Somalia

Energy Sector Needs Assessment and Investment Programme

AFRICAN DEVELOPMENT BANK GROUP

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Foreword

While assistance is required in all sectors of the Somali economy, infrastructure is particularly important, as it is the base of all productive and social activities. Thus, the efficient and effective intermediation of development assistance targeted towards the rehabilitation and development of Somalia's infrastructure sub-sectors (Energy, Transport, Water & Sanitation, and ICT) is a top priority. In this regard, the Federal Government of Somalia (FGS) intends to play an increasingly important role in attracting foreign development assistance and private investment toward infrastructure. This will play a critical role in accelerating Somalia's inclusive and sustainable economic recovery, peace and state building.

In order to understand the needs and build a pipeline of projects, the Bank, in collaboration with the FGS, has undertaken Infrastructure Needs Assessments (INA) in the Energy, Transport, Water & Sanitation, and ICT sub-sectors. These assessments are key deliverables of the Government's Economic Recovery Plan (2014-15) and will also feed into the preparation of the Government's new National Development Plan (NDP) and an initial pipeline of activities for the Bank's Somalia Infrastructure Trust Fund (SITF). The NDP will also serve as the Interim Poverty Reduction Strategy Paper (IPRSP) and begin to elaborate a vision and direction for Somalia's socio-economic development and poverty reduction efforts.

A previous version of this report (draft final report) was prepared for discussion at a validation workshop that was held in Mogadishu in August 2015. The FGS Ministry of Energy and Water Resources (MEWR) and the Bank co-chaired the meeting. About 35 persons – including representatives from the FGS, Puntland, the Interim Juba Administration, the Interim South West Administration, United Nations Agencies, bilateral donors and international financial institutions – attended the meeting. This final version of the report includes modifications arising from discussions at the validation workshop.

The Bank has recently adopted a Ten Year Strategy (2013-2022), which is designed to place the Bank at the center of Africa's transformation. In order to deliver on this Strategy, the Bank has adopted five priority areas of focus – the "High 5s" – which aim to: i) light up and power Africa, ii) feed Africa, iii) industrialise Africa, iv) integrate Africa, and v) improve the quality of life for the people of Africa. Through this report and the Bank's management of the SITF, we hope to play a central role in delivering light and power to all Somalis.

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The report was prepared by Michel Del Buono, who was supported by our late colleague and friend, engineer Musse A. Abdi, formerly Advisor to the Ministry of Energy and Water (MEWR) of the FGS.

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We also are gratefully acknowledge the comments and suggestions that were received from Bank staff, including Girma Abiyehoy (Senior Energy Specialist), Olufunso Somorin (Senior Policy Officer), Ahmed Dualeh (Consultant) and Salome Kimani (Consultant).

Abbreviations and acronyms

ADRA	Adventist Development and Relief Agency
AfDB	African Development Bank
A/I	Action/investment
ENEE	Ente Nazionale Energia Elettrica
ESAIP	Energy sector action/investment programme
EU	European Union
FGS	Federal Government of Somalia
HFO	Heavy fuel oil
IGAD	Intergovernmental Authority on Development
IJA	Interim Juba Administration
IMF	International Monetary Fund
ISWA	Interim South West Administration
LPG	Liquid petroleum gas
MEWR	The Federal Government of Somalia's Ministry of Energy and Water Resources
NEC	Nugaal Electricity Company
NGO	Non-governmental organisation
PPP	Public-private partnership
PSAWEN	Puntland State Authority for Water, Energy and Natural Resources
SDG	Sustainable Development Goal
SE4All	Sustainable Energy for All
SEA	Somaliland Electricity Agency
TA	Technical assistance
UN	United Nations
UNDP	United Nations Development Programme
US	United States
USAID	United States Agency for International Development
WB	World Bank

Executive summary

Introduction

1. 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 Trust 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 was 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 president have been elected, leading to international recognition of the FGS. A new constitution has been adopted, and new institutions are being put in place. The prospects appear more favourable 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.

2. Somalia joined a group of fragile post conflict countries that were determined to change their relationship with donors and 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 FGS and international development partners. The compact enumerates the critical priorities under the five Peace and State Building Goals endorsed as part of the New Deal principles and also includes a special arrangement for Somaliland. The FGS has also developed a two-year economic recovery plan for 2014–2015, presented together with the compact, contemplating total investment of USD 661.7 million, of which the highest priority flagship programmes amount to USD 221.9 million.

3. The FGS intends to play an increasingly important role in attracting foreign development assistance and private investment, and to assist and facilitate the mobilisation 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 living standards (better lighting, household appliances) and security, contributes to stabilisation and permits increases in productivity.

4. 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.

5. The FGS's ability to provide the basic public goods (that define what a government is and does) is severely limited, 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. it is avoiding “excessive premature load bearing”. For this reason, this report recommends the creation of a parastatal institution to manage the electrification process, an arrangement that might be more palatable than a state-owned solution to all levels of government, given Somalia’s federal nature.

6. Further, the country is divided into entities, with some claiming to be regions within a federal Somalia and one, Somaliland, claiming to be independent of the FGS. 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) would be preferable. 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. Several of these, namely, Puntland, Galmudug, the IJA, and the ISWA participated in the validation meeting.

7. 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 Mogadishu, Hargeisa, Bosaso, Berbera, in the north and south, one can find distribution of petroleum derivatives such as automotive fuels (diesel, gasoline), kerosene, and liquid petroleum gas (LPG). There is also a consolidation of small electricity generators that 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, Bosaso and Qardho), the entire energy supply system, based almost entirely on diesel generation and minigrids, is owned and operated by the private sector.

Objectives/scope

8. This energy sector needs assessment and action/investment (A/I) plan 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 companies/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 ESAIP. The overall ESAIP 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

9. The ESAIP resulting from this assessment has two main objectives:

- 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
- 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 solar/photovoltaic) and promoting non-grid modern energy services and products to poor rural and nomadic people.

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

10.1 To this end, **the programme to reduce use of biomass** fuels would assist 700,000 households in cutting their 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 six to seven years, roughly a quarter of estimated current consumption, noticeably reducing pressure on the threatened, dwindling, slow-growing and precious vegetative cover.

10.2 The **electric power supply expansion programme**, over the ten-year period, would result in the installation of close to 200MW of power generation capacity, of which 40–50MWp of renewable energy (mainly solar/photovoltaic), the creation/repair of 18 city grids (regional capitals plus Mogadishu and Hargeisa), and a pilot project consisting of ten rural hybrid minigrids. It also contemplates the electrification of as many as 20 other urban centres. 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 USD 1/kWh to about USD 0.50/kWh). This programme would enable access to reliable and sustainable quality electric service for about 300,000 households.

10.3 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.).

10.4 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 the Puntland State Authority for Water, Energy and Natural Resources (PSAWEN). These projects would also create capacity to collect basic data/information on the energy sector, and for monitoring and evaluation.

The energy sector and the sustainable development goals

11. The energy sector has a specific sustainable development goal (SDG), namely, SDG 7: Ensure access to affordable, reliable, sustainable, and modern energy for all. This is the main objective of the programme, and if implemented reasonably well, it will lead to major progress on SDG 7. However, the agreed ESAIP proposed in this report also touches on SDG 9: resilient infrastructure, as a reliable electricity supply will support other reliable infrastructure; SDG 15 as substitution of biomass fuels will permit sustainable forest management, combat desertification and protect biodiversity; SDG 1: End poverty, because greater access to energy will make people more productive, earning them greater incomes; and SDG 2, as more reliable and accessible cooking fuels will improve food preparation/security. While some elements of education (energy sector related skills) and improved health conditions for women (when they use better fuels for cooking) will be promoted to some extent, they are akin to collateral or indirect benefits of the ESAIP.

Energy sector: current status

12. 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 the collapse of the Somali State. 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 year[1], 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; these 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.

13. A recent study conducted by Habitat[2] for the European Union (EU) surveyed the energy situation of Mogadishu 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 severely depleted near cities. (Actually, charcoal sold in Mogadishu originates far from the city.) The very poor in Mogadishu now use waste paper, plastic and other garbage as cooking fuels.

14. 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.

15. Public supply of electricity ceased altogether after the state collapse as chaos, looting and destruction prevailed. Small companies emerged to supply power in their immediate vicinity at low voltage (LV). 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 running 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 was estimated at about 100 MW in 2014 with an estimated 250,000 connections.[3] If these numbers are broadly indicative of the situation, they would imply a capacity of about 300W/connection at generation (much less at household level given the high distribution losses).

16. There is 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.

17. Petroleum products – essentially for transport and electricity generation and in smaller quantities for cooking and lighting – account for about 10% of total

1 Equivalent to about 400kg/capita/year. Quoted in many sources, the earliest of which is a 1985 World Bank report entitled Somalia: Issues and Options in the Energy Sector.

2 UN-Habitat/Sustainable Employment Creation and Improved Livelihoods for Vulnerable Urban Communities in Mogadishu; Energy baseline survey for Mogadishu, June 2013.

3 As estimated from 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 caution; the numbers are probably overestimated, but they are presented here for want of better ones.

energy use. Electric power generation (almost entirely diesel-fuelled) accounts for about two of the ten percentage points provided by petroleum fuels. Transportation fuels (gasoline and diesel) account for most of the rest. Gasoline, kerosene and LPG are already imported and widely available across most of Somalia. LPG is used for cooking by the wealthier 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 (USD 6–7/barrel, equivalent to about USD 0.04/litre) on the part of federal and/or regional administrations.

Four main energy sector issues

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

18.1 **Shortage or lack of qualified personnel.** The most important crosscutting 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.

18.2 **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 productivity. Public supply of electricity in cities is limited in quantity, quality and reliability, and dogged by drops in tension (voltage) and frequent failures.

18.3 **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 country's very limited ecological/environmental resources.

18.4 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 only non-grid and portable solutions make technical and economic sense.

Characteristics of an energy sector action/investment plan

19. For Somalia, any energy sector development programme, or action plan should:

- Improve knowledge and build the capacity of institutions by expanding and improving their staff, even if initially only through short-term, stop-gap measures;
- Expand access to modern energy, especially electric power;
- Reduce the consumption of biomass-based fuels and substitute away from them;
- Extend modern energy products and services for cooking and lighting to rural and nomadic communities and
- Economise on scarce trained/qualified personnel while taking measures to increase its supply sustainably, probably only in the longer term.

Size of the programme

20. At about USD 800 million, the proposed ESAIP is large but not unduly so. It responds to the concerns expressed by Somali leaders consulted for this assessment, who are extremely conscious of the obstacles and difficulties of implementing energy

projects in the country. Many of them expressed the wish to see an ESAIP 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 Somalia's low absorption capacity, 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 ESAIP will have a short/medium-term phase of three years but no emergency phase (giving initial projects the time needed for their implementation) and an overall horizon of ten years.

21. This report suggests an aggregate ESAIP of USD 803 million allocated as in Table 1.

Table 1 Energy sector action/investment programme (2016–2025)

Item	USD million*
Training, capacity building and technical assistance (policy-making bodies)	58
Establishment of a Somali electrification institute	10
Expansion of electricity supply	580
Substitution of biomass fuels	95
Provision of modern energy to rural/nomadic communities	60
Total	803

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

22. The programme proposed in this paper is ambitious and farsighted: USD 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 from a country emerging from conflict and long-term chaos. More than the precise amount of the A/I plan, it is the rough order of magnitude and the distribution over the main group of activities that matter. In brief: a plan of roughly this size can address all major energy sector problems/issues at a scale that will produce substantial positive results. 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 three-year period and a subsequent consecutive seven-year period.

23. The ESAIP consists of an immediate USD 58 million programme of training, capacity building and TA for the main policy-making bodies of the FGS and the better established areas of Somaliland and Puntland.[4] The other major interventions are:

- A USD 10 million project to create a Somali electrification institute (an appropriate name to be discussed among and agreed upon by the FGS, regional and other authorities and development partners) to manage and regulate electric power generation and distribution;
- A USD 580 million programme to expand access to electric power in cities, including USD 10 million for rural/village hybrid minigrids;
- A USD 95 million programme to substitute modern fuels for biomass, essentially in households (including small projects to create alternative

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

livelihoods for charcoal producers, and construct modest storage facilities for liquid fuels); and
- A USD 60 million programme to introduce non-grid-based modern energy products and services for nomadic and rural communities.

24. The average annual expenditure per year in the initial three-year period is set at only about USD 40 million (versus about USD 100 million for the second period spanning seven years). If this modest spending target for the tree-year period were achieved, considering it is mainly for capacity building, training and TA to the ministries of Energy and similar bodies, many useful things could be achieved. The establishment of a proposed Somali electrification institute has a slightly more ambitious spending target, above 50% of the total expenditure within the first three years, considering it needs to be created entirely within that initial three-year period.

25. The most urgent tasks after the preparation of this ESAIP would be the actual preparation of the TA projects and the design of a Somali electrification institute, which could also help with some of the tasks being added in the TA and capacity building projects. The first component should be training and information/knowledge sharing about basic energy sector concepts and policies. This should be the first priority because it became evident during the research phase conducted for this report that hardly anybody understands even basic energy sector management concepts (power, energy, peak demand, load curve, load factor, economic tariffs etc.) and that there are very few persons working on energy sector management.[5] Energy and electricity are often confused, as are operations of electric utilities and energy sector policy/management. Given this state of knowledge, 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 dialogue on sector development and policies, so that Somalis can more fully understand and own their energy sector development process. The establishment of the following systems should be prioritised:

- An information/data collection system;
- A system to monitor developments in the energy sector, including the evolution of this ESAIP; and
- An initial analysis of the legal forms to adopt (e.g. PPPs and joint ventures), given that most of the investment is to be carried out by the private sector supported by donors.

These initial capacity building projects would also need to consider the requirement for further training of technicians for energy activities (conventional and renewable) and the possibility of studies abroad for high-level technicians and professionals (engineers, economists and accountants).

26. This ESAIP is not cast in concrete: it can evolve with developments on the ground or be seen as an input into the Somali authorities and their development partners' energy-sector policy-making and development planning. It would be presumptuous and premature to try to establish a rigid blueprint for a ten-year programme in Somalia. This ESAIP 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, around 2020, to capitalise on the lessons learnt 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 mobilised at that time.

Comments on Somalia's specific characteristics and risks

27. 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

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

the impossibility of insuring ships/cargo). 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 both the authorities and development partners fall victim to discouragement. The very size of the programme is based on a projection that security, governance and civic behaviour will progress over the coming years and facilitate the implementation of the programme.

28. 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 USD 1500/kW for diesel-fuelled equipment, and USD 8,000/kWp for solar/photovoltaic. In part this is due to the high costs of security, in addition to the inefficiencies/risks mentioned earlier.

29. Another risk is that the TA/training needed for qualified personnel may be very expensive or not even available at all. It might also be difficult to find external experts willing to spend long periods in Somalia; Hargeisa is relatively comfortable, but Garowe and more so Mogadishu 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, who should be convinced to return from abroad through proper financial and other incentives, which in turn bring about their own difficulties. Also, partnerships with other specialised implementing institutions (UN Development Programme (UNDP), the German Gesellschaft für Internationale Zusammenarbeit, the International Labour Organization, some experienced international non-governmental organisations (NGOs) etc.) will need to be explored in order to make sure that all avenues to accelerate implementation are pursued.

30. Still, Somalia is a fascinating country, and Somali culture is vital and original.[6] Providing Somalia with sustainable new sources of energy will enable the population to improve its quality of life and wellbeing, and enable the people of Somali to fend for themselves more effectively, reducing their needs for assistance in future.

