister of Public Works Somaliland (ex minister Commerce);
Tel. mobile +252 2 4240037
Office ; +252 2 52523229/ +252 2 520611; Email: dawdar@hotmail.com;
dawdar2001@yahoo.com

Eng. Rashid Mohamed Ali, Director of Planning, Ministry of Public Works, Housing and Transport
Tel: +252 2528505 Fax +252 2528805 Mobile: +252 24424129/ +252 8283431
Email: rasmel_ali@hotmail.com Web site: www.hawlahaguud.com

Mr. Saed Ahmed Jibril, DG of Ministry of Energy and Minerals Tel: +252 63 4241087/ +252 63 4724203 Email: moem.dg@gmail.com/ Siciid_66@yahoo.com

Mr. Suleiman Abdulahhi Jama, Director of Energy, Ministry of Energy and Minerals
Tel;+252 63 4402468 Email:allakaashi4@gmail.com

Mr. Mohamed Hamoud Aden, ADRA Hargeisa
Email: hamoud22@hotmail.com

Mr. Yusuf, Deputy Manager Maan-soor Hotel and Power Company
Tel + 252 2 527000/1/2 (Telesom) +252 7 953995/6/7 (Somtel) +252 213 930011/2 (STC)
Email: maansoorhotel@hotmail.com Web site: maansoor.com

Abdul Karim H. Musa (Muruqliqe), General Manager, SOMGAS, Gas Distribution Company
Tel: +252 2 2521666 Mobile: +252 2 4426482 Email: abdikarim@somgas.net/
muruqliqe2@hotmail.com Web site: www.somgas.net

PUNTLAND

Hon. Mr. Ali Ahmed Fatah, Minister of Planning and Int'l Cooperation, Puntland State of Somalia,
Mobile tel: +252 90 7793872; Email: minister@mopiplgov.net / amakhiri@aol.com;
Website: www.mopiplgov.net

Mr. Ali Hersi, General Director, Ministry of Planning, Puntland State of Somalia
Tel: +252 907 272310 Email: d.general@mopiplgov.net Website: www.mopiplgov.net

Mohamed Salad Abdi, Acting Chairman, PSAWEN (Puntland State Authority for Water, Energy & Natural Resources). Tel: +252 90 7797883/ 7720389 Email: psawen@hotmail.com/
psawenpi@gmail.com

Dr. Abdirisak Mohamed Ali, Ph.D., Director General, Puntland Ministry of Environment, Wildlife and Tourism; Tel(Mobile): +252 9 7727275 Skype abdirisak.ali94 Email: ama992003@yahoo.com/director.general@moewtpl.com

Mukhtar Abdirahman Ahmed, Director, Projects and Programmes,
PSAWEN (Puntland Authority for Water, Energy and Natural Resources
Email: mukhtar.psawen@gmail.com -----Tel: +252 90 7799545

Cabdifitaax Maxamed Cabdi, Chairman of NECSOM (Nugaal Electricity Co);
Email: waamol@hotmail.com Tel: +252 90 7794037

Abdi M. Dahir, Programmeme Director, NRM, ADESO (implementing EU Millennium Initiative)
Email: adahir@adesoafrica.org ---tel: +252 7797305/ +252 90 7407473 Skype: amdahir

Abdurahman Ahmed Derie, Deputy Project Manager, ADESO
Email: aderie@adesoafrica.org Tel: +252 5 866704 / 7950418(Puntland) /0634411898
(Somaliland)Mobile: +252 90 950418 Website: www.adesoafrica.org

ADRA-Garowe, Mr. Minyu Mugambe (no card given).

