

The Republic of South Sudan

Sustainable Energy for All



Rapid Situation Assessment and Gap Analysis Report

Final Draft



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List of Acronyms

AfDB	- African Development Bank
ATC	- Appropriate Technology Club of Rumbek secondary school
CGGC	- China Gezhouba Group Corporation
CNPC	- China National Petroleum Corporation
CPA	- Comprehensive Peace Agreement
DRC	- Democratic Republic of Congo
DCD	-Department of Community Development
EAPP	- East Africa Power Pool
EB	- Electricity Bill
EE	- Energy Efficiency
EPC	- Engineering Procurement and construction
FAO	- Food and Agricultural Organization of the United Nations
GDC	- Geothermal Development Company of Kenya
GNI	- Gross National Income
GNPOC	- Great Nile Petroleum Operating Company
HFO	- Heavy Fuel Oil
ICAO	- International Civil Aviation Organization
IFC	- International Finance Corporation
IMF	- International Monetary Fund
IPP	- Independent Power Producers
GDP	- Gross Domestic Product
GoE	- Government of Egypt
GOSS	- Government of South Sudan
GWh	- Giga watt hour
ICRC	- International Committee of the Red Cross
Km	- Kilometers
ktoe	- thousands of Tons of Oil equivalent
kW	- kilo Watt
kWh	- Kilo Watt hour
kV	- kilovolt
LPG	- Liquefied Petroleum Gas
MDTF	- Multi Donor Trust Fund
MED	- Ministry of Electricity and Dams
MFIs	- Micro Finance Institutions
MW	- Mega Watt
NEC	- National Electricity Corporation
NGos	-Non Governmental Organizations
NELSAP	- Nile Equatorial Lakes Subsidiary Action Programme
NBI	- Nile Basin Initiative
NPC	- National Petroleum Commission
NRECA	- National Rural Electrification Cooperative Association of USA
OLS	- Operation Lifeline Sudan
PAS	- Project Assessment Services
PPAs	- Power Purchase agreements
PPP	- Public -Private Partnerships
PV	- Solar Photovoltaic
RE	- Renewable Energy
REF	- Rural Electrification Fund
ROSS	- Republic of South Sudan
SEDC	- State Electricity Distribution Companies
SE4ALL	- Sustainable Energy For All
SSDP	- South Sudan Development plan

SSC -South to South Cooperation
SSEC - South Sudan Electricity Corporation
SEDC - State Electricity Distribution Companies
SSP - South Sudan Pound
SPLA - Sudan People's Liberation Army
SPLM - Sudan People's Liberation Movement
TOR - Terms of Reference
TPB - Tabular Plastic Biodigester
UN - United Nations
UNDP - United Nations Development Programme
UNICEF-United Nations Children's Fund
USA - United States of America
USAID - United States Agency for International Development
USD - United States Dollar
WDAs - Women Development Organizations
WFP - World Food Programme of the United Nations

EXECUTIVE SUMMARY

The UN General Assembly resolution 65/151, which was passed on 20 December 2010, designated 2012 as the International Year of Sustainable Energy for All. This was in recognition of the growing importance of energy for economic development and climate change mitigation. It also attempted to correct what many people working on energy and development issues had for many years argued was a major error in not including action on energy poverty in the Millennium Development Goals. The UN Secretary General established the Sustainable Energy for All Initiative in September 2011, in order to guide and support efforts to achieve universal access to modern energy services, rapidly double the rate of energy efficiency, and double the use of renewable energies in the global energy mix.

At country level, this initiative is expected to be implemented in 3 steps namely (1) conduct a rapid situational assessment and gap analysis of its energy sector, (2) develop an action plan that will give national priorities in the energy sector, and (3) implement the action plan.

This report is the product of step 1 on rapid situational assessment and gap analysis.

SUMMARY OF FINDINGS

The Republic of South Sudan attained independence on July 9, 2011 following a referendum in which 98.83% of the population voted for separation from Sudan, as per the Comprehensive Peace Agreement (CPA) of 2005. South Sudan is one of the world's most underdeveloped countries. The country has little infrastructure with just a few kilometres of paved roads. The youngest African Nation has a population of around 8.3 million according to the 2009 Census. Most of the South Sudanese sustain themselves through subsistence agriculture. The country is the most oil dependent country in the world, with oil exports accounting for almost the totality of exports, and for around 80% of gross domestic product (GDP). Oil revenues provided 98% of the country's national budget in 2011. Prior to independence, South Sudan produced 85% of the whole Sudanese oil output. Apart from oil, the country also exports timber to the international market.