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 between 1998 and 2002, including a period as principal economic advisor to the transitional national government, and as a senior economist at the UNDP's Somalia office. This assignment represents his third period of work on Somalia over 40 years.

I. Introduction and background

1.1 Introduction

1.1.1 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 Trust Territory of Somalia, collapsed. Most recently, Somalia 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 in addressing the country's immense challenges for a return to peace and eventually development appear more favourable than they have been for some time. 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.

1.1.2 The FGS intends to play an increasingly important role in attracting foreign development assistance and private investment, and to assist and facilitate the mobilisation 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 living standards (better lighting, household appliances) and security, contributes to stabilisation and permits increases in productivity.

1.1.3 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 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, where 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.

1.1.4 Somalia joined a group of fragile/post conflict countries that were determined to change their relationship with donors and 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 FSG and the international community endorsed the Somalia New Deal Compact on 16 September 2013. The compact enumerates the critical priorities under the five Peace and State Building Goals endorsed as part of the New Deal principles for engagement in Fragile States and also includes a special arrangement for Somaliland. The pillars of the Peace and State Building Goals are:

- inclusive politics,
- security,
- justice,

- economic foundations and
- revenue and services.

The compact is expected to guide international support to Somalia over the three years spanning 2014–16. Development assistance will be mobilised and channelled through a proposed new financial vehicle called the Somalia Development and Reconstruction Facility, which is expected to bring together several existing and new funds (managed by the World Bank (WB), International Monetary Fund (IMF), UN and the AfDB respectively) under a unified management and operating structure. In order to rebuild the Somali economy and provide better service delivery, the FGS has also developed a two-year economic recovery plan for 2014–2015, presented together with the compact. The economic recovery plan contemplates total investment of USD 661.7 million, of which the highest priority flagship programmes amount to USD 221.9 million. It seems that a two-year planning horizon was somewhat short as there have been some delays.

1.1.5 In Southern Somalia, the FGS in Mogadishu 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 FGS's ability to provide the basic public goods (that define what a government is and does) is severely limited, 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 FGS. 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.

1.1.6 Conflict has ebbed and flowed since 1991 when the Somali State collapsed. Certain periods permitted some reconstruction, and some periods had some measure of government (e.g. during the tenure of the transitional national government from 2000–03). Some periods were very conflictive, and there was regression. However, since 2012–13, there has been a tendency for life to return towards normal, with Mogadishu 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 and offer judiciary services again.

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

1.1.8 The subsidiary regional administrations that 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 Galmudug). And this popular will to restart also expresses the people's refusal to return to the chaos of the past. 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 that 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 reorganised, 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 localised problems to the holding of elections, as certain areas are better prepared than others. Overall, however, prospects are good and positive.

1.1.9 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 Mogadishu, Hargeisa, Bosaso, Berbera, in the north and south – one can find distribution of modern fuels such as kerosene, LPG and automotive fuels, which bodes well for the future. There is also a consolidation of small electricity generators, which are grouping together to afford the high investments necessary to offer state-of- the-art power supply services. Private investors, who may have profited from the war economy, are now 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 that is reaping its first rewards, as foreign companies (two Turkish companies are running the port and airport of Mogadishu) are taking their first tentative steps in Somalia. It is to be hoped that others will follow. These positive signs are likely to continue, and security will improve, especially if the international community continues its support, which should be more reliable within the New Deal framework.

1.1.10 Fortunately some areas, including those of Somaliland and Puntland, have made substantial progress in terms of security and safety, relative to 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 nationwide programmes (e.g. city electricity grids, substitution of biomass fuels, TA to ministries or other bodies responsible for energy) are being proposed and will include Mogadishu/Benadir and other regions in Southern Somalia, as, when and where they are effectively created and security conditions permit.

1.2 Objectives/scope

1.2.1 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 companies/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 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 energy sector

1.3.1 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). In addition to neglect, wanton destruction and looting 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. 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 organisation and policies

1.4.1 In Mogadishu, the 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 that there is a need for assistance with financial resources to compensate for this extreme budget stricture. The ministry's energy sector management department 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]

1.4.2 The ministry would like to develop the capacity to experiment with new and renewable sources of energy and 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 TA to ameliorate the staff shortage problem. The Ministry of Energy and Water Resources further intends to assist local governments (the future federal units) to 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 that 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 that would further 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.

1.4.3 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 centralising and used the model of a state-owned, vertically integrated monopoly. However, in Somalia, decisions are never unequivocal, and it seems the FGS has appointed new management for the previous state-owned power company, the National Electric Energy Entity or Ente Nazionale Energia Elettrica (ENEE) within the Ministry of Energy. It survives also, vestigially, and mostly in name, in Qardho and Bosaso, where the partly publicly owned power plants are still known under the ENEE or its abbreviation in Somali, WXKU)

1.4.4 In the area of Somaliland, the Ministry of Energy and Mineral Resources has responsibility for energy sector policy and oversight. It was recently reorganised, and water resources were transferred to another ministry. However, the Ministry of Public Works supervises the Somaliland Electricity Agency (SEA) because it was the ministry that rehabilitated the power plant and grid. A publicly owned, vertically integrated utility, the SEA owns and operates power plants and grids in both Hargeisa and Berbera. The only public generation and distribution utility, the 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 and Mineral Resources has little qualified staff and thus limited capacity to manage the sector.

1.4.5 Further, in Somaliland, the management and control of natural resources including charcoal are the responsibility of the Ministry of Environment and Rural Development, which finds itself under similar circumstances: strictly limited budget, shortage of qualified staff and, consequently, no capacity to oversee and regulate charcoal production and marketing, which are part of its mandate. But there are also some overlaps, as the Somaliland Ministry of Rangelands has jurisdiction over the vegetative cover and conducted a study of charcoal consumption together with UNDP in 2011.

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 programme for its first 100 days of functioning.

8 The old legislation would not be useful in that it gives the ENEE, the former state-owned utility, a monopoly of generation, transmission and distribution. The ENEE currently has a vestigial existence, as the FGS has appointed a director general. To what end is unclear.

1.4.6 Somaliland adopted its National Energy Policy in November 2010, as a result of the Somaliland Energy Policy Dialogue and Somaliland Energy and Livelihoods Programme, both supported by the EU. Somaliland energy electricity regulations and the Somaliland Electrical Energy Act have been prepared with support from the United States (US) 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 and trust fund. Other institutions to be created to implement the Somaliland national energy policy include an energy inspectorate and 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 accelerate access to modern energy. The WB has suggested that, during these early stages of the electric power regulation sector's development, simple regulations (minimal quality and service standards), in addition to basic health and safety rules, could be logical and easy to implement in functioning operations.

1.4.7 The Puntland administration has no ministry of energy, or water or natural resources. Instead, there is the PSAWEN. Reporting directly to the office of the president, it is an autonomous agency with a mandate to oversee and regulate the electric power industry. However, PSAWEN has no staff with adequate technical expertise. The 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 only the operating companies themselves take into account quality and safety concerns as far as possible.[9]

1.4.8 The PSAWEN is loosely organised 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 Bosaso and Qardho power plants, which are ostensibly state-owned (see more below). This directorate does not have a detailed mandate or terms of reference but only a letter from the president saying that the PSAWEN has the mandate for energy, water etc.

1.4.9 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 responsibilities that they cannot possibly discharge too quickly.[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.

1.5 Reliance on the private sector

1.5.1 It has been reported that a purely private company cannot operate in Somalia; it must have some link with the administration somewhere. This arose in a discussion of the private nature of a company 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 power utility free diesel to cover costs of free power to mosques and other public institutions. The government discourages

9 In fact, the director for energy at PSAWEN, now the acting chairman, was also the general manager of the Bosaso power plant. All other staff members 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 Paper 1. Copenhagen, 16 Nov 2014 (by World Bank and federal ministries of finance and planning. Page 4.)

other investors, thereby helping to maintain the firm's monopoly. 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 company 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.

1.5.2 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 and programmes to substitute biomass with 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 community in various Somali areas, as well as in Kenya and in Dubai, as, in fact, a large share of the business community is based in the two last locations. The most important 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 best incentive for investment in addition to any government/donor support, meant to be shifted to consumers in the form of lower tariffs once investors earn normal profits.

1.6 Four main issues facing Somalia's energy sector

1.6.1 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 crosscutting issue: it will be discussed here but will not be repeated each time it might be required. In effect, there is 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 the challenge of importing energy in bulk because of lack of security (e.g. cargo cannot be insured) and 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.

1.6.2 The four issues are:

- Shortage or 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.

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

1.6.3.1 **The most important, crosscutting 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 TA 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 are less costly than external/expatriate TA, 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 that 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 terri-

torial entities (states, regions), then it may become difficult to have a free and open (Somalia-wide) skilled/qualified labour market that is unhindered by clan considerations.

1.6.3.2 **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 scarce ecological/environmental resources of the country. This calls for the introduction of substitute fuels for cooking everywhere, in the city and the country.

1.6.3.3 **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 existing supply sometimes runs only some hours per day and is dogged by drops in tension and frequent failures. There is limited potential for hydro electricity generation, especially on the Juba River, but it has never been exploited (an EU funded project to build a dam at Bardera started shortly before the state collapsed) and is unlikely to be harnessed until the current situation is resolved. There is also potential for renewable energy, which energy planners should serious consider for the medium term, but it is yet to be evaluated[11].

1.6.3.4 **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 portable solar lighting products are reportedly 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. Poverty and other characteristics (dispersion, movement) of the rural and nomadic population are such that non-grid and portable solutions make the most technical and economic sense.

11 The World Bank is proposing to include Somalia in its scientific evaluation of Eastern African renewable resources.

II. Energy sector and main subsectors

2.1 Subsector: biomass/household energy

2.1.1 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. Policy makers in all areas have mentioned it as the first priority by; the federal energy minister prioritises the search for alternatives to charcoal in all southern cities including Mogadishu; charcoal supply to cities is the main culprit of massive tree cutting/destruction of vegetation. The Somaliland energy minister and peers in the planning and environment ministries of Puntland also consider deforestation their major problem and have expressed the need for it to be addressed urgently and decisively. Considering the transition from biomass to cleaner sustainable fuels their most urgent and important task, these government officials also have ideas as to how the problem should be addressed. In Somaliland, the energy ministry proposes to launch a major campaign to promote the use of kerosene as a cooking fuel. In Puntland, the environment ministry proposes an attempt to introduce subsidised LPG as a substitute to fuel wood 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 as it comprises a geographical area that is so extensive that no single solution is likely to suit all situations.

2.1.2 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 never been possible. 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 as a source of energy, biomass resources are being exhausted because of the very slow growth of vegetation due to the dry climate. Annual consumption of charcoal is estimated at around 4 million tons per year[12], a rate that is quickly exhausting Somalia's few remaining forests. Using charcoal and wood for cooking also has some serious health impacts at the household level, with women being the main victims of indoor air pollution. The illegal export of charcoal further contributes to the assault on the precarious and fragile vegetation, and this links up with SDG 15 (sustainably manage forests, combat desertification, halt and reverse land degradation, halt loss of biodiversity).

2.1.3 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, this activity undoubtedly continues, and it can only be decisively banned when an effective government re-establishes control and legality over the whole area, including the coastline. 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.

2.1.4 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 biomass supply and demand sides. There are indications, not precise data, that demand for biomass fuels vastly ex-

12 Equivalent to about 400kg/capita/year

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, the Bay region, and Trans Juba).

ceeds supply (i.e. the natural increment/growth of biomass), which is not sustainable.[14] The impact of charcoal supply to cities and for export, added to the historical factor of overgrazing (growing population, growing cattle herds),[15] is making a serious impact on the vegetation cover and may accelerate the process of desertification, while making access to biomass fuels more expensive and time-consuming, especially for women and children who are usually responsible for procuring them.

2.1.5 The results of an energy survey/analysis conducted in Somaliland in 2011[16] show that biomass energy, particularly charcoal, constitutes the most important fuel by far. In Hargeisa and several other cities, over 90% of end users depend on biomass as the primary energy source for cooking and heating. The Somaliland energy ministry estimates 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 continue to increase. Thus the indications are that there has been no fundamental change in the pattern of energy use and that with a growing population, demand for biomass fuels increases and biomass resources become even more threatened. These observations also seem to apply to 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.

2.1.6 Another study, conducted by Habitat[17] for the EU, has surveyed the energy situation of Mogadishu and has provided revealing data as well as insights into possible actions. The demand for energy for cooking, lighting and 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, especially not near cities. Charcoal is sourced from several hundred kilometres away to be sold in Mogadishu, for instance. The very poor in Mogadishu now use waste paper and plastic for cooking. All energy forms consumed in Mogadishu are increasingly expensive, and a typical household spends an average of USD 60 on energy every month; this is equivalent to about 30% of its average monthly income (of USD 190–220).[18] The study suggests developing a strategy to substitute biomass fuels.

2.2 Subsector: electric power

2.2.1 At the end of the 1980s, just before it collapsed, Somalia as a whole had installed power generation capacity of about 175–180MW, of which near 100MW in Mogadishu.[19] Many cities had grids, and service varied in quality according to the availability of fuel. Except for the major cities (Mogadishu, Hargeisa and Kismayo), which had conventional grids, other smaller cities and towns that had electricity relied on diesel generators and minigrids much like those of today. No two cities were interconnected. Tariffs were low and level nationwide, so the main cities – which tended to be less costly to serve (since all load centres were served by same utility, the ENEE – subsidised high-cost isolated systems. According to historical estimates, electricity production in Somalia in 2008 was 326GWh or just 33kWh/capita/year, compared to the world average of 2,777kWh and the African average of 579kWh[20]. Electricity generation is entirely diesel-fuelled, and supply is from a large number of independent, individual, mostly small power producers operating local LV minigrids. Electricity is extremely expensive and inefficiently supplied, the absence of normal grids causing huge technical, non-technical or financial losses between generation and final use.

14 EU; Energy Sector Report for Somaliland and Puntland States, Oct 2012.
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 wood fuels.
16 UNDP-Somalia; Energy Consumption and Supply Survey, Somaliland, January 2011.
17 UN-Habitat/Sustainable Employment Creation and Improved Livelihoods for Vulnerable Urban Communities; Energy Baseline Survey (for Mogadishu), June 2013.
18 UN-Habitat/Sustainable Employment Creation and Improved Livelihoods for Vulnerable Urban Communities; Energy Baseline Survey (for Mogadishu), June 2013.
19 World Bank; Somalia: Issues and Option in the Energy Sector, Washington, 1985.
20 Per capita per annum

2.2.2 Public supply of electricity ceased altogether after the state collapse as looting and wanton destruction prevailed.[21] Small companies emerged to supply power at low tension in their immediate vicinity. 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 customer's home[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 energy ministry in Hargeisa reported that about a third of meters were not functional. Powering a 50W bulb (which runs for roughly six hours a day) for a month costs USD 10, more or less a set price by now, which is equivalent to more than USD 1/kWh. By comparison, estimated tariffs in similar countries are: USD 0.10–0.12/kWh in Burundi, USD 0.50–0.55 in Liberia (Monrovia), USD 0.18 in Kenya, and about USD 0.40 in Uganda.[24]

2.2.3 Several cities – e.g. Garowe, Hargeisa, Bosaso, Berbera, and Qardho – have small, generally dilapidated grids that are not always in use. Garowe has an 11kV line, while Hargeisa has a 15kV line[25]. Only "real" grids will enable the competitive operations of several independent generators and allow for measures to reduce losses and improve efficiency. These real grids can only be envisaged in secure places where expensive installations and equipment can safely remain on the streets. Most electricity generation is privately owned and managed, but there are some instances of public electricity supply (e.g. with, until recently, minor publicly owned utilities in Hargeisa, Qardho, Berbera and Bosaso but now semi-public utilities in all four cities).