Puntland private solar/energy company SECCCO

Email: omarirbad@hotmail.com ; samatarirbad10@gmail.com --tel: +252 90 716913

United Nations

Mr. Sayed Sahibzada, Head of Office Garowe, UNDP Somalia Tel; +252 584 6484 Ext.111

Mobile: +252 90 779 4366(Garowe); +254 708 319 527(Nairobi)

Email:sayed.sahibzada@undp.org.....Web site www.so.undp.org

Ms. Susan Martin, Office of the Humanitarian Coordinator, UN, Garowe.

susanmartin89@hotmail.com; +252 907794957; susan.martin@one.un.org

Abdi Abokor Yusuf, Programmeme Officer, Poverty Reduction and Environment (PREP) UN Development Programmeme (UNDP) Tel: +252 252 5045/5(Office) Fax: +254 20 42555101

Mobile: +254 2 4428251 Email: abdi.yusuf@undp.org Skype: abokor.abdi

Web site: www.undp.org

Stephen Kinloch Pichat, Head of Sub-office, UN Development Programmeme, Hargeisa

Tel: +252 2 525504/5 Ext 104 Mobile:+ 252 2 4000 294(Hargeisa) +254(0) 731 909104(Nairobi)

Email: stephen.kinloch-pichat@undp.org ;Skype: stephen_kinloch_pichat

Abdul Qadir Rafiq, Project Manager-Environment and Energy, Poverty Reduction & Environment Protection, UN Development Programmeme, Tel: +254 20 4255000/ +254 20 4255189(Direct Line)

Fax: +254 20 4255101 Mobile: +254 (0)703 717030 Email: abdul.qadir@undp.org Skype: aqrundp

World Bank-Nairobi

Mr. Alex Appiah-Koranteng, Sr. Governance and Public Sector Specialist, World Bank, Nairobi

Tel: +254 708 7741??(Kenya)

Email: aappiahkoranteng@worldbank.org ;Web site: www.worldbank.org

Hugh Riddell, World Bank Nairobi, Tel; +254(0) 706 746023 Email: hriddell@worldbank.org

Others

H.E, Mr. Fabrizio Marcelli, Ambassador of Italy to the Federal Republic of Somalia,

Tel: 3319050 / 22401 16 Ext 117 Fax +254 20 2247086 Email: fabrizio.marcelli@esteri.it

Ms. Alessia Riccardi, Italian Embassy NBO, in charge of development cooperation with Somalia.

Meeting on 5 Dec. Tel: +254 20 319193/9 Mobile; +254 705 266255

Email:somalia.nairobi@esteri.it ;Web site: www.nairobi.cooperazione.esteri.it@CoopNairobi

Mr. Lucian Harriman, Danish Demining Group, Deputy Country Director, Somalia and Somaliland, Nairobi Tel: +252 63 4000 585/ +254 704 113342 Email: dcd@ddgsomalia.org

Web site: danishdemininggroup.dk

Ms. Joanne Crouch, Project Manager, SAFER WORLD, Somalia/land, preventing violent conflict, building safer lives. Tel: Mobile: +254 723 951124 Office: +254 (0)20 27 13603 /2733750/

2736480/44 Fax: +254(0)207736283 Email: jcrouch@saferrorld.org.uk

Web: Www.saferrworld.org.uk

Mr. Mohamed Ahmed Mohamoud "Barawaani", Executive Director, SONSAF (Somaliland Non State Actors Forum). Civil Society Group requesting accountability and transparency from the state.
Mobile: 252 634414335/ 252 65 91 15796 Tel(O): 252 2 570536
Email:mohamed@sonsaf.org/sonsafed@gmail.com

Abdullahi A Ga'al, Monitoring and Evaluation Advisor, European Union Delegation to the Federal Republic of Somalia. Tel: +254 2 2802000 mobile +254(0) 722 229515; Email: abdullahi.ga'al@ext.eeas.europa.eu ;Web site: www.eu-somalia.eu

Paul Simkin, Country Director-Somali Programmeme, Conflicts Dynamics International Tel: +254 721 205306/ +252 616 101032 Email: psimkin@cdint.org Skype: paulsimkin Website: www.cdint.org

Paul Smith, Infrastructure Programmeme Manager, EU delegation to the Republic of Kenya-Somalia unit Tel: +254 20 2713250(Pilot line) +254 20 2802115(Direct Line) Fax: +254 20 2724657 Mobile: =254(0) 703 717030

Philippe Durand, Field Officer EU delegation to the Republic of Kenya-Somalia Mission ; Tel:+25420 2802000 Fax:+254 20 2710997 Mobile: +254 727 798823(Kenya) +252 90 7794315(Garowe) +252 2 4251026(Hargeisa) Email: philippe.DURAND@ext.eeas.europa.eu Website: www.eu-somalia-unit.eu

SECCCO Solar Energy Company: owners: Omar Irbad, Email: omarirbad@hotmail.com (Father); Samatar Irbad, Email: samatarirbad@gmail.com (Son); Garowe; +252 90 716913.