Energy situation

Energy needs in South Sudan are predominantly met by biomass, consisting of the burning of charcoal, wood, grass, cow dung and agriculture residues. According to the National Baseline Household Survey of 2012, over 96% of the population use firewood or charcoal as the primary fuel for cooking (which typically constitutes 90% of the energy used in a rural household).

Over 95% of the households in Juba cook with wood fuel or charcoal, the vast majority using charcoal. Those in the low-income housing areas, where 75% of the population lives, spend 10-15% of their average household income on charcoal per month. Firewood is the most used source for lighting in South Sudan, used by 35 percent of population. Grass (15 percent) and paraffin lamps (13 percent) are the second and third most used source for lighting. 27 percent of the population has no source of lighting.

Only about 1% of the population has access to grid electricity. These who have electricity are mainly in Juba, the capital city of the Republic of South Sudan, with the remaining few in the towns of Wau and Malakal.

Since the colonial period followed by Khartoum rule, there has never been an electricity transmission backbone in South Sudan. The only available network is in three isolated distribution systems located in three urban centres of Juba, Wau and Malakal totalling about 15 km of 11 kV lines plus some electrified commercial centres. Installed capacity for the South Sudan is about 30 MW of which about 22 MW is currently operational. The total number of customers connected to the network is about 22,000 customers. Per capita electricity consumption in South Sudan is about 1 - 3 kWh, the lowest compared to the rates in its neighbouring countries. The average per capita electricity consumption in the Sub - Saharan Africa is about 80 kWh.

The current demand for electricity is estimated at 300MW which is expected to rise to over 1400MW by 2030.

Since February 2013, the available generation capacity in the whole country is 0 MW due to lack of fuel and spare parts of the thermal power plants as a result of austerity measures following the oil shutdown shortly after the independence and cut of oil revenues from Sudan.

Currently, oil products consumed in South Sudan are imported from Mombasa port through Kampala since independence as there is no trade of products between Karthoum and Juba.

The Ministry of Electricity and Dam (MED), established after independence, has drafted a national electricity policy that prioritizes the use of indigenous energy resources mainly crude oil and hydropower to supply power to the upcoming industries and households. The most critical and urgent short term action for the Government is to procure fuel and spare parts for the thermal power plants in Juba, Wau, Malakal, Yambio, Bor, Bentiu and Rumbek and be able to supply electricity to people who are already connected to the grids.

Short term actions prioritized by the Government include putting in place the required policy, Institutional, legal and regulatory frameworks to create foundation for the power sector to operate and be able to attract investments from Donor Community and Private Sector.

To boost the generation capacity, a number of projects have been identified. In the medium term, MED is planning to import 50-100 MW from Ethiopian hydropower plants, develop the Fula Rapids 40 MW hydro project, Tharjath 200-300 MW crude oil fired power project, Sue 15 MW mini hydro project and import power from Sudan by extending the transmission line from Renk to Malakal. The long run plans include the development of the Bedden 540 MW hydro project and Grand Fula 890 MW hydro project. Of course, such generation projects will need to be accompanied by investments in transmission and distribution projects simultaneously.

Current situation with regard to the Sustainable Energy for All goals

With regard to universal access to modern energy, South Sudanese people lack access to electricity as only 22,000 households are connected to the local grids, representing around 1%. In Juba and other cities, businesses and residential houses use individual diesel generators. Most of South Sudanese rely on the traditional use of biomass for cooking, heating and lighting.

Traditionally, South Sudanese cook on the three stone open fires. There have been initiatives to promote wood fuel improved cook stoves especially in Juba. One of these

initiatives was Hope Ofiriha's **Onura Clean Cook stoves Project** to set up 10 small women groups to train women on how to make and market clean and efficient cook stoves made in clay in Onura, in rural area.