Table 2 Installed generating capacity and connections: all Somali areas*

Area	Installed capacity (kW)	Number of connections	Power per connection (W)
Mogadishu/Benadir	29,370	120,850	243
Central State	6,610	16,000	413
Hiran & Lower Shabelle	3,050	8,115	376
South-West State	4,064	7,500	542
Juba State	2,400	12,500	192
Puntland State	11,375	19,535	582
Somaliland State	46,535[26]	85,500	544
Total	103,404	270,000	383

*This table is the best the mission could compile, although it is certain it represents an overestimate of connected households, especially in Mogadishu and Hargeisa/Somaliland

21 Except in Bosaso, Qardho, Berbera and later Hargeisa.
22 Bosaso, Qardho, Hargeisa, Garowe, Berbera.
23 As reported by the manager of the El Mansoor private generation company in Hargeisa and 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 USD 0.49/kWh and sells it at USD 0.12/kWh, with the Ministry of Finance subsidising the difference.
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 33kV. Further, it is only the SEA that uses the grid in Hargeisa, serving a minute share of the market.
26 The energy ministry in Hargeisa mentions installed capacity of 70MW in Somaliland but with actual availability at 50%. Our late colleague Eng. Musse A. Abdi computed the number in this table, mostly based on data from electricity generating companies (and it approximates actually available capacity).

2.2.4 Total installed generating capacity in all of Somalia in 2014 was estimated at about 100 MW, with about 250,000 connections.[27] If these numbers were broadly indicative of the current situation, they would imply a capacity of about 350 W/connection at generation, which is little but sounds plausible. Table 2 illustrates the overall situation.

2.2.5 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 Mogadishu and Hargeisa is likely overestimated. The numbers are based on reported figures by ministries of energy and 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 households with access to electricity in Somalia as a whole (say, 1.5 million people out of the 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).

2.2.6 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 190W (rather than the 380W computed in table). But that is not the whole story; 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 380W, later reduced to 190W, now drops further to effectively 100W/connection.

2.2.7 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 five to six hours per day. Since distribution is at low tension (480/220V) sometimes over 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. Mogadishu is reported to have about two-thirds 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 (100W/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 households[29] use battery-powered torches/flashlights for lighting; some are reportedly using solar-powered lanterns, while many others use kerosene.

2.2.8 These factors go some way to explain why access appears high but is really rather low. A fairly high number (or proportion) of city households are able to turn on a light bulb at night, yet the situation can hardly be called electrification, and the available power cannot be said to contribute to productivity.

2.2.9 Tariffs: In regional centres such as Hargeisa (served by the SEA, in addition to more than a dozen private generators of varying sizes), Garowe (in Puntland) and several others, customers are billed through meters, and the charges are: i) USD 0.65–0.80/kWh for three-phase supply and ii) USD 0.60–1.2/kWh for single-phase supply (with larger consumers paying the lower-tier

27 As estimated through direct interviews, estimates from authorities and other information the mission staff collected.

28 The Habitat Sustainable Employment Creation and Improved Livelihoods for Vulnerable Urban Communities in Mogadishu baseline study suggests that 10MW of the 29MW belong to the African Union Mission in Somalia, 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 earlier statements that 80% have electricity. This also confirms the earlier claim that access to electricity is overestimated.

tariffs). However, across the nation, the average charge per kWh of electricity used is USD 0.80–1.2. In many parts of the country, hospitals, mosques, schools, public clinics, recreation centres/community halls and streetlights are charged at USD 0.50/kWh. Some suppliers do not charge some of the institutions mentioned. In addition, in some regions (Bosaso, Qardho), government-owned buildings are connected to government-owned power stations and do not pay for electricity. In terms of tariffs, this report proposes that, in accordance with the most recent best practice of electrifying rural areas of Africa, donors cover a substantial part of investment costs and consumers the rest as well as all operation and maintenance expenses. The introduction of renewable energy (with negligible operation and maintenance costs) 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 together with operation and maintenance expenses. 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% solar/photovoltaic generation) under the terms described above, could lead to tariffs in the range of USD 0.60-0.70/kWh. This tariff reduction must take place (i.e. engineered by public policy through the electrification policy described in the following chapters) in order to expand access to electric power.

2.2.9.1 How high are tariffs really in Somalia? Much has been written about the high costs of power supply in Somalia, and there is debate about the profitability of power generation. Since all generation in Somalia is diesel-fuelled, it might be useful to examine the costs of diesel generation.[30] Efficient diesel generation on a reasonable scale – say, above 5MW – costs about US 0.50/kWh (there are many examples including Liberia and Burundi). Adding average losses of 50% (maybe more in Somalia) makes it USD 0.75/kWh. Adding in other cost disadvantages (small scale of imports, lower scale of generation, bad maintenance etc.) can easily add another USD 0.25/kWh, thereby showing that USD 1/kWh in Somalia is more or less justified by costs. New generating plants would be temporarily more profitable. If and when donors agree to subsidise capital costs (say, by 75%, as in a Mali project which is mentioned in Footnote 30) for hybrid systems, with diesel or heavy fuel oil (HFO) for base load and renewable energy for the rest, electricity tariffs could drop to below USD 0.50/kWh. Furthermore, should oil prices stay relatively low, the cost of efficient diesel generation could drop by another USD 0.05/kWh. That could expand the potential household demand for electricity by a substantial amount; larger businesses already pay closer to USD 0.60–0.70/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, a necessary condition for a significant expansion in access to electricity.

2.2.9.2 Therefore it would seem that under normal Somali conditions, the profitability of electricity generation and distribution is not excessive. The conditions that make it so are: old and poorly maintained generation plants (generators, actually); expensive and dirty diesel fuel; and primitive distribution systems, with undersized and damaged conductors of excessive length causing losses of 40–50%. Generators most probably earn only modest profit, akin to economists' 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 companies that happen to have invested in new generators, or maybe in better maintenance, probably earn a small temporary premium (until their 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 plants, so generators with better plants earn a small surplus, since their costs are, maybe temporarily, lower.

2.2.10 **North: Somaliland and Puntland areas:** The energy ministry of Somaliland and Wakaladda Korontada/SEA claim that total installed generating capacity is about 70MW, but the share of generating capacity actually available is not known. This assessment's own data collection shows about 46MW.

30 See the cases of Burundi and Liberia (EU, Energy in Fragile States) where electricity is generated at costs of USD 0.50–0.55/kWh. See also the case of Mali (World Bank/International Development Association, Mali renewable energy project: project appraisal document for a rural electrification hybrid system project in Mali, November 15, 2013).

In Hargeisa, according to the SEA and public works ministry, perhaps 80% of households (out of an estimated 120,000–130,000) are said to have access to electricity, of which 5,000–6,000 are/were served by the SEA. In Hargeisa, the SEA, which owns the generation plant and the 15kV medium-tension line, competes with a host of private generators that deliver power to their customers at LV directly with their own wires.[31] In Hargeisa, only the SEA uses the 15kV grid; private generators do not. While there are no interconnections in Somaliland, some border areas do receive power from the Ethiopian grid.

2.2.10.1 The installed capacity in Puntland is not known accurately (see Table 2), but Bosaso and Garowe together have about 10MW of installed capacity, of which probably not more than half is available[32]. According to the utility Nugal Electricity Company (NEC) in Garowe, they serve 6,000-7,000 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 Bosaso, a city of perhaps 700,000 inhabitants (more than 100,000 households), there are only 12,000–13,000 connections. There is only one supplier, a descendant of the previously state-owned company ENEE, but the private sector is attempting to break into the market. In Garowe, there is only one generating company, and the authorities tend to discourage competition in electricity generation.

2.2.11 Southern Somalia and Mogadishu: Before the collapse, Mogadishu 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 centre. In comparison, the 2013 Habitat Sustainable Employment Creation and Improved Livelihoods for Vulnerable Urban Communities benchmark study of Mogadishu estimated total installed generating capacity at 39MW with effective available capacity at less than 50% of installed capacity. Considering that Mogadishu has more than one million inhabitants, perhaps 300,000 households (of which over 60,000 are internally displaced persons), 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 (LV) with wires to each customer's house. About 65% of households in Mogadishu are reported to have access to electricity supplied through private mini/microgrids, but this seems obviously overestimated and contradicts the data collected from private generators.

2.2.11.1 In other parts of Southern Somalia, conditions are similar to those of Mogadishu, namely, generating capacity available is about half of installed (name-plate) capacity, distribution is at low tension (LV), generally at 400–220V, but at times, e.g. in Beledweyne, 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 Somalia also have minimal capacity per household (from about 200W to 300-400W) with significant interruptions and voltage drops.

2.2.12 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 USD 0.80 and USD 1.50/kWh.[34] This means that only a small segment of the Somali population can afford grid-delivered energy services, and consumption remains minuscule (perhaps 20kWh/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.

2.2.13 It is possible also that (almost) all who can afford electricity in Somalia are supplied, because at a rate of USD 1–1.5/kWh, not many people can afford it. Therefore, expansion of demand (and of supply, naturally) is strongly conditioned by increasing efficiency and lower tariffs that should lead to higher consumption

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 3MW installed but has difficulty covering the 1.6MW evening peak. See Table 2 for an estimate of capacity in Puntland.

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

to make the running of larger utilities financially feasible. Some of this can happen by using cheaper fuels (HFOs) and by adding small measures of (donor funded/subsidised 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 the population is considered urban makes electric power supply in cities a priority as a necessary improvement in living standards, as a contribution to stabilisation and improved security and to expand opportunities for productive use of power.

2.2.14 Interconnections: There was no interconnected grid in Somalia before the state collapsed. Even Mogadishu was not interconnected, though an interconnection with Afgooye in the Shabelle River valley had been under consideration. The Bardera Dam project, at an advanced stage of construction when the state collapsed, would have forced some interconnection (though adding to supply costs because of its location far from load centres). The Eastern Africa Power Pool has been mentioned as a potential source of least-cost electric power. However, since Somalia as a whole will remain without extensive interconnection, it will take some time before it can benefit from such a position. Further, Somalia's total load is modest (80–90MW now, 200MW in 10 years), and so benefits would also be small. The specifications required for interconnecting with a massive, international power pool are also so strict that Somalia at present cannot hope to meet such standards. In any case, Ethiopia – for its own reasons, including to exert influence in the region, to behave as a good neighbour, to open new markets for the power capacity it is currently constructing etc. – is proposing to expand the border areas it has supplied with electricity in the past by interconnecting initially with Somaliland and Puntland. The WB has accepted this idea and is taking it into account in the preparation of its on-going master plan for electricity in Somalia. Interconnections often provide least-cost supply, but the circumstances must also be adequate, and for Somalia, this is only expected to become possible in the long run, probably beyond the 10-year horizon of this programme.[35]

2.3 Subsector: petroleum products

2.3.1 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 two of the ten 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 across 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 populations. 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 (USD 6-7/barrel, equivalent to about USD 0.04/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.

2.3.2 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 tons/year), given that prices are expected to drop by about 30% with bulk imports saving on both gas costs and freight.

34 It is reported that large users are able to negotiate discounts from the published tariffs, and many enterprises report paying tariffs of USD 0.60–0.70/kWh. Obviously, a more desirable load can be served at lower costs. Furthermore, in late 2014, several generating companies had reduced tariffs to below USD 1/kWh in response to falling diesel prices. A barrel of diesel fell from USD 170 in 2013 to USD 140 in recent months (to just under USD 1/litre).

35 Except for the Ethiopian interconnection, which could be dubbed "political", as opposed to economic.

2.3.3 LPG consumption in Puntland is markedly lower, at perhaps 10 tons/month.[36] An EU funded study by the NGO Adeso claims consumption in 2014 may have been 400 tons, or 33.33 tons/month. Towards the end of 2014, it was reported that LPG was not available for public sale in Mogadishu. It now appears that it has become available, but there is no way of estimating in what quantities. As for kerosene, a small number of people, about 5% of urban consumers and perhaps a few rural consumers, already use it for cooking. Some small businesses also use kerosene for process heat and for institutional cooking. If plans to ease pressure on Somalia's vegetation cover through substituting charcoal as cooking fuel 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.

2.4 Subsector: renewables

2.4.1 There is 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 for power generation in most of Somalia. The solar energy potential ranges from 5–7kWh/m^2/day with more than 310 sunny days in a year (sometimes reported as about 3,000 hours of sunshine per year, but 2,500 hours seems closer to the mark). These are very high values (Germany has fewer than 100 days/year; Sicily, one of the best solar energy zones in Europe, has only about 150 days of sunshine/year). However, the use of solar energy has been rather limited in Somalia because of lack of information and access to end-use devices, and also poverty, which prevents purchase of appropriate generating and end-use equipment.

2.4.2 Somalia is also characterised by strong wind, with annual average speeds of 1.5 to about 11.4m/s.[37] Many organisations are starting to monitor wind speeds and sunshine hours in hope of developing renewable energy projects in the near future. There is limited hydropower potential, estimated to be around 100-120MW, along the Shabelle and Juba rivers, but it remains untapped, due to lack of security.[38] In the northern regions, there are deposits of coal and lignite but only a little artisanal exploitation has occurred and seems to have ceased. With a coastline exceeding 3,000km, Somalia has 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 energy sources requires more and better evaluation and mapping.

2.4.3 An experimental project is being implemented in Garowe, and it concerns adding small amounts of wind or solar/photovoltaic energy or both to a renewed diesel-based system. The Garowe power utility NEC[39] has been monitoring wind speeds for the past three years, as it plans to add wind/solar generation to its diesel plant. It is probable that with the support of donor funding, small hybrid grids could increase supply of/access to electric power in a number of cities. Further, if tariff policy is based on recovery of only operating and maintenance costs and only a small share of capital costs, the rest of which to be covered by donors, the proportional reduction of diesel power generation could lead to a reduction in tariffs, making electricity affordable to greater numbers of urban consumers.

36 Estimate based on information from LPG importers/distributors. See also the Adeso presentation on LPG in Nairobi dated 9 November 2014. After reviewing this preliminary report/presentation, it would seem this study suffers from some methodological problems. Samples of households analysed 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 elsewhere, and they range from around 60–70%.

37 Sustained wind speeds in excess of 6-7m/second, which are needed for wind generation, are very frequent, and solar/photovoltaic potential, at 5.8 to 6 kWh/m2/day, is the average insolation in Somalia.

38 Should conditions improve to make construction of such a plant feasible, studies funded by the EU in the 1980s could quickly be updated and implemented. However, the economics of this scheme were always marginal, with the plant located hundreds of kilometres away from population centres, with the added complication of the Juba being an international river having most of its active watershed in Ethiopia.

39 NEC

2.4.4 In recent years, a number of small projects have been implemented in various parts of Somalia, and some solar generating capacity does exists, but it is in the kilowatt rather than the megawatt range. It must be kept in mind, however, that discontinuous sources of energy such as solar/photovoltaic 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 sizeable city grid wishing to offer reliable service to its customers.

2.5 Sector-wide issue: qualified personnel constraint

2.5.1 Another pervasive and crosscutting 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 people suitable for further training cannot be taken for granted. For example, a recent study of Somaliland states that there is only one person knowledgeable about energy issues in the sector ministry.[42] Recent interviews conducted in Puntland for this report show there is not one single person in PSAWEN who understands energy sector management concepts – such as power, energy, peak demand, load curve, load factor – and there is not one person working solely on energy sector management.[43] Energy and electricity are often confused, as are operations of electric utilities and energy sector policy/management. Given this state of knowledge, it seems obvious that training in simple energy sector concepts and management must be provided before Somalis and external partners can conduct any meaningful dialogue on sector development and policies.