ANNEX VIII

Population		Figures - Somalia			(Base: 2005 Census)
		TOT - growth rate	< 5 & WCBA	> 5	
ZONES & DISTRICTS		3%	20%	80%	
North East		1,093,320	218,664	874,656	12%
BARI		465,712	93,142	372,569	5%
1	Bosasso	208,898	41,780	167,118	
2	Gardo	89,719	17,944	71,775	
3	Banderbayla	18,211	3,642	14,569	
4	Ishkushuban	54,505	10,901	43,604	
5	Alula	44,339	8,868	35,472	
6	Qandala	50,040	10,008	40,032	
NUGAL		184,115	36,823	147,292	2%
1	Garowe	73,461	14,692	58,769	
2	Dongoroyo	25,755	5,151	20,604	
3	Burtinle	43,924	8,785	35,139	
4	Eyl	40,974	8,195	32,779	
MUDUG		443,494	88,699	354,795	5%
1	Galkayo	174,392	34,878	139,514	
2	Goldogob	51,219	10,244	40,975	
3	Jiriban	49,666	9,933	39,733	
4	Hobyo	85,189	17,038	68,151	
5	Harardere	83,028	16,606	66,422	
North West		2,316,592	463,318	1,853,273	24%
W. GALBEED		887,176	177,435	709,741	9%
1	Hargeisa	709,427	141,885	567,541	
2	Gabiley	100,789	20,158	80,631	
	Berbera	76,960	15,392	61,568	
AWDAL		386,943	77,389	309,554	4%
1	Borama	273,136	54,627	218,509	
2	Baki	39,019	7,804	31,215	
3	Luhaya	39,019	7,804	31,215	
4	Zeila	35,767	7,153	28,614	
TOGDHER		509,614	101,923	407,691	5%
1	Burao	365,097	73,019	292,078	
2	Odweine	53,244	10,649	42,595	
3	Buhodley	48,679	9,736	38,944	
	Sheikh	42,595	8,519	34,076	
SOOL		190,366	38,073	152,293	2%
1	Lasanod	95,560	19,112	76,448	
2	Teleh	32,118	6,424	25,694	
3	Hudun	23,796	4,759	19,037	
	Ainabo	38,892	7,778	31,114	
SANAG		342,493	68,499	273,994	4%
1	Badan	113,660	22,732	90,928	
2	Elafweyn	83,350	16,670	66,680	
3	Erigabo	145,483	29,097	116,387	
BANADIR		1,141,594	228,319	913,275	12%

1	Karaan	156,029	31,206	124,823	
2	Yaqshid North	162,765	32,553	130,212	
3	Shibis	101,026	20,205	80,821	
4	Bondere	77,454	15,491	61,963	
5	Shingani	30,869	6,174	24,695	
6	Abdilaziz	28,063	5,613	22,450	
7	Wardigley North	67,923	13,585	54,338	
8	Heliwa North	55,003	11,001	44,003	
9	Hodan	90,688	18,138	72,550	
10	Hawlwadag	49,548	9,910	39,639	
11	Hamarweyn	54,863	10,973	43,890	
12	Waberi	64,433	12,887	51,546	
13	Darkenley	51,916	10,383	41,533	
14	Madina	63,478	12,696	50,782	
15	Daynile	41,511	8,302	33,209	
16	HamarJabJab	46,023	9,205	36,818	
South central		4,952,631	990,526	3,962,105	52%
BAKOOL		393,493	78,699	314,794	4%
1	Wajid	88,286	17,657	70,629	
2	Rabdure	36,963	7,393	29,570	
3	Huddur	117,872	23,574	94,297	
4	Elberde	47,696	9,539	38,157	
5	Tieglow	102,676	20,535	82,140	
BAY		786,109	157,222	628,888	8%
1	Burhakaba	159,127	31,825	127,301	
2	Baidoa	288,521	57,704	230,817	
3	Khansadhare	118,714	23,743	94,971	
4	Dinsor	95,982	19,196	76,786	
5	Berdale	123,766	24,753	99,013	
GALGADUD		418,108	83,622	334,486	4%
1	Abudwak	52,022	10,404	41,618	
2	Adado	57,803	11,561	46,242	
3	Dushamreb	115,605	23,121	92,484	
4	El bur	100,191	20,038	80,153	
5	El Dhere	92,484	18,497	73,987	
HIRAN		417,795	83,559	334,236	4%
1	Beletweine	182,852	36,570	146,282	
2	Mataban	35,095	7,019	28,076	
3	Mahas	27,765	5,553	22,212	
4	Bulo Burti	112,895	22,579	90,316	
5	Jalalaksi	59,189	11,838	47,351	
LOWER SHABELLE		1,077,578	215,516	862,062	11%
1	Wanle Weyne	197,164	39,433	157,731	
2	Afgoy	171,029	34,206	136,823	
3	Awdegley	97,161	19,432	77,729	
4	Merka	244,409	48,882	195,527	
5	Quorirole	170,007	34,001	136,006	
6	Kurtunwarey	82,904	16,581	66,323	
7	Brava	60,364	12,073	48,291	
8	Sablale	54,541	10,908	43,633	
GEDO		415,979	83,196	332,784	4%
1	Bulahawa	70,925	14,185	56,740	
2	Dolo	33,563	6,713	26,850	