In Juba, in recent years a number of models of fuel efficient stoves have developed. The design chosen for introduction in Juba by the Department of Community Development (DCD) is a modified version of UNICEF Nairobi's 'UmemeJiko' called in Sudan '**Kanun el Jadid**' meaning 'new stove'. With this new stove, a bag of charcoal which lasts a family 10 days would last 16 days. In addition the new stoves are stronger and will last longer.

LPG use remains insignificant in South Sudan, given the cost of transportation and poor transport infrastructure. So far there is one oil company known as IMATONGAS that is working on building bulk storage and bottling facility for LPG in Juba. This facility will be the first LPG filling plant of its kind in South Sudan.

Biogas technology was introduced in South Sudan during the year 2001 through a UNICEF/OLS-supported Biogas Pilot Project at the Rumbek Secondary School. Here, 20 students and 2 Teachers of Rumbek Secondary School were trained, first on the theory of biogas and then on installation of the Tubular Plastic Bio digester. UNICEF later installed other 2 additional digesters in the same school to serve as pilot for other schools and institutions where people use collective toilets. There is no any other biogas system known in South Sudan, though the country is the richest in cows in the region.

The total number of customers **connected to the electricity** network of 22,000 includes 1,500 customers of NRECA/USAID trained cooperatives in towns of Yei, Wau and Malakal. These who are connected to the grid have to pay a high cost for the service at an average tariff of US\$ 0.22/kWh. This price is not cost reflective as the production cost is around USD 0.70/kWh. The power sector in South Sudan is highly subsidized. It is important to note that the big customers mainly the Government institutions, military barracks, airport, hospitals do not pay their bills of electricity.

Regarding the **access to modern energy for productive use**, the only initiative known is the use of solar PV for water pumping to supply water to 55,000 people in the region of Akobo, Jonglei state, in the north-eastern part of South Sudan, close to the Ethiopian border. The project was financed by the International Committee of the Red Cross (ICRC) to supply water to displaced people.

So far there are no known **programs or projects for energy saving** in South Sudan.

Regarding **Renewable energy sources**, South Sudan has high potential for renewable energies to generate electricity, including small-scale and large scale hydropower, solar photovoltaic, and wind, biomass, geothermal and waste-to-energy. The share of renewable energy in the national generation mix is zero today. However, a number of **hydro projects are in pipeline** including large scale, mini and micro hydro projects as the country is rich in hydropower resources.

South Sudan has access to an average of more than 10 hours of sunshine per day year round, with radiation on the horizontal surface of about 5 kWh/m²/day. One of the famous projects in **off-grid solar systems** is the IndiGo pay-as-you-go solar project in Nimule. Eight19 has partnered with WorldVenture, an international charitable organisation, to deploy the solar systems in rural villages in the region of Nimule in South Sudan. Eight19 deployed around 1000 units to the region. The Government of the Republic of South Sudan

is already using solar street lighting in Juba and is planning to expand this program in other cities.

With support of UNDP, the Government has installed solar PV in some of the police stations in rural areas. In addition, solar PV is used for water pumping in three locations to supply water to displaced people in Akobo.

There is no known wind farm in South Sudan and the wind regime is not attractive for investment. However, micro wind farms can be developed for rural electrification and productive use.

Given the geographical location of South Sudan, it is believed to host high potential of geothermal resources but there are no studies conducted yet in this field. The GoSS intends to work with Geothermal Development Company (GDC) of Kenya for preliminary geo-scientific exploration studies.

Biomass energy remains the most used renewable energy in South Sudan and the situation is likely to remain so for the coming decades. Biomass fired power plant could be an option for increasing generation capacity in the future.