2.5.2 Since additional qualified labour will be needed both for staff operating enterprises as well as for public bodies, and local supply is limited, donors and Somali administrations should already start to consider ways and means of attracting young people from the diaspora to return and work in the sector. Some consideration should also be given to establishing long-term programmes to train suitably prepared/educated people, especially for higher-level qualifications (e.g. high-level specialised 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 university and technical training institution scholarship programmes for young Somalis. The search for appropriate TA to support the first training/capacity building interventions should also begin immediately, so that this activity can make progress in the first three-year period.

40 The project costs USD 3-4 million, as it includes replacement of the diesel-fuelled generating capacity.

41 Existing diesel-based grids, e.g. Hargeisa and Garowe, could be complemented by 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. Technically, however, these microgrids are not easy to manage.

42 EU; Puntland and Somaliland: Needs and Opportunities in the Energy Sector for Growth, Hargeisa 2013.

43 Interviews conducted in Mogadishu, Garowe and Hargeisa confirm that these concepts are not clearly understood.

III. Energy sector – recent developments and external donor assistance

3.1 Recent developments

3.1.1 **Southern Somalia**: It has been reported that a major telecoms investor/operator has offered to construct a medium-tension distribution grid in Mogadishu and reportedly would be ready to pay a fee of USD 4 million to the FGS for the privilege. Such a transaction would give a complete monopoly to this group, as it 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 medium-tension distribution grid). 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, and assisting small generators to consolidate may well be the best option for the next quantum leap in electricity supply, as expelling the small generators from the electricity business altogether might well raise a series of other difficulties.

3.1.1.1 The Malaysian firm Polaris is seeking a licence to explore for hydrocarbons (mainly natural gas) and in exchange is said to offer to build a power plant of 80MW (2 x 40MW) capacity in Mogadishu, initially diesel-fuelled but to eventually be converted to natural gas (if and when such gas is found of course). Whatever the merits of this proposal, 80MW appear at this time to be vastly in excess of effective demand for electric power in Mogadishu.

3.1.1.2 The two proposals briefly described above are in line with the past way of doing business in Somalia and would exclude the possibility of co-opting existing small generators and helping them consolidate (to continue as participants in the expansion of electricity supply in Somalia). These two projects would also continue the tradition of the old PPPs in other ways, by being non-transparent, exclusive and privileged. A better way of dealing with such proposals would be to (eventually) design a process whereby potential investors in electric power bid for supplying some quantity of power to the grid or system. On the other hand, enterprises wishing to explore for natural resources would pay for an exploration licence. They might even agree to undertake a minimal programme of exploration in exchange for recognition of rights to any discovery. However, given the lack of information about natural resources in Somalia and the difficulties of prospecting, a licence might not cost very much.

3.1.1.3 Ethiopia, Somalia and Kenya signed a memorandum of understanding in 2014 to build a hydroelectric power plant on a watercourse flowing near the tripoint where their borders meet.[44] The countries 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 organised by the Intergovernmental Authority on Development (IGAD) to discuss co-operation in the management and sustainable development of the river. 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, and formed an IGAD-steered technical team to conduct a feasibility study of the proposed projects.

44 The Standard, Nairobi, 14 November 2014.

Box 1 Recent electricity developments per area

Mogadishu/Southern Somalia

- Well-known local financial group offers USD 4 million for privilege to build grid and power plant in Mogadishu.
- Malaysian company Polaris offers to build 80MW power plant in exchange for gas exploration licence.
- Memorandum of understanding signed under Intergovernmental Authority on Development auspices to build power plant on Dawa River (Ethiopia/Kenya/Somalia).

Somaliland area

- Semi-privatisation of the state-owned Somaliland Energy Agency.
- Berbera Corridor: Ethiopia undertakes to supply more electricity to border areas of Somaliland.
- Ethiopia/World Bank: interconnection of border areas (Borama, Hargeisa)

Puntland area

- Renewable energy power generation of 1,000kVA being installed in Garowe power plant.
- Private financial group building 6MW diesel/heavy fuel oil power plant at Bosaso.
- Ethiopia/World Bank interconnection considered for Puntland also.

3.1.2 **Somaliland**: Major change is under way at the SEA. In March 2013, a newly appointed SEA management team started improving financial performance (billing and collections) and was apparently making good progress by September that year[45]. However, in March 2014, the entire generation capacity of the SEA broke down, and the agency was unable to serve its near-6,000 customers. The management team was therefore dismissed, and a local business group was persuaded to intervene and purchase generators (totalling about 6MW by December 2014). The number of customers supplied dropped from 6,000 to about 3,000 but appeared to be growing again in late 2014, as the generating capacity continued to grow.

3.1.2.1 The SEA is now under the temporary management of the finance ministry 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 USD 7-8 million, including both the power plant and the grid, as against the government's 33%. Total private investment was about USD 4.5 million (of which USD 1.5 million to repay debt owed by the SEA). It seems that this opportunistic privatisation (or rather conversion of a publicly owned enterprise into a joint venture or PPP) is being extended to Berbera, where a subsidiary of the SEA is the main power supplier, and there have been consumer protests rejecting the proposed privatisation. The SEA charges slightly lower tariffs for its power, reportedly USD 0.90/kWh as opposed to the USD 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 an optimal size state-of-the-art generation plant.

45 When this author first met with the SEA.

3.1.2.2 Somaliland signed a memorandum of understanding 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.[46] The WB and Ethiopia are considering an interconnection with the main cities of Somaliland and possibly also Puntland.

3.1.3 **Puntland**: The managers of NEC, the privately owned Garowe utility, reported that their project of adding renewable energy to their diesel generation capacity is almost completed: they have replaced their aging diesels with four new sets of 650kVA each and are adding 500kVA of solar/photovoltaic energy and wind turbines with capacity to generate 500kVA. 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 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 skills needed are not currently available in Somalia. The proposed interconnection with Ethiopia is also expected to link some Puntland cities.

3.1.3.1 The power plant at Bosaso is ostensibly publicly owned. It has continued operating despite the 1991 collapse. However, it operates as an independent company in that it receives all revenues and affects all expenses directly (without the intermediation of the finance ministry). Until some years ago, it managed to cover the demand peak (about 1.6MW) by using the original old generators. It paid its workforce from its collections. In more recent years, except for one machine, the original generators have been out of order. In order to continue to serve their customers despite an absence of government funding, the plant workers collected funds and purchased replacement generators. These employees 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 Qardho.

3.1.3.2 Independently of all this, a private investment group has built a 4MW plant (to be expanded to 6MW) on the outskirts of Bosaso 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 are to be drastically reduced, demand for such quantities of power appears inexistent in Bosaso. 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 nearby plants/factories ion future.

3.2 Donor assistance to the energy sector

3.2.1 **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 bandits, 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. Losses that can be tolerated with distribution at low tension limit the size of generation/distribution units, which means there tends to be a large numbers of companies, especially in the larger cities, but often more than one generator even in small/medium-sized

46 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.

cities. The role of the various governments is minuscule, almost non-existent, and external donors tend to want to deal with governments, especially it concerns official development assistance, as the international donor subsidy must go to the collective, or to communities, rather than to private firms or businesses. The main recent or current donor activities are listed in Table 3.

Table 3 Somalia energy sector: recent donor assistance

Agency	Project scope/name	Funding(USD million)
United Nations Development Programme	i) Somalia Programme for Sustainable Charcoal Production and Alternative Livelihoods: substituting charcoal with modern fuels ii) Solar initiative/Japan: installing solar panels at hospitals in the south and north (4 x 25 kW)	20+ (?) 1.0
European Union	i) Somaliland Energy Policy Dialogue: technical assistance (TA) ii) Somaliland Non State Actors Forum: (TA) iii) Somaliland Energy and Livelihoods Project	4–5
	iv) Millennium Initiative (mainly Puntland areas), also known as rangelands project and charcoal substitution project with a liquid petroleum gas component (euro 23 million) v) Somalia Energy Transformation Project; fuel substitution and non-grid energy services/products all over Somalia (euro 2.7 million) vi) Proposed new projects for substitution of biomass fuels and VTE for infrastructure skills	26–27 3.0 3.5
United States Agency for International Development	Pilot wind generation project/legal assistance	0.5
World Bank	i) Somalia power master plan (mostly Northern Somalia) ii) Mapping of renewable resources iii) Power Interconnection with Ethiopia (including Somaliland and Puntland), and transmission/distribution project	1.0 n.a. n.a.
African Development Bank	Somalia: infrastructure needs assessment and TA	1.0

3.2.1.1 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 facilities that were owned by the state pre-1991 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.

3.2.1.2 Until recently, donors have intervened mostly with 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. The ratification of the New Deal with more predictable donor support for infrastructure should see a spike 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/implementers in the energy sector. The WB

and the AfDB are poised to enter soon. The main donor efforts (in the pipeline, on-going or recently completed) are indicated in Table 3.

3.2.2 **Recently completed or on-going projects**: Donor assistance for 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 aimed at improving the efficiency of the use of traditional fuel, primarily charcoal, concluded in recent years or are still on going. The UNDP has conducted a modest Somalia-wide project that included an experiment with improved charcoal stoves and introduced improved charcoaling methods. With the support of Japan, the programme is also implementing a USD 1 million pilot project that proposes to equip hospitals with solar facilities for electricity and water heating (one each in Puntland and Somaliland, and two in Central and Southern Somalia). It also included the training of 100 technicians in the installation and maintenance of new and renewable energy equipment. This project was successfully completed at the end of 2014. The company that installed the solar units has obtained a number of other private sector contracts for the installation of similar units elsewhere in the country.[47]

3.2.2.1 The UNDP is also implementing a programme intended to be large-scale and nationwide. With initial external seed funding, this initiative, which was projected to come in at more than USD 20 million, aims to substitute away from charcoal and drive reforestation, displaying similar broad objectives – namely promoting efficiency in traditional energy use and transformation (charcoaling) and searching for alternative cooking fuels – to earlier pilot programmes.[48] Though this project, named the Somalia Programme for Sustainable Charcoal Production and Alternative Livelihoods, has been ready since late 2013, donors have not rushed to finance it, as they appear to be waiting for the development of new financial architecture before committing.[49]

3.2.2.2 The 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 (five small wind generators at Hargeisa Airport, costing USD 350,000)[50], which became operational in late 2014 and was linked to the grid. However, the energy minister decided to halt the operation because he found that the required maintenance could not be conducted. To avoid inevitable breakdown, the minister decided to mothball the wind turbines until such time as proper maintenance could be carried out. This is another manifestation of the shortage of skilled personnel and of the difficulty of maintaining equipment with both electronic with mechanical components. However, wind energy is raising enthusiasm, and a number of other units are being considered for the country as a whole, with some at various stages of implementation.

3.2.2.3 The EU has become one of the most active donors in Somalia. Already in the period 2007–11 it financed two medium-sized projects: the Somaliland Energy and Livelihoods Programme and the Somaliland Non State Actors Forum (until 2012). Larger than pilots but not large enough to significantly modify the fuel mix, both these projects aimed to reduce the consumption of biomass fuels and to introduce new technologies and renewable forms of energy. An international NGO, the Adventist Development and Relief Agency (ADRA), implemented these projects, which were active in both Puntland and Somaliland and resulted in the distribution of about 20,000 improved charcoal stoves. The projects included

47 The Danish company Garsten installed a unit of 25kVA in four hospitals – in Burao, Garowe, Baidoa and Galkayo. These were turnkey contracts costing USD 150,000 each. At that rate, a kilowatt comes in at USD 6,000. This report uses USD 8,000/kW to cost solar/photovoltaic generation projects. Garsten reports having signed several other contracts for similar units with private parties in Mogadishu.

48 UNDP-Somalia Programme for Sustainable Charcoal Production and Alternative Livelihoods", first phase, 2013–15, funded by Sweden and the EU and implemented by the UNDP, UN Environment Programme and the Food and Agriculture Organization of the UN.

49 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 FGS and hardly mentions Somaliland and Puntland, where project activities are bound to be easier to carry out. This may create some implementation problems.

50 IPS, Hargeisa, 22 April 2013.

training artisans to produce the stoves; some small companies are still manufacturing and selling them,[51] in both Somaliland and Puntland. They cost about USD 10 dollars, and even though they repay themselves rather quickly from the charcoal savings, the cost is unfortunately a barrier to their more widespread adoption, especially by poorer households, who need them most. The projects have also overseen the import of good quality kerosene stoves as an experiment as well as solar cookers and researched the use of coal briquettes. Furthermore, the projects also experimented with modern non-grid energy by importing and distributing solar lanterns and provided photovoltaic electricity generation to a small number of schools. These projects have shown that many of the pilot ideas were feasible and that there is room for large-scale improved-stove programmes (both charcoal and kerosene) as well as for a programme to promote the use of kerosene for cooking.

3.2.2.4 In 2013, the EU started implementing a major project in Puntland, known alternately as the Millennium Initiative, or rangelands or charcoal replacement project. Several NGOs and UN agencies implemented the Millennium Initiative with its budget of euro 23 million and main project objective to consolidate food security through the sustainable use of rangelands. Among other aims, the project has set its sights on 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 or pilot all these alternatives, but project management already carried out a feasibility study of importing larger quantities of LPG (in bulk). The feasibility study was completed towards the end of 2014 and evaluated by the EU.

3.2.2.5 A similar semi-private project, importing LPG in bulk and bottling it locally, is currently under being implemented as a PPP funded by the owners of the private LPG import/distribution company, Somgas, and credit from an international small business-loan facility. Expected cost savings, achieved by buying in bulk and shipping larger volumes, will permit a 30% price cut, and the supplier intends to target the richest 30% of urban households. The project was in final stages of completion at the end of 2014. A similar project in Puntland was also to target high-income urban households, but these might be few, and their switching to LPG might not induce a significant cut in charcoal consumption in Puntland. Hargeisa-based Somgas is also active in the Bosaso LPG market.

3.2.2.6 Another EU funded project is the Somali Energy Transformation Project, which was presented by ADRA-Germany and proposes to increase and improve access to sustainable, affordable and appropriate energy services for 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 who live far from existing or proposed power grids. It has a budget of euro 2.7 million (USD 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.

3.2.2.6 The WB, 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 TA 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 USD 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 USD 2 million[52] and intends to start building

51 The small private company Solar Energy Consulting and Construction Company in Garowe, for instance, and a number of other small companies in Hargeisa/Somaliland.

52 At the moment there is no sizeable agglomeration in Somalia/Somaliland with a distribution grid suitable for interconnection, so there would be nothing to interconnect. The reason for establishing a few city distribution grids in advance of studies, which the WB proposes to do, would be to create some load centres 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 50–70MW. This load might be more certain to materialise if tariffs could be expected to fall to USD 0.50–0.60/kWh from current levels of USD 0.90–1.0/kWh. Still, these modest loads would probably not justify a high voltage line from, say, Jijiga 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.

electric power grids in a few cities in advance of its electricity master plan findings. In fact, these projects have recently been approved and will require some amount of coordination with an electricity supply expansion programme proposed later in this report. The WB is extending an Ethiopian wind- and solar-resource-mapping project to Somalia to acquire reliable information on which to base investments in renewable energy.

3.2.2.7 The AfDB has defined a small support programme to the energy sector also, consisting initially of about USD 1 million in studies and TA and several million dollars in technical and feasibility studies for future projects. More sizeable investment projects are expected to follow these studies. The AfDB is considering extending financing for TA to public bodies in charge of energy in all Somali areas to accommodate training in basic energy concepts so as to facilitate a policy dialogue between Somalis and their development partners. With its Somali counterparts the AfDB is also proposing to explore, in the near future, other aspects of this A/I plan it will support. 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 the Somali people unable to understand and thus unable to own the development of their own energy sector.