3	Luq	79,430	15,886	63,544	
4	Bardera	134,496	26,899	107,596	
5	Garbahare	48,159	9,632	38,527	
6	Burdubo	24,076	4,815	19,261	
7	El wak	25,330	5,066	20,264	
MIDDLE SHABELLE		652,261	130,452	521,809	7%
1	Jowhar	276,190	55,238	220,952	
2	Adenyabal	57,343	11,469	45,874	
3	Mahadey	64,897	12,979	51,917	
4	Adale	59,183	11,837	47,347	
5	Warskeikh	19,727	3,945	15,782	
6	Runingod	22,358	4,472	17,887	
7	Balad	152,562	30,512	122,050	
MIDDLE JUBA		302,602	60,520	242,082	3%
1	Buale	75,359	15,072	60,287	
2	Sakow	83,573	16,715	66,858	
3	Jilib	143,671	28,734	114,937	
LOWER JUBA		488,706	97,741	390,965	5%
1	Kismayo	211,129	42,226	168,903	
2	Jamame east	163,602	32,720	130,882	
3	Badade	48,948	9,790	39,158	
4	Afmadou	65,028	13,006	52,023	
Somalia		9,504,138	1,900,828	7,603,310	100%

Population Size and Distribution

The findings of the Population Estimation Survey for 2014 are that the estimated total population in urban, rural, nomadic areas and camps for IDPs in the 18 pre-war regions was **12,316,895**.

POPULATION	NUMBER (Million)	%
Estimated population	12.3	100%
Urban	5.2	42.4
Rural	2.8	22.8
Nomadic	3.2	25.9
IDPs	1.1	9.0
Male	6.2	50.7
Female	6.1	49.3
Source: UNFPA PESS, 2014		

UNFPA (PESS) Population by Region: Urban, Rural, Nomadic, and IDPs (in 000s).					
	urban	rural	nomadic	IDPs	Total
1.Awdal	288	144	234	8	673
2.Wookooyi Galb.	803	139	256	45	1242
3.Toghdeer	484	57	155	26	721
4.Sool	121	14	188	5	327
5.Sanaag	160	31	353	1	544
6.Bari	472	65	133	49	720
7.Nugaal	139	31	213	9	393
8.Mudug	381	80	186	71	718
9.Galgaduud	184	52	214	120	569
10.Hiraan	81	136	253	51	521
11.Shabelle Dhexe	114	249	10	52	516
12.Benadir	1281			369	1651
13.Shabelle Hoose	216	724	160	103	1202
14.Bay	93	463	196	40	792
15.Bakool	62	134	147	24	368
16.Gedo	109	178	145	77	508
17.Jubbada Dhexe	56	148	131	27	363
18.Jubbada Hoose	173	162	124	31	489
Totals	5216	2807	3187	1107	12317