SE4All national goals

The GoSS has not yet set a clear program to boost its energy supply towards achieving the objectives of sustainable energy for all initiative. In its Strategic plan 2013-2016, the sector plan focuses on grid-based expansion to 48,000 customers (all 10 state capitals will be electrified) from the current 22,000, investment in expansion of thermal generation capacity to 96 MW, as well as the expansion of distribution networks. SSDP also describes plans to import 140 MW power from Sudan via a 220 kV interconnector line. The power sector development action plan has six key components for the decade ahead: (i) to meet existing and projected demand for power, undertake a major program of expansion in generation capacity from the current 30 MW (22 MW available) to about 580 MW by 2025; (ii) extend the national transmission and distribution grid to link all ten state capitals and link the South Sudan grid to those of Ethiopia, Kenya and Uganda; (iii) expand access to electricity to provide 75% of urban households with access to electricity from the national grid by 2025, compared with only 1% at present; (iv) complete a major restructuring of SSEC to convert it into a fully-fledged, and financially sound, state enterprise that has the capacity to enter into take or pay contracts with private suppliers of electric power; (v) strengthen the enabling environment for private investment in power generation and attract private investors to operate as independent power producers (IPPs) within South Sudan; and (vi) strengthen the existing regulatory arrangement for the electricity sector. The electricity consumption will also increase from the current 25 kWh to about 140 kWh per capita per year by 2020. If well implemented, this would be a good milestone towards sustainable energy for all by 2030.

A summary of gaps and barriers identified

The main gap is that South Sudan is a new state, devastated by long term wars and its focus today is on a recovery program. Most of its developmental policies, strategies and plans are still drafts.

In the area of thermal energy for households, there is no institution in charge of policies and strategies on the use of biomass for cooking, brick burning and production of heat and even though biomass is the main source of energy in the country. There are no biomass

energy policy, strategy and laws and regulations in place. The institutional framework also needs to be put in place. In terms of efficient use of biomass and alternatives to biomass energy, there are *no clear programs for the use of improved cook stoves, improved charcoaling methods, biogas and LPGs.*

If the country is to promote the use of renewable energy and Energy Efficiency successfully, the GoSS should focus on (i) adopting a comprehensive Renewable Energy and Energy Efficiency Legislation, (ii) Establishing RE and EE Strategies and Action Plans and (iii) Developing a financial Mechanism for RE and EE

In the power sector, the main gap and barrier is the lack of policies, sound Legal and regulatory framework to organize the sector and attract private investments in the power sector. South Sudan has a vacuum in terms of laws. Lack of Human Resources capacity across all the institutions in different levels of decision making is hampering development of the Ministry of Electricity and Dams, South Sudan Electricity Corporation and all the relevant institutions.

Lack of funding for power projects is an important barrier. Today there is no generation due to the shutdown of oil supply through Sudan and hence lack of budget as 98% of the country's budget was financed by oil revenues. There are austerity measures to cut down expenditures and fuel and spare parts of the generators were cut. There is need to attract investments in hydro power projects that have been identified. Both public and private investments need to be mobilized as well as the involvement of NGOs and Community-based organisations in the energy sector.

There is no policy and programs for the productive use of energy. The ministry in charge of Rural Development and the Ministry of Electricity and Dam would need to sit and design a comprehensive program as the country implements its electrification programme.

Section 1: INTRODUCTION

1.1 BACKGROUND

1.1.1 Energy and Development

Energy plays a significant role in improving people's livelihoods, thereby contributing to development. It supplies water and fuels agricultural output, health, education, job creation and environmental sustainability. Despite this, over 1.6 billion people in developing countries are deprived of access to reliable and affordable energy services (such as electricity and LPG), and over 80% of the population of sub-Saharan Africa use traditional biomass for cooking and heating. With more than one-third of a household's budget being set aside for fuel costs in many countries, the region's population pays an onerous price for fuel (mainly biomass) that is of poor quality and not very effective. In many countries in sub-Saharan Africa, there is inadequate access to reliable, affordable, effective and environmentally sustainable energy services that could support economic and human development.

The predominance of traditional fuels for cooking - over 60% dependency on biomass in Africa, takes a toll on the environment (soil erosion, desertification, etc.), and the absence of modern fuels propels the poverty spiral further downward. Thus, increasing access to good, affordable modern energy services is likely to engender considerable benefits in terms of people's living conditions, as well as help to achieve Millennium Development Goals.

Though energy is not explicitly taken into account in the Millennium Development Goals, the contribution of energy services to their achievement is widely acknowledged. Figure 1.1 shows the relationship between access to energy services and a selection of the eight Millennium Development Goals.