IV. Introduction: the energy sector action/investment plan

A quick overview of major donors' on-going projects was presented above. As it stands now, the pipeline of donor projects appears rather limited. This seems to reflect two things: the difficult conditions to prepare and implement 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. Finally, this ESAIP can be linked to the proposed SDGs for the period after 2015.

4.1 The energy sector action/investment plan and the Sustainable Development Goals

4.1.1 The energy sector has a specific SDG, namely, SDG 7: Ensure access to affordable, reliable, sustainable, and modern energy for all. This is the main objective of the programme, and if implemented reasonably well, it will lead to major progress on SDG 7. However, the agreed ESAIP proposed in this report also touches on SDG 9: resilient infrastructure, as a reliable electricity supply will support other reliable infrastructure; SDG 15 as substitution of biomass fuels will permit sustainable forest management, combat desertification and protect biodiversity; SDG 1: End poverty, because greater access to energy will make people more productive, earning them greater incomes; and SDG 2, as more reliable and accessible cooking fuels will improve food preparation/security. While some elements of education (energy sector related skills) and improved health conditions for women (when they use better fuels for cooking) will be promoted to some extent, they are akin to collateral or indirect benefits of the ESAIP.

4.2 Needs and other background materials

4.2.1 Somali leaders and policy makers consulted in recent months emphasise mostly short-term needs for the development of the energy sector. Revealingly enough, all Somali leaders consulted this report expressed virtually the same needs for short-term assistance. They basically pleaded for TA 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 international partners ought to respond favourably. Long-term ideas expressed during consultations with leaders and policy makers were relatively general and concerned matters such as access, coverage, and sector characteristics, i.e. the relative roles of the public and private sector; the 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 some TA and training, these ideas and vision would gain in precision, clarity and depth, enabling leaders and policy makers to better evaluate proposals made in this report as well as those coming from other partners. This would also enable Somali ownership of this arduous process of reconstructing the energy sector and other infrastructure.

4.2.2 By and large, Somali leaders understand that in the energy sector, the time of state-owned monopolies has passed, and the private sector will have to play a much more important role, hence a change in the role

53 The senior people consulted included 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 director general of the Puntland Ministry of Environment.

of the state, from operator of utilities to grantor and supervisor of licences for or contracts with private independent generators, and perhaps as regulator of grids open to many competing generating companies, under open access principles. The same applies to trade in petroleum derivatives, with common or joint terminals being used by all bulk importers.

4.3 Existing public-private partnerships: de facto relationships

4.3.1 In Somalia, however, 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 term PPP implies that the local regional authority gives something to the utility – some fuel, support with initial investment in generators, some form of market protection etc. – in exchange for e.g. free power for public buildings, government offices, mosques, schools, public lighting, etc. The values exchanged are very difficult to determine and measure, 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.

4.3.2 Existing PPPs really imply a privileged relationship between the authority and a private company. Therefore, almost by definition, such a partnership cannot be extended to other companies. A high-ranking official pointed out that a truly private company – i.e. one without any relationship to an authority – might not be able to operate in Somalia. A simple but operational PPP framework will not only resolve this problem but also expand access to electricity in Somalia. The next generation of PPPs ought to be much simpler and more transparent than their predecessors and open to all investors wishing to participate in the expansion of electricity supply in Somalia.

4.3.3 The current PPP relationships defy a clear definition. In Garowe, the utility claims to be entirely private and that the government only provides it with fuel for the free electricity it provides selected users including the government, public buildings etc. Yet, various ministries report that they do not get any free electricity while others report 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 putting themselves in a great position from which to enter the electricity business at large scale. The SEA will also control the formerly publicly owned grid, leading to a monopoly position like NEC 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. This legislation/set of regulations should fall within the initial work programme of the advisory/training/TA services being provided and should be consider as one of the most urgent interventions in the energy sector.

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

4.3.5 An effective way of starting this ESAIP would be to propose for the quick implementation all those capacity building, training and TA activities that important sector leaders have required. So, the first three years of the ESAIP should concentrate on these activities; the identification and preparation of other important sector projects, which could also be used as training opportunities for staff of sector management organisations); and on measures designed to augment the supply of trained personnel such as training and study programmes for young people, domestically and abroad. These activities would also enable conceptualising 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 prepare

their TA and for the roll-out of some basic regulatory framework/principles, notably some sort of simple PPP legislation/regulations.

4.4 Energy sector action/investment plan principles

4.4.1 Any substantive, meaningful, principled programme to expand access to modern energy in Somalia must take into account the needs of Somali decision-makers and leaders, which include first and foremost the training and capacity building of their own institutions. Furthermore, such a programme must also deal with the two main issues raised earlier, namely low access to grid-supplied modern energy in cities and excessive rural consumption of firewood urban consumption of charcoal. A fourth major set of issues to be addressed is the extreme shortage of qualified personnel and the uncertainty regarding future supply of trainable persons given the 20-year interruption of quality education. So any energy sector development programme or action plan should:

- Improve knowledge and build the capacity of institutions, improving their staff, even if initially only with short-term, stop-gap measures;
- Expand access to modern energy, especially electric power;
- Reduce the consumption of biomass-based fuels and substitute away from them; and,
- Economise 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 attempting to regulate everything without the required competent staff or financial/budget resources in the hopes re-establishing state control.

4.4.2 In terms of priorities, however, it is the considered opinion of most leaders consulted for this study and of experienced UN, EU and WB staff that expanding access to modern energy, especially electricity, in cities should take the highest priority in order to improve the welfare of people and their productivity and contribute to socio/political stability in this most fragile state.[54] Almost equally important is making sure that everyone has continued access to affordable and sustainable household cooking fuels. Last but not least, these proposed programmes will only be feasible given proper training and capacity building offered to energy sector institutions that have clearly identified 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 and regulatory capability in the regional/local and federal governments. Training and capacity building should also be supported by efforts to increase the supply of trained personnel, who are extremely scarce. Training, capacity building and promoting the supply of trained personnel should be prioritised, as the feasibility of the rest of the programme depends on these actions.

4.5 Size of the programme

4.5.1 All Somali leaders consulted are extremely conscious of the obstacles and difficulties of implementing energy projects in the country. As a result, many of them expressed the wish to see an ESAIP 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 biggest 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

54 While poverty reduction is the global priority, it is widely felt that in fragile/conflict-affected countries, increased stability and better security should be equally prioritised. Both stability and security could be furthered by greater availability of electricity, hence this prioritisation of urban electricity supply.

of volume or time. Therefore, this ESAIP will have a short/medium-term phase of three years, and an overall horizon of 10 years; no emergency phase shorted than three years is being proposed. Projects will obviously be initiated but probably not completed.[55]

4.5.2 This report suggests an aggregate programme of USD 803 million, of which USD 58 million will be allocated to training, TA, and capacity building; USD 10 million to the creation and operation of a Somali electrification institute over five to six years; USD 580 million for the expansion of electricity supply, especially in cities; USD 95 million for reducing/substituting the consumption of biomass fuels; and USD 60 million for promoting off-grid energy services/products to rural/nomadic communities. More than the precise amount of the ESAIP, it is the rough order of magnitude and the distribution over the main group of activities that matter. In brief: an A/I plan of roughly this size can address all major energy sector problems/issues at a scale that will produce substantial positive results. All it presents is an indication of what could be done to address known issues, if security and governance develop positively over the next decade.

Table 4 Summary: energy sector action/investment programme (2016–2025)

Item	USD million*
Training, capacity building and technical assistance (policy-making bodies)	58
Establishment of a Somali electrification institute	10
Expansion of electricity supply	580
Substitution of biomass fuels	95
Provision of modern energy to rural/nomadic communities	60
Total	803

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

4.5.3 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 such as Somaliland, Puntland other regional/federal units to be formed in future, and Mogadishu/FGS. This should include 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 in preparation for long-term solution to the skilled personnel shortage. Training and TA programmes should be carried out or at least started within the initial three-year period.
- Expansion of access to electric power in cities, hopefully 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 Mogadishu and Hargeisa. Programme to be completed within the ten-year period. As more modern, efficient electric power supply systems are created (and investment costs become subsidised), tariffs should gradually descend to the USD 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. A scenario where donors and investors share investment costs and consumers cover the

55 This is why it is hard to understand how knowledgeable institutions could, in September 2013, have subscribed to a two-year economic recovery programme for 2014–2015. After more than a year, political wrangling has been the main occupation of the FGS and very little else has been achieved except for the approval of a Cabinet.

private investors' share of investment costs plus operations and maintenance is envisaged.

- A programme to reduce charcoal consumption should be introduced. This effort should also seek substitutes for urban and rural household energy sources, especially for cooking, for welfare, efficiency and environmental reasons. This substitution will require campaigns to explain and promote the new fuels and the required new end-use devices. The programme should also include possible alternative sources of income for charcoal producers.

- A programme to expand off-grid access to modern energy, especially lighting, among poor 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, should be embarked upon.

V. Training and technical assistance at ministries of energy or similar bodies

5.1 As mentioned before, all the institutions nominally in charge of the energy sector have requested immediate TA 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, as even a basic conversation about energy sector development policies would be very difficult, if not impossible, given the current state of knowledge of sector principles and concepts in all Somali areas. Therefore, the most urgent task after the definition/approval of this A/I plan should be the fuller identification and preparation of this project, which the FGS's Ministry of Energy and others have also suggested. In fact, many ideas have emerged about the scope and content of these projects, and their preparation is thus urgent to determine their capability and subsequently identify actions that need to be outsourced to other vehicles.

5.2 A basic project should be designed, prepared and implemented immediately to support the three existing bodies responsible for the energy sector: the federal Ministry of Energy and Water, PSAWEN and the Somaliland Ministry of Energy and Minerals. Some allowance should also be made also for emerging regional/federal entities that are now being established, including but not limited to Puntland, Galmudug, the IJA and the ISWA. The project should consist of a simple module: two senior consultants for three years (one technical, one financial), together with a small budget to hire expertise ad hoc. The senior experts would train the staff of these organisations and also hire specialists for more specific training. They could also advise on the creation or expansion of technical training institutions to expand the supply of personnel with skills relating to energy, both conventional and renewable. These projects might also set up, within the ministries/similar bodies, small funds for conducting simple feasibility/engineering studies for small private sector projects. Most likely, these experts will be expatriates, though diaspora Somalis could serve if appropriately qualified, and/or in areas where expatriates might have difficulties.

5.3 These experts would also advise the minister or chairman based on their research and accumulated knowledge and experience. With the staff being trained, they could also conduct experimental, demonstration and pilot projects in various fields of energy. These experts could create a system for data and information acquisition for future sector regulation/oversight and for monitoring and evaluation. They could also create a system to continuously monitor the implementation of this ESAIP and any other active plans and support the sector authorities in their initial dialogue with external partners.

5.4 These experts should also start working on concepts for a very simple electricity law or basic rules to govern private investment, including through PPPs, and set out main parameters for service quality and safety. This work would be useful in the creation of a proposed electrification institute (see Chapter 6) and help to mobilise private investment in electric power, as there is an urgent need to define the modalities of joint ventures or so-called PPPs. These experts should also set the stage for a more active role for these organisations 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.

5.5 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 TA, which would cost approximately USD 3.0 million each for the Puntland and Somaliland areas, and USD 4.0 million for the federal Ministry of Energy, a total of USD 10.0 million for an initial period of three years. Funding for this project should be

extended for a further three-year period, with appropriate modifications dictated by lessons learnt over the first three-year implementation period.

5.6 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 for this sector it would be desirable to limit the list to ministries of environment and those responsible for hydrocarbons such as oil, gas and fuels. Ministries of finance could be considered also for this inclusion, but Bretton Woods institutions such as the IMF and the WB) typically provide support here. 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 WB and the IMF, which supports the idea of 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 finance ministries, so a small amount (USD 1 million/year) for such ministries is included under the TA project, with the understanding that major TA and capacity building for these organisations is expected to come from the WB and IMF.

Table 5 Technical assistance to energy sector policy-making bodies (6-year period)

Assistance to the Federal Government of Somalia's Ministry of Energy & Water	
Two senior experts (72 staff/months)	USD 1.8 million
Short-term specialised expertise (12–15 staff/months)	USD 0.5 million
Materials and other training costs	USD 0.7 million
Costs of coordination/support to other regions	USD 1.0 million
Subtotal (3 years)	**USD 4.0 million**
Assistance to Puntland State Authority: Water, Energy and Natural Resources	
Two senior experts (72 staff/months)	USD 1.8 million
Short-term specialised expertise (12–15 staff/months)	USD 0.5 million
Materials and other training costs	USD 0.7 million
Subtotal (3 years)	**USD 3.0 million**
Assistance to Somaliland Ministry of Energy and Minerals	
Two senior experts (72 staff/months)	USD 1.8 million
Short-term specialised expertise (12–15 staff/months)	USD 0.5 million
Materials and other training costs	USD 0.7 million
Subtotal (3 years)	USD 3.0 million
Grand total, technical assistance (3 years)	**USD 10.0 million**
Assistance to environment/hydrocarbon/finance ministries	USD 9.0 million
For other regions (Galmudug, Jubba, South West etc.)	USD 10 million
Grand Total TA (6 yrs. or USD 29 million x 2)	**USD 58 million**

5.7 For indicative purposes, this programme would include some funding for the strengthening of the above mentioned ministries: USD 1 million per year for each ministry/agency, a total of USD 9 million over three years, for ministries of environment, hydrocarbons and finance. This would be used to procure TA and expertise (including diaspora Somalis) for improving the energy functions overseen by these ministries. In total, TA and capacity building would therefore require about USD 19 million for the first three years, and another USD 19 million for a further three years. A budget of USD 10 million has been allocated for each three-year period for training, TA and capacity building for other federal/territorial entities expected to be created in the near future.

VI. Expansion of access to electric power in cities

6.1 Introduction

6.1.1 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; existing grids are small, dilapidated and may have the wrong technical specs. 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 reorganise themselves.

6.1.2 It is suggested that the grid be publicly owned because it is a long-lived, monopolistic and low-profitability asset. If the community (as opposed to the central or regional state) rather than a competitor such as another generator owns the grid, it may also be more acceptable in a world of competitive power generation. Private generators in Hargeisa for instance refused to use the medium-voltage grid only because of its ownership – a power generator, publicly owned at the time but now fully private.

6.1.3 In places where only one generator supplies electricity, it might be permitted to own the grid, but there is no incentive to do so. A grid is very costly and requires government regulation because of its monopoly aspects. And even if there is only one generator, its ownership of the grid might discourage potential entrants, which is what happened in Garowe, where potential entrants have been discouraged, and Bosaso, where a privately owned power plant was built but investors were unable to secure access to the grid, which was owned by the descendent of a state-owned utility/company.

6.1.4 In order for this plan to function, the generators must 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 authorities and donors. They must also agree to generate power that can be delivered through the grids. Base-load generation will most likely continue to be diesel-fuelled (or perhaps HFO-fuelled, as the Ministry of Energy in Hargeisa suggested), but suppliers will also be assisted to generate from renewable energy sources. They will also need help to consolidate to invest the larger sums needed for efficient generation capacity scale.

6.1.5 The medium voltage (MV) grids should be standardised and abandon the old Italian colonial standard of 15kV MV, 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, Bosaso, Qardho and Galkayo have 15kV grids. Berbera, Borama and Garowe have grids that cover almost the entire central city; Hargeisa's grid is small and covers only a part of the city, serving perhaps 5–6% of consumers. Mogadishu has no MV grid at all.

6.1.6 This ESAIP does not envisage investment in interconnections. In fact, none were in existence in Somalia before state collapse. However, it appears that an interconnection promoted by Ethiopia may happen in the next few years as an extension of its supply to some border areas of Somalia and Somaliland. If this happens, it is for the better and to the advantage of Somali consumers, provided that most of the costs are covered by Ethiopia. This is because the size of the load in most cities likely to be interconnected would

not justify the costs of a 300km interconnection (from Jijiga to Berbera, which is apparently under consideration), meaning that it would be too costly for consumers.

6.1.7 Also, the Eastern Africa Power Pool has been mentioned as a potential source of least-cost electric power. However, since Somalia as a whole will remain without extensive interconnection, it will take some time before it can benefit from such an interconnection. Further, Somalia's total load is modest (80-90MW now, 200MW estimated in ten years), so benefits would also be small. Furthermore, the specifications required for interconnecting with a massive, international power pool are so strict that Somalia cannot hope to meet them at present. However, in certain densely populated areas with high economic potential, i.e. the Shabelle and Lower Juba valleys, several nearby small towns could at some point be linked to improve the reliability of electricity supply and, accessorily, make power available to farms and other rural activities along the line.

6.2 Electric power supply projects: organisation and finance

6.2.1 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. Private concessionaires could rent grids out for operation, or a state-related agency could run them. They would become community property but would be 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 – including Morocco, Senegal, Mali and Tanzania (WB and/or Sustainable Energy for All (SE4All) programmes – 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 then need to be supplied by investors and recovered through tariffs, in addition to operation and maintenance.

6.2.2 In short, what is proposed for the financing of investment and the reduction of electricity tariffs, key if coverage is to be expanded significantly in Somalia, is for donors to fund about 75% of investment in generation and 100% of investment in grids. The private generators wanting to enter the new electricity business in Somalia, presumably most of the existing small generators, would need to fund about 25% of generation investment, which they would recover through tariffs. These would cover all operation and maintenance costs but only about 25% of investment costs, thereby permitting tariffs to drop to about USD 0.50/kWh and the expansion of the number of households able to afford electricity. It should be noted that these are approximate figures (25% could be 20% or 30%), as this report wants to specifically avoid spurious accuracy.

6.3 Establishment of a Somali electrification institute

6.3.1 An organisation 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.

Box 2 A Somali electrification institute

This institution should have a central branch in Mogadishu to serve southern federal state areas and Puntland and a northern branch located in Hargeisa to serve Somaliland areas.

Its role would be to evaluate and 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 a New Deal committee (since it would help disburse New Deal funds) or perhaps to a body under the Intergovernmental Authority on Development, which could be given authority similar to a management board.

It would need a mix of Somali and foreign staff, paid competitive salaries and offered 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 USD 1 million/year for each of the two offices. Security costs would be additive. A notional sum of USD 10 million is budgeted for this institution for its creation and start-up, and its first four to five years of operation. Its creation is vital for the implementation of the electrification programme. In future, it might charge something for its services, e.g. a licence fee for operating a power plant. If so desired by the Somalis themselves, this institute could be extended to cover some other infrastructure sectors.

6.3.2 The proposal to create a Somali electrification institute was made to accelerate the expansion of electricity supply while the energy ministries are strengthened, their capacities built and staff trained and readied to play a growing role in the development of the energy sector. Furthermore, the idea of creating an institution similar to the one proposed was not only approved but also received support from some of the more qualified and directly concerned participants from the various federal states. If investment in electric power is to wait for the energy ministries to be in a position to play a leading role in managing and regulating the sector, it might cause long delays (longer than the three years of lead time the A/I plan projects). The energy ministries would, in any case, have an important role to play; they would be on the management board of the institute (together with donors, partners and other stake-holders, including regional and other sector authorities) and help set the institute's basic policies and operating procedures. Meanwhile they would develop their own capacity for technical supervision (norms, standards, quality of service, etc.), which they would gradually assume. Therefore the energy ministries can act more effectively through an institution agreed to and supported by all stakeholders, given all required financial and technical support to promote investment in electric power. While the federal Ministry of Energy and its regional counterparts have numerous functions, the electrification institute would have only one function,

namely to promote electrification and manage the contractual agreements necessary to secure electricity supply. It would be judged entirely on its performance on these activities. So in conclusion: the federal Ministry of Energy can delegate to others some of the tasks it may not yet be able to carry out and thereby obtain recognition by partners that it is a prudent institution, not just intent on maximising its own power but genuinely concerned with improving the access to reliable, efficient and economical electric power all over Somalia. Obviously, a number of things need to be clarified, and detailed discussions need to occur to better define the characteristics that the electrification institute should have so as to be effective and responsive to the needs of the people of Somalia and accountable to sector authorities and development partners. This process could be undertaken within the preparation of the sector authorities TA projects, which should start in earnest very soon. The actual creation of the institute has its own funding, which could start even before preparation is completed. The possibility of the institute having a liaison office of some sort in Dubai or Nairobi – to seek information on prices, technologies, possible sources of procurement, facilitate communications and so forth – should be considered.

6.3.3 The programme of expanding electricity supply in cities would invest in rebuilding the grids and improving generation in a number of agglomerations, such as in all regional capitals. There were 18 administrative entities with capital cities in pre-1991, including the two main cities, Mogadishu 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 two or three sizes) could be designed and implemented.[56] The standard projects could involve hybrid generation capacity of between 1MW and 3MW together with medium and LV grids able to distribute such a load among, say, between 1,000 and 10,000 connections (with power of 300W–1 kW/connection). A standard package might be similar to that described in Footnote.[57]

6.3.4 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, Garowe, Berbera, Bosaso, Qardho, possibly Mogadishu, etc. Other suitable cities would be identified in due course, jointly with the authorities and the communities themselves.[58]

6.3.5 The WB has mentioned the desirability of starting to build grids and improving generation in the first three or four cities immediately, before the end of planning studies. This could be considered within the initial phase, though it is likely to take more than three years to carry out. Coordination of this programme with that of the WB is straightforward: if the cities to be electrified under the WB project are selected within the three-year period, they would be known by the time this programme starts and could simply be eliminated. After all, this A/I plan considers the electrification of about 38 cities (not all identified by name) plus 10 villages (through hybrid microgrids). Therefore, removing three or four cities would not affect the programme significantly.

6.3.6 This electricity supply expansion programme would lead 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 (of which the WB might have funded some parts). Other large agglomerations (e.g. Qardho, Hobyo, Harardhere, Gabiley, Lasanod, Badhan, Tiyeglow, Burhakaba, Khansadhere, Dinsoor, Berdale, El Buur, Buloburti, Wanlaweyn, Afgooye, Qoryoley, Balad, Jilib, Jamame) that may not be regional capitals could also be added to this list. While this is a desirable programme, its feasibility would heavily depend on

56 Some of this preparation work could perhaps be done through the soon-to-start WB electricity master plan.

57 A standard Package could be constructed as follows: generation: 1.5MW to 2MW 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 400-500W.
This module can be estimated to cost approximately USD 14 million including materials for house connections (USD 800/connection).

58 The inclusion of additional cities should be on condition of further security improvements and the willingness of private investors to accept the terms of the agreement regarding acquisition of generating capacity.

local conditions and circumstances, which might vary often, making it difficult to work 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).

6.3.7 The cost of the investment programme to electrify all regional capitals, other large cities and a number of smaller centres (via minigrids) could be estimated at about USD 580 million, allocated as shown in Table 6. This investment would imply installing close to 200MW of generating capacity, of which 30-40MWp of mostly solar/photovoltaic. Including a pilot project consisting of 10 hybrid minigrids serving about 5,000 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.

6.3.8 However, this programme is intended to be permissive, i.e. it is an outside estimate of what would be needed, not necessarily what can actually be implemented. Implementation would require some analysis, e.g. through some project preparation facility perhaps attached to the electrification institute and a guarantee that the city to be electrified is safe and secure enough. Also, private investors need to be identified as able and willing to invest in generation under the terms and conditions determined by the authorities through the proposed Somali electrification institute or a similar organisation.

6.3.9 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. It cannot be implemented if the federal state or other areas/regional administrations expect to play central roles immediately. They need to relinquish some of their authority to an operational, externally funded and supported organisation that will greatly empower the electric power industry.[59] 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.

6.3.10 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. Unlike generation, it depends entirely on local, site-specific characteristics of population density and dispersion.

Table 6 Electrification of urban centres 2015–25

Description	Number of connections	Value (US dollar)
5 cities	5,000+	USD 14 million x 5 = USD 70 million
10 cities	10,000	USD 25 million x 10 = USD 250 million
3 cities (e.g. Mogadishu, Hargeisa, Bosaso)	50,000	USD 50 million x 3 = USD 150 million
Total (over 10 years		USD 470 million
20 other urban agglomerations	1,000–5,000	USD 100 million
10 minigrids (100kVA diesel + 1,000kWp solar)		USD 10 million
Grand total urban electrification		USD 580 million

(Memo: creation of a Somali electrification institute: USD 10 million)

59 The Democratic Republic of the Congo has a similar office, which it created under the auspices of a WB project and still operates. Called the Bureau Central de Coordination, its original mandate was to prepare/implement/monitor projects to compensate for government weaknesses. This organisation would only implement projects in the energy sector.

6.4 Hybrid minigrids and electricity supply

Box 3 Minigrid according to Sustainable Energy for All policy book*

System
100kWp solar/photovoltaic + 100kVA diesel (max/peak generation about 150 kW???)
3.5km low-voltage grid with batteries (560kWh) and inverter (60kW, AC/DC system)
Diesel cost: valued at euro 0.70/liter
Financing plan: 20% equity, 30% debt, and 50% grant.
Total investment: estimated (by SE4All in 2013) euro 520,000

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

6.4.1 An additional amount should be added for the electrification of larger cities that are not regional capitals. There are about 20 such cities that could justify a grid able to serve 1,000 to 5,000 connections. The total investment would reach about USD 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% donor subsidy. The absorptive capacity might not be so constraining if the authorities were able to set up the proposed Somali electrification institute to counsel and assist private investors by approving the proposed investments/business plans and establishing procedures to disburse the subsidy, possibly directly to the foreign suppliers of the generation equipment.

6.4.2 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, 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 WB's power master plan. Box 3 shows a typical minigrid system in line with SE4All definitions and policies.

6.4.3 However, the figures in Box 3 underestimate costs in Somalia. A similar system in Somalia would cost at minimum USD 1.2 million, including a small grid, which would not be unbundled in such small systems, as the same investor/company would own generation and distribution. The SE4All system reportedly breaks even at a tariff of euro 0.43/kWh, with sales of 420kWh/day (hence revenues of euro 181/day).[60] The SE4All example does not say number of customers served, but at Tier 3 electrification level (200–500W/customer)[61], it could serve as many as 400–500 customers given daily sales of 420kWh; sales/connection would be about 1kWh/day, which seems a bit low. Adaptation for Somalia would require a simpler financial structure, such as the one proposed by the WB for Mali rural electrification described elsewhere. The proposal would be to require a 25% equity contribution from investors, eliminate debt and offer a grant of 75% of investment cost, namely generation plus distribution. The tariff for this modified system in Somalia might therefore be slightly higher – less debt but a higher share of investment costs – say, USD 0.60-70/kWh; note also that diesel is more expensive in Somalia at USD 0.80-0.90/litre after a recent price fall. A notional amount of USD 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, which equates to about USD 2.5 million.

60 Tariff would be about USD 13/month, equivalent to the minimum tariff charged by SEA in Hargeisa. But since SEA charges USD 0.90/kWh, a payment of USD 13 implies half the energy supplied to average user, about 500Wh/day, is by minigrid).
61 EU, Minigrid Policy Toolkit. There are five tiers of electrification, ranging from Tier 1 (1-20W/connection) to Tier 5 (> 2kW/connection).

VII. Programme to reduce consumption of biomass fuels (wood and charcoal)

7.1 Biomass fuels and cooking stoves: the big picture

7.1.1 Nearly 2.9 billion people – more than the combined populations of India and China – still use polluting fuels like wood and charcoal to cook and heat their homes, at a huge cost to society in terms of health, environmental and economic costs, estimated at over USD 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 cooking stoves and fuels still remains limited in much of the developing world with a devastating impact on people's health, especially on that of women, who do the lion's share of cooking. 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% of the world's population will still not have access to clean cooking in 2020, making it all the more difficult to attain universal access to modern energy services by 2030, as mandated by the SE4All initiative.[62]

7.1.2 The issue of clean cooking crosses so many sectors: health, gender, environment, technology, poverty and energy. The challenge is to replace old cooking stoves 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 cooking stoves 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.

7.1.3 Authorities in all Somalia areas 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 (mentioned elsewhere in this report), 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 generalised. 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.

7.1.4 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 both in the cities and the countryside already use kerosene for cooking.

7.1.5 The advantages of kerosene compared to both wood/charcoal and LPG are well known. In comparison to wood or charcoal, kerosene is more energy dense, thus packs a lot more energy per unit volume or weight, and generally enjoys higher efficiency and better conversion, especially with improved stoves. As compared to LPG, it is less expensive as it is imported as a liquid, in barrels or larger containers; infinitely divisible, so a family can buy only what is necessary for cooking one meal; and has no important cost barriers, other than a moderately

62 These paragraphs are based on the WB's Energy Sector Management Assistance Program and the Global Alliance for Clean Cookstoves. They estimate that households in the developing world spent more than USD 100 billion across all cooking fuels in 2010 alone, with one-third of the amount spent on charcoal, coal and wood.

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 resource cost of the trees, or 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 in tree cutting, thereby protecting the threatened vegetative cover.

7.1.6 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.[63] 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 for this "middle" income class. Also, kerosene is the most feasible, likely alternative to charcoal for cooking as compared to 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. This links up to SDG 7 in terms of forest management, fighting desertification and conserving biodiversity.

7.1.7 A number of analysts (including ministers in Mogadishu, Garowe and Hargeisa) consider kerosene the most likely candidate to substitute for charcoal in a country as poor as 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's Somalia Programme for Sustainable Charcoal Production and Alternative Livelihoods and the EU Millennium Goals 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.

7.1.8 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 large-scale awareness and advocacy education campaign would be essential to inform the public about the characteristics, advantages and safety benefits of using kerosene. It should also 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.

7.1.9 Unlike other potential substitute energy sources, kerosene, which is also called paraffin in some countries, has well-functioning supply/market structures and is available in substantial quantities at all times. Kerosene has multiple uses and is easily divisible (unlike LPG).[64] 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 its wider use for low-income end users (who are a majority of biomass fuel users). However, once people agree to spend USD 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.

7.1.10 On the demand side, ADRA and the UNDP have found that a significant number of larger-scale end-users (household and commercial enterprises) are currently using kerosene either as the primary energy source for cooking or as a supplementary source. 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.

63 It is perhaps a bit unrealistic to expect Puntland inhabitants to convert to LPG cooking in large numbers 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 reduce overall charcoal demand somewhat, but not significantly.

61 EU, Minigrid Policy Toolkit. There are five tiers of electrification, ranging from Tier 1 (1-20W/connection) to Tier 5 (> 2kW/connection).

7.1.11 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 that 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 subsidise kerosene cooking 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 projects similar to those run in classic 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.

7.1.12 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 charcoal producers 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 previous paragraph). 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 a 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.

7.1.13 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 behaviour in markets – monopolisation would need to be avoided – so the benefits of lower costs accrue to people rather than importers.