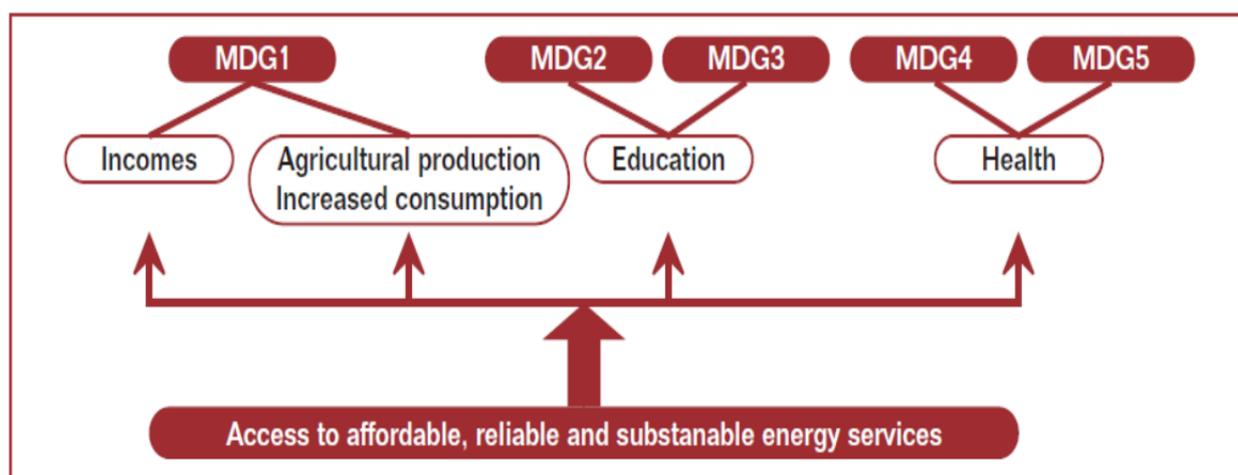


Figure 1.1: Relationship between energy and achieving MDGs

1.1.2 Sustainable Energy for All Initiative

In recognition of the critical need to improve global access to sustainable, affordable and environmentally sound energy services and resources, the United Nations General Assembly declared 2012 the International Year of Sustainable Energy for All (SE4ALL). It called on the UN Secretary-General Ban Ki-moon to organize and coordinate activities to

increase awareness of the importance of addressing energy issues. In response, the Secretary-General launched a global initiative on Sustainable Energy for All (SE4ALL). The initiative is aimed at mobilizing action from governments, the private sector, and civil society around three objectives: (1) ensuring universal access to modern energy services, (2) doubling the global rate of improvements in energy efficiency, and (3) doubling the share of renewable energy in the global energy mix, all to be reached by 2030.

Since the launching of the initiative at the General Assembly in September 2011, the Secretary-General has been successful in mobilizing action across the globe. This has included support from many developing countries which have now embraced the initiative, and are actively undertaking stock-taking exercises to determine plans of action designed to advance on the objectives, according to each country's priorities and circumstances.

At global level, the initiative is chaired by the UN Secretary General himself and Co-chaired by the World Bank President. At country level, this initiative is chaired by the UN Resident Coordinator and Co-chaired by the Minister in Charge of Energy.

The Republic of South Sudan, through the Ministry of Electricity and Dams, applied to join the initiative. The UN Resident Coordinator directed the UNDP Country Director to take action in technically supporting the GoSS. It is in that context that the UNDP Regional Energy Program for Africa hired a consultant to undertake a SE4All rapid assessment and gap analysis in South Sudan, the result of which is this report.

At country level, the SE4ALL initiative is expected to be implemented in 3 steps namely (1) conduct a situational assessment and gap analysis of its energy sector, (2) develop an action plan that will give national priorities in the energy sector (3) implementation of the action plan. This report presents the first stage of conducting a situational assessment and gap analysis of its energy sector in South Sudan.

1.1.3 Rapid Assessment and Gap Analysis of South Sudan's energy sector

Among the various activities envisaged, one is to undertake a rapid situation assessment and gap analysis with baseline data on sustainable energy access, including an assessment of national initiatives on (1) universal access to electricity; clean fuels and devices for cooking/heating; and mechanical power; (2) improvements in energy efficiency; and (3) increasing