7.1.14 A small petroleum products storage project could be implemented pari passu with the kerosene promotion project (see Table 7). 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 and 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 TA 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

7.2.1 Overall consumption of charcoal in Somalia is said to total about 4 million tons per year. It is not possible to disaggregate this total. It looks plausible because about 400kg/capita/year for 8-9 million people comes close to this number. It is often reported, in a WB Issues and options document among others. 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 tons[66], as estimated by the regional directors of the Ministry of Livestock, Pastoral Development and the Environment of Hargeisa. About 98% of households in both Hargeisa and Burao, and 79% in Borama, even people of middle and high incomes, use charcoal for cooking. Currently, the demand vastly exceeds supply

66 Figures were drawn from the UNDP and Somaliland Ministry of Livestock's 2011 energy consumption and supply survey of Somaliland. When estimated by sack and truckload, charcoal consumption numbers are contradictory by a factor of 10. Also, the survey is based on rather small samples that could easily be biased. The results tend to exaggerate consumption, and therefore lower estimates of consumption that appear more logical and plausible have been used.

due in part to natural incremental growth of wood in existing forests/trees, and the biomass energy production is unsustainable to such an extent that 35% of Hargeisa's charcoal supply is reported to originate in Ethiopia.

7.2.3 Assuming that kerosene contains about twice the energy of charcoal, has a density of 0.8 and has a higher conversion rate – 25% as opposed to less than 20% for an improved charcoal stove, or 15% for an unimproved one – it would take about 400kg of kerosene, or 500 litres, to replace one ton of charcoal. To replace half the monthly charcoal consumption of Hargeisa would therefore require distributing about 240 tons/month or 300m3, which is equivalent to 300,000 litres or 30 medium-sized tanker trucks carrying 10m3 each at a rate of one/day).

7.2.4 Projects of this size could be implemented in Somaliland and Puntland, where security conditions are acceptable; and a somewhat larger one could be implemented in Southern Somalia, though feasibility remains uncertain given the continued levels of insecurity. Carrying out projects of this nature and size might well require five years, starting during the initial three-year period of the ESAIP. It would appear, however, that the import of kerosene has stopped in Puntland for some reason and may have stopped in Southern Somalia also. Many interests now centre on importing LPG. On the other hand, it was reported in 2013 that no LPG was available for public sale in Mogadishu, while it appeared to be for sale by late 2014.

7.2.5 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 for other suppliers – may have decided not to import the competing product that is kerosene. Since there are no public bodies in charge of protecting consumers, such behaviour is eminently possible in Somalia. It may also be that, if the statements coming from Mogadishu that almost no-one uses kerosene for lighting as they have switched to solar power/lanterns are correct, 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.

Table 7 Kerosene Promotion Project: Somalia, area of Somaliland (5–7 years)

Description	Units	Total (USD million)
Stoves (improved, kerosene) imported	200,00 X USD 30+	6*
Materials to produce 200,000 stoves	200,000 x USD 15+	3
Publicity, information and promotion campaigns (including materials)		3
Training of craftsmen and initial stocking of materials		approximately 3
Social forestry project (for ex-charcoal producers)		5
10 minigrids (100kVA diesel + 1,000kWp solar)		5
Sub-total		**25**
Extension for 3 years (to end of programme period)		5
Total (8–9 years) Somaliland area		**30**
Puntland area		30
Southern Somali areas		35
Grand total		**95**

* Estimate by project staff

7.2.6 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 USD 30 million and require the import/procurement and eventual possibly 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 with the same size of USD 30 million and one for the southern areas at a larger size of USD 35 million – should be budgeted for. These projects would be able to help perhaps about 700,000 households, or 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 they 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. Once in full swing, these projects might also save perhaps as many as 1 million tons of charcoal/year, or about 25% of current consumption. These are significant figures.

7.2.7 The import of kerosene is commercially viable 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 the Somali private business community.[67] 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 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.

7.2.8 The UN-Habitat study referred to earlier makes a number of recommendations for Mogadishu that are widely applicable everywhere. 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 Fuel substitution recommendations

- 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. The decision to substitute with kerosene has already been taken in Hargeisa.
- 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 that meet Lighting Africa standards and are powered by solar energy.
- Support production, commercialisation and marketing of energy efficient cooking stoves using all available fuels, i.e. charcoal, kerosene and LPG.

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

VIII. Programme to introduce off-grid modern energy in rural and nomadic communities

Box 4 Lighting Africa Program

Lighting Africa, a joint initiative of International Finance Corporation and the World Bank, accelerates the development of markets for clean off-grid lighting products in sub-Saharan Africa. The programme mobilises 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 programme was launched in September 2007 with the goal of catalysing markets for clean, modern off-grid lighting products to light up the homes and businesses of 250 million people by 2030. The programme is active in 10 countries across Africa, including Liberia, Mali, South Sudan, Kenya and Ethiopia, countries both comparable to Somalia and close to it. Funders include the US, the Netherlands, Italy, Denmark, the Energy Sector Management Assistance Program, the Global Environment Facility and the Africa Renewable Energy and Access Program.

Modern technology has evolved and enabled new products that are useful to people who cannot be linked to a grid or whose way of life is nomadic. Somalia's population is thought to 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. Like everything else in the country, the evolution has been haphazard, unplanned and unregulated. A programme can be envisaged to monitor and regulate the import and distribution of these new products:

- solar home systems, either for sale or on a fee-for-service basis;
- smaller solar systems (with light points and rechargers);
- solar lanterns of various types; and
- solar rechargers for batteries or telephones.

8.1 Lighting Africa

8.1.1 An easy way to do this could be partnering with the Lighting Africa programme of the WB/International Finance Corporation. This programme sets standards and 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. In fact, the WB has just recently approved funding for the preparation of a Lighting Africa project for Somalia with the help of the Energy Sector Management Assistance Program. The funding proposed under this A/I plan would go towards the project once it is identified and prepared.

8.1.2 Lighting Africa would inform the business community about the norms and standards expected of authorised products and manufacturers. Often the good quality products are not more expensive than those that 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.

8.1.3 Costs are hard to define, but an amount of about USD 10 million/year for five to six years could significantly improve access to quality lighting for rural inhabitants and nomadic populations. This funding could simply be channelled through the Lighting Africa

project. These resources would be used for procuring equipment, managing trade networks and spreading information and publicity about quality products. Since the targeted communities 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 of charge. Eventually, the procurement and distribution system will move towards a commercially feasible model, with perhaps only a bit of help from public authorities. Further, in some cases the organisation of small businesses to provide energy – or just lighting, depending on consumer demand – on a fee-for-service basis could also be encouraged. In any case, these matters will be considered within the Lighting Africa project preparation process.

Table 8 Off-grid and other energy goods and services for rural and nomadic areas (6-year program)

Description	Annual value (USD million)	Total value over six years (USD million)
Procurement of equipment	4	24
Information and promotion campaigns	2	12
Technical assistance/training	1	6
Other (goods and services)	3	18
Total	10	60

8.1.4 This type of project requires a large quantity of actions, and the coordinated activities of many groups of people including project managers, importers, local traders and entrepreneurs/providers of services under fee-for-service arrangements, users of equipment, representatives of local administrations and so forth. It is extremely complex to manage, and for this reason the Lighting Africa intervention was mentioned early on, as this initiative has these procedures well defined and experience in implementing them. Carrying out such a project would therefore be a difficult task, and it is serendipitous that Lighting Africa has now decided to enter Somalia. This will be a complex commercial project and will take some time to prepare, yet the rewards are large, as a number of people who are generally ignored – relatively poor rural and nomadic families – will be able to partake of the benefits of technology appropriate to their resources and lifestyles.

IX. Concluding remarks, and some words about implementation

9.1 Introduction

9.1.1 The programme proposed in this paper is ambitious and farsighted: USD 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 three-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 consecutive large seven-year programme.

9.1.2 The programme consists of an immediate programme of training and capacity building for and TA to the main policy-making bodies of the FGS and the better established areas of Somaliland and Puntland. As other federal units are created, resources can perhaps be assigned to help them. At this time, Puntland, Galmudug, the IJA and the ISWA are in existence or are being created. 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 has been allotted incremental resources to that end. It would then be a matter of the federal ministry initiating 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.

9.1.3 What can be gleaned at this stage is some idea of the basic institutions that will be needed in the immediate fledgling years of the ESAIP. It is obvious that there will be a steep learning curve in the initial implementation of even just the first projects, and that change will be a constant feature of such a process. The ESAIP as identified at this stage is an attempt to address the major issues facing the Somalia population: lack of skilled human resources; weak/non-existent public institutional capacity, lack of reliable supply of modern energy, especially electricity in cities; unsustainable excess 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.

9.1.4 Needless to say, these issues can be addressed in several ways. This report has chosen to address them through these five groups/clusters of actions, namely:

- Strengthening institutions via TA, training and capacity building of policy-making bodies;
- Creating needed institutions;
- Expanding access to quality electric power supply;
- Substituting biomass fuels with cleaner modern fuels and more efficient stoves; and
- Expanding supply of modern energy services into the countryside and to poorer, disadvantaged groups, including nomadic communities.

9.2 Programme summary and time profile of estimated programme expenditure

9.2.1 The ESAIP is summarised in Table 9, and more details are shown in the tables in Annex I:

Table 9 Somalia's energy sector action/investment plan (2016–2025)

Item	Value (USD million)
Training, capacity building and technical assistance (policy/regulatory bodies)	58
Somali electrification institute	10
Expansion electricity supply in cities	580
Substitution of Biomass Fuels	95
Modern energy for rural/nomadic communities	60
Total	803

* Mission estimates, at 2015 prices (adjusted to account for Somali excess costs)

9.2.2 Table 10 below gives some idea, a projection of what the disbursement profile might ideally be for the five project clusters proposed in this ESAIP. This profile is sanguine: it assumes that security and quality of life continue to improve in Somalia and dares to think positive.

9.2.3 Absolutely crucial in making this profile something more than the arithmetic dream of this researcher is the capacity building and TA to ministries and similar bodies and the creation of an institution, dubbed the Somali electrification institute in this report, able to vet, approve and oversee electricity generation projects and approve licences for public electricity supply within the parameters agreed by the authorities and the development partners.

Table 10 Somalia energy sector action/investment plan: time profile of estimated programme expenditures

Actions	Values (US dollar million)											
Years	2016	2017	2018	2016–18	2019	2020	2021	2022	2023	2024	2025	2016–2025
Capacity building and technical assistance 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
Substitution biomass fuels	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

9.3 Public lighting

9.3.1 This ESAIP 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, i.e. finance ministries 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 licences 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 will 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 official in the licence 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. Through the licensing authority, the administrations could also give some incentives for public lighting, e.g. tax breaks on diesel and eventually breaks on profits tax etc.

9.4 Implementation strategy and methods

9.4.1 The programme summarily described in Table 9 and estimated to cost USD 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. Its successful implementation further assumes and requires a continuous gradual improvement in security and in the capacity/effectiveness of public institutions. It is likely that as things improve, there will be the possibility of using more implementing partners such as NGOs, UN agencies etc. 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 a 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, so, in what may seem a complex path, all areas can receive investments in state-of-the-art electric power supply and distribution.

9.4.2 Sine qua non for a successful start of all programmes is support (training, TA and capacity building) to ministries and similar bodies in the various areas. So far, three such agencies 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 tariffs, and pricing and taxation of petroleum fuels) should also be started immediately.

9.4.3 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. In fact, the idea of such an institution was endorsed by the meeting and received subsequent additional support, after a fuller description. These projects would be approved when presented by a private business person or group that is possibly already active in the electric power industry and that is able to invest an amount equal to 25% of the costs of the generating plant, which should be large enough to serve the population willing to pay for

electricity, which could perhaps be identified through a survey estimating the expenditures on energy and comparing them to the proposed tariff and consumption. This report suggests that these duties be fulfilled by a Somali electrification institute; the official name of such a body is yet to be determined, but its functions and functionality must be clear, and it must be given the authority to approve projects including financing and to license electric power generators once plants have been completed.[68] The creation of such an institution is naturally subject to discussion and agreement among the Somalia authorities, private investors both Somali and foreign, and development partners.

9.4.4 Even before playing this role, it could/should/might help the existing electric power generators to consolidate – not into one group yet into as few groups as possible, especially in the larger agglomerations – so that they can invest in a 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 exclusive property of the generators although it could be the property of an association of generators. In fact, a better option might be to make the grid into the collective property of the city, province or community. In this case public ownership might be acceptable rather than private ownership by private Somali generating companies, as an alternative to having some one or several competing companies 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 generator-owned given the modest size of the generation/distribution investment and the small dimension and cost of the minigrid (without transformation or MV lines). The institute could also fund simple feasibility/engineering studies for small private power projects.

9.4.5 Donors, operators of the trust funds and development partners should generally agree to fund the projects vetted by the electrification institute. They would agree to finance 75% of the costs of private generation projects, which 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, with generation based on both diesel and solar/photovoltaic 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).

9.4.6 Given that donors would be giving these important powers to the electrification institute, it seems obvious that the latter cannot not report, at least in some fashion, to the latter in addition to reporting to the authorities of the various Somali areas. It was earlier suggested that this organisation report either to some of the New Deal committees, to New Deal donor-created bodies or to some IGAD-created committee. Both donors and administrations could perhaps also serve on and guide its management board. 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 institute and its modus operandi. Enabling documents – statutes, rules and regulations, procedures – would then be required and suitable staff identified and appointed. Fully describing the policies and procedures of such an institution is beyond the scope of this report. But these should be considered when the implementation of the project is contemplated, perhaps through a type of feasibility study.

9.5 Somalia: risks and specificities

9.5.1 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

68 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.

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 that was without the basic public goods most people take for granted: rule of law; legality/safety/security; representation on international bodies; representative, responsible government; international travel, including passports; and postal services etc.

9.5.2 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 international shipping lines serving them, in part because of high risks due to piracy and the impossibility of insuring ships/cargo. 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.

9.5.3 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 and so forth – are estimated at twice the costs in Europe, except for generating equipment, which is priced at USD 1500/kW for diesel-fuelled equipment and USD 8000/kWp for solar/photovoltaic. In part this is due to the high costs of security in addition to the inefficiencies/risks mentioned earlier.

9.5.4 Another risk is that the TA/training needed for qualified personnel may be very expensive or not even available. It might also be difficult to find external experts willing to spend long periods in Somalia; Hargeisa is relatively comfortable, but Garowe and even more so Mogadishu are 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, through proper financial and other incentives, to return from abroad. And that has its own difficulties.

9.5.5 Still, Somalia is a fascinating country, and Somali culture is vital and original.[59] Working with Somalis is an exciting experience; you get to assist people who really do need the help. Somalis deserve help from more fortunate societies, and assisting them with modern sustainable new sources of energy would enable them to improve their quality of life, or level of well-being, and equip them to fend for themselves more effectively, reducing their needs for assistance in future.

69 This remark is based on this author's acquaintance with Somalia, which harks back to 1975 (as WB 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 between 1998 and 2002, including a period as principal economic advisor to the transitional national government, and as a senior economist at the UNDP's Somalia office. This assignment represents his third period of work on Somalia over 40 years.

Annexes

Annexes

Annex I

Energy sector action/investment plan description and value by time period

Activity	Summary of investments: Somalia energy action plan	Value (USD million) 2016-18	Value (USD million) 2019-25	Total value (USD million)
Technical assistance to & capacity building for 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 (generation & distribution)	6	4	10
Expanding access to electricity in cities	Expand access to electric power especially in cities	76	504	580
	Cities with 5,000 connections (5)	14	56	70
	Cities with 10,000 connections (15 district capitals)	25	225	250
	Cities with 50,000 connections (3)	30	120	150
	Twenty other urban areas (1,000–5,000 connections)	5	95	100
	Hybrid minigrids (10 minigrids: 200–1,000 connections)	2	8	10
Substituting for biomass fuels	Promotion of kerosene as cooking fuel	6	89	95
	Southern states (equipment and technical assistance)	2	33	35
	Puntland	2	28	30
	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
	Technical assistance/training	1	5	6
	Other goods and services	1	17	18
Grand total		**117**	**686**	**803**

Annex II
Installed capacity, connections and power/connection

Mogadishu/Benadir

Company Name	Total power installed (MW)	Number of customers	Average power (kW)
Somali Power & Water	9	42,000	
Somali Energy	7.8	40,500	
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	120,850	0.21
Self-producers*	3.2	X	X
Total Mogadishu	29.37	120,850	0.243

Galguduud & Mudug regions (Central State)

City	Installed capacity (kW)	Customers	Customer power (kW)
Galguduud			
Dhusamareb	670	1,000	0.67
Abudwak	600	1,200	0.50
Guri'el	620	1,100	0.56
Adado	520	1,400	0.37
Total (Galguduud)	2,410	4,700	0.512
Mudug			
Galkayo 1[70]	3 X 640 = 3,200		
Galkayo 2	2 X 500 = 1,000		
Total (Mudug)	4,200	11,300	0.37
Grand total	6,610	16,000	0.41

Middle Shabelle & Hiran regions

City	Installed capacity (kW)	Customers	Customer power (kW)
Galguduud			
Dhusamareb	670	1,000	0.67
Abudwak	600	1,200	0.50
Guri'el	620	1,100	0.56
Adado	520	1,400	0.37
Total (Galguduud)	2,410	4,700	0.512
Mudug			
Galkayo 1	3 X 640 = 3,200		
Galkayo 2	2 X 500 = 1,000		
Total (Mudug)	4,200	11,300	0.37
Grand total	6,610	16,000	0.41

70 In fact, only the southern part of Galkayo belongs to Galmudug. The northern part belongs to Puntland and should be shown there; it has been left here simply for convenience so as not to split Galkayo over two pages.

Bay & Lower Shabelle regions (South West State)

Company	Power installed (kW)	Customers	Customer power (kW)
Bay			
Baidoa Power Station	2,580	3,000	0.86
Partial total	2,580	3,000	0.86
Lower Shabelle			
Afgooye	440	4,500	0.1
Merca	680	X	X
Barawa	184	X	X
Qoryoley	180	X	X
Partial total	1,484	4,500	0.1
Grand total	4,064	7,500	0.4

Juba Interim State (Kismayo)

Unit	Power (kW)	Customers	Average power per customer (kVA)
Wesco	2 X 700 = 1,400	8,000	0.175
Somtel	2 X 500 = 1,000	4,500	0.222
Total	2,400	12,500	0.192

Puntland

City	Installed power (kW)	Customers	Average power per customer (kVA)
Bosaso	6,295	15,000	0.42
Qardho	2,080	4,354	0.47
Garowe	3,000	7,000	0.43
Total	11,375	26,354	0.43

Somaliland

City	Installed power (kW)	Consumers	Average power per consumer (kW)
Hargeisa	30,000	60000	0.5
Berbera	5,100	3200	1.6
Borama	3,735	9000	0.415
Burao	7,500	12,500	0.6
Erigavo	?	?	?
Lasanod	?	?	?
Total	46,535	85,500	0.54

Installed available capacity: all Somali areas

Area	Installed capacity (kW)	Number of connections	Power per connection (W)
Mogadishu/Benadir	29,370	120,850	243
Central State	6,610	16,000	410
Hiran & Lower Shabelle	3,050	8,115	370
South West State	4,064	7,500	400
Juba State	2,400	12,500	192
Puntland State	11,375	19,535	430
Somaliland State	46,535	85,500	540
Grand total	103,404	270,000	380

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

Annex III
Standard electrification costs: scalable model

(developed with the assistance of Electricity of Portugal director general Joao Baptista)

Generation
2MW: 1.5MW thermal, 500 kW solar/photovoltaic.
Cost of generation: 1500kW @ USD 1,500/kW = USD 2.25 million plus 500kW @ USD 8,000/kW = USD 4.0 million. Total = approx. USD 7 million.

Grid
Maximum load: 2MW
Consumers: 1,000–5000 (400W–2kW/connection)
Maximum contracted power per consumer: 2kW (2MW = 1,000 x 2)
Length of 11kV aerial lines: 2 lines x 10km/line = 20km (assuming very dispersed population and generation/substation at one end of the city)
Typical capacity of 11kV/LV transformer: 100kVA (pole mounted on 11kV poles)
Number of 11kV/LV transformers required: 2,000kW/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).
T**otal 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: 17 consumers x 2kW = 34kW (or larger number with lower power each)
Total length of 11 kV lines: 20km
Total length of LV lines: 20km (assuming dispersed location of consumers)
Unit cost of 11 kV lines: euro 21,000/km (including poles)
Unit cost of LV lines: euro 8,000/km (either mounted on poles or in bundled conductors attached to houses)
Unit cost of 100 kVA transformer: euro 8,000/transformation point
Total cost of 11 kV network: 20 x 21,000 = euro 420,000
Total cost of LV network: 20 x 8,000 = euro 160,000
Total cost of pole mounted transformers: 100 x 8,000 = euro 800,000 (including LV fuses and connections to three outgoing feeders in each transformer)
Total cost: 420,000 + 160,000 + 800,000 = euro 1,380,000 (= USD 1.5 million). For taking into account Somali conditions and costs, this estimate will be multiplied by 2 and total USD 3.0 million.
Cost of materials for 5,000 connections: USD 800/connection: approximately USD 4 million.

Summary: cost of electrifying a town/village with 5,000 connections

Description	Value (USD million)
Generation of 2MW (hybrid 3/4 diesel, ¼ solar/photovoltaic; diesel generation estimated at USD 1,500/kW and solar generation at USD 8,000/kW)	7
Grid of 5,000 connections	3
Materials for connecting 5,000 households	4
Approximate total in round numbers	14

Medium voltage grid (11kV): USD 42,000/km
LV grid including MV/LV transformers: USD 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 are estimated to cost about twice as much as in Europe.

Materials for house connections: USD 800–1,000, as estimated in a WB project in Liberia).

This cost is for very dispersed households, therefore it can accommodate up to 5,000 connections with small increases in costs (mainly for transformers and LV grid). Strictly speaking, for 1,000 connections less than 1MW would be enough (say 500kW diesel and 250kW solar/photovoltaic) and fewer transformers (20 transformers, 10km 11kV lines, 10km LV lines and a smaller grid if houses are not very far apart).

Total cost: USD 2.8 million for generation, USD 1.0 million for the grid, and USD 1 million for materials to connect houses.

Total cost for 1,000 connections: approximately USD 5 million, in round numbers.

The total costs do not rise with the number of connections because this size/capacity grid is sufficient for many more connections. The requirements are more generation and more transformation, as well as more materials for house connections themselves. The USD 800/house estimate comes from a WB project in Liberia.

Standard 50,000 connection electric power project
Total generation: 50MW, of which 40MW thermal and 10MWp solar/photovoltaic
Capital cost of generation: thermal, USD 60 million; solar/photovoltaic, USD 80 million
Grid: 100km @ 11kV; 300km at LV

Hybrid city grid with 1,000 connections
The standard project to establish a grid and connect 1,000 customers might be as follows: generation could be about 750kW (say 500kW diesel and 250kWp solar/photovoltaic) or about 600–700W per household, and grid could be 10km of 11kV lines, 10km of LV lines and 20 transformers. A smaller grid could be sufficient if houses are not far apart.

Total cost: USD 2.8 million for generation, USD 1.0 million for the grid and USD 1 million for materials to connect houses

Total cost for 1,000 connections: = USD 4 million to USD 5 million, in round numbers. There are many towns and villages that could justify this type of system. All towns with around 50,000 people could be considered for this programme.

Annex IV
SE4All: electrification standards (from SE4All)

Tier 1: 1-20W, task light and phone charging (2-4 hours/day)
Tier 2: 20–50W, general lighting, television, fan (2-8 hours/day)
Tier 2.5: 50–200W (2–6 hours/day, this power level not shown in SE4All document)
Tier 3: 200–500W, additional appliances (2–8 hours/day)
Tier 4: 500W–2kW, plus medium power appliances (4–16 hours/day)
Tier 5: >2kW, all appliances (4–22 hours/day)

Minigrid according to SE4All policy book

System
100kWp Solar/photovoltaic + 100kVA diesel (max/peak generation about 150 kW???)
3.5km low-voltage grid with batteries (560kWh) and inverter (60kW, AC/DC system)
Diesel cost: valued at euro 0.70/litre
Financing plan: 20% equity, 30% debt, and 50% grant.
Total investment: estimated (by SE4All in 2013) euro 520,000
This is badly underestimated. A similar system in Somalia would cost at minimum USD 1 million.
The system reportedly breaks even at a tariff of euro 0.43/kWh with sales of 420kWh/day (hence revenues of euro 181/day). The book does not state 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 between 600Wh and 1kWh/day, which seems a bit low.
An adaptation for Somalia would require a simpler system, such as the one proposed by the WB for Mali rural electrification. The proposal would be to require a 25% equity contribution from investors, eliminate debt and offer a grant of 75% of investment cost (generation plus distribution). The tariff for this modified system in Somalia might therefore be slightly higher – less debt but a higher share of investment costs – say, USD 0.60-70/kWh.

Annex V

Tariff structure for Minigrid

Minigrid policy toolkit and possible tariff options for hybrid minigrids. Published by: EU Energy Initiative Partnership Dialogue Facility c/o Deutsche Gesellschaft für Internationale Zusammenarbeit, P.O. Box 5180 65726, Eschborn, Germany; info@euei-pdf.org www.euei-pdf.org www.africa-eu-renewables.org. Currently financed by the Netherlands, Germany, the European Commission, Sweden, Austria and Finland. Place and date of publication: Eschborn, 2014.

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Tariff structure for minigrids

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 photovoltaic diesel hybrid minigrid in Bangladesh has a connection fee of euro 47 and an operational tariff of euro 0.28/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. According to the Energy Sector Management Assistance Program, basic tariff would limit consumer consumption to e.g. 60W and charge each consumer euro 5.54 each month. 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. According to MicroEnergy International, the tariff is based on kilogram, hour, litres or other units of service, e.g. TV service: euro 0.68/hour/person. 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 minigrid 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 categorised as either breakeven or profitable; free-of-charge tariffs are not discussed here. Break-even tariffs are designed to ensure cost-coverage and are often used in community minigrids. Profitable tariffs, which are usually higher, are designed to generate sufficient return on investment to appeal to private sector investors and typically cover all system costs; they are flexible and can be revised.

Other tariffs that can be energy-based, power-based or work on a fee-for-service basis, and categorised either as 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-subsidise residents.

- U-stepped tariff regime: includes different tariffs depending on consumer consumption levels.
- With progressive tariffs, consumers pay low tariffs for the first kilowatt hours (or watts) and higher tariffs for further consumption (cross-subsidisation). It may also include a lifeline tariff, which is basically a subsidised tariff providing basic electricity needs.
- With regressive tariffs, larger-scale 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 to 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.

Annex VI

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Annex VII

Meetings and interviews (persons and institutions)

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, EU Delegation to the Federal Republic of Somalia Tel: +254 2 2802000 mobile +254 722 229515 Email: abdullahi.ga'al@ext.eeas.europa.eu Website: 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 Website: www.nairobi.cooperazione.esteri.it@CoopNairobi

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PUNTLAND

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Annex VIII

Population figures (base: 2005 census)

		Total 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	Bosaso	208,898	41,780	167,118	
2	Qardho	89,719	17,944	71,775	
3	Bander Bayla	18,211	3,642	14,569	
4	Iskushuban	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	Galdogob	51,219	10,244	40,975	
3	Jariiban	49,666	9,933	39,733	
4	Hobyo	85,189	17,038	68,151	
5	Harardhere	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	
3	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	Lughaya	39,019	7,804	31,215	
4	Zeila	35,767	7,153	28,614	
Togdheer		509,614	101,923	407,691	5%
1	Burao	365,097	73,019	292,078	
2	Odweine	53,244	10,649	42,595	
3	Buhoodle	48,679	9,736	38,944	
4	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	Xudun	23,796	4,759	19,037	
4	Ainabo	38,892	7,778	31,114	
Sanaag		342,493	68,499	273,994	4%
1	Badan	113,660	22,732	90,928	
2	Elafweyn	83,350	16,670	66,680	
3	Erigavo	145,483	29,097	116,387	

		Total growth rate	< 5 & WCBA	> 5	
Zones & districts		3%	20%	80%	
Benadir		**1,141,594**	**228,319**	**913,275**	**12%**
1	Karan	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	Wardhiigley North	67,923	13,585	54,338	
8	Haleiwa North	55,003	11,001	44,003	
9	Hodan	90,688	18,138	72,550	
10	Hawl Wadaag	49,548	9,910	39,639	
11	Hamar Weyne	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	Dayniile	41,511	8,302	33,209	
16	Hamar Jabjab	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	Hudur	117,872	23,574	94,297	
4	Elberde	47,696	9,539	38,157	
5	Tiyeglow	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	Khansadhere	118,714	23,743	94,971	
4	Dinsoor	95,982	19,196	76,786	
5	Berdale	123,766	24,753	99,013	
Galguduud		**418,108**	**83,622**	**334,486**	**4%**
1	Abudwak	52,022	10,404	41,618	
2	Adado	57,803	11,561	46,242	
3	Dhusamareb	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	Beledweyne	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	Wanlaweyn	197,164	39,433	157,731	
2	Afgooye	171,029	34,206	136,823	
3	Awdheegle	97,161	19,432	77,729	
4	Merca	244,409	48,882	195,527	
5	Qoryoley	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	

		Total growth rate	< 5 & WCBA	> 5	
Zones & districts		3%	20%	80%	
Benadir		**1,141,594**	**228,319**	**913,275**	**12%**
Gedo		**415,979**	**83,196**	**332,784**	**4%**
1	Bula hawa	70,925	14,185	56,740	
2	Dolo	33,563	6,713	26,850	
3	Luuq	79,430	15,886	63,544	
4	Bardera	134,496	26,899	107,596	
5	Garbaharey	48,159	9,632	38,527	
6	Bur Dubo	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	Adan Yabal	57,343	11,469	45,874	
3	Mahaday	64,897	12,979	51,917	
4	Adale	59,183	11,837	47,347	
5	Warsheikh	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	Bu'ale	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	Afmadow	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 of Somalia for 2014 were that the estimated total population in urban, rural, nomadic areas and camps for internally displaced persons in the 18 pre-war regions was 12,316,895.

Population	Number (million)	Percentage
Estimated population	12.3	100
Urban	5.2	42.4
Rural	2.8	22.8
Nomadic	3.2	25.9
Internally displaced persons	1.1	9.0
Male	6.2	50.7
Female	6.1	49.3

Source: UN Population Fund Population Estimation Survey 2014

Population by region: urban, rural, nomadic and internally displaced persons (in 1,000s)

Region	Urban	Rural	Nomadic	Internally displaced persons	Total
1 Awdal	288	144	234	8	673
2 Wookooyi Galb.	803	139	256	45	1,242
3 Togdheer	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 Nugal	139	31	213	9	393
8 Mudug	381	80	186	71	718
9 Galguduud	184	52	214	120	569
10 Hiran	81	136	253	51	521
11 Middle Shabelle	114	249	10	52	516
12 Benadir	1,281			369	1,651
13 Lower Shabelle	216	724	160	103	1,202
14 Bay	93	463	196	40	792
15 Bakool	62	134	147	24	368
16 Gedo	109	178	145	77	508
17 Middle Jubada	56	148	131	27	363
18 Lower Jubada	173	162	124	31	489
Totals	5,216	2,807	3,187	1,107	12,317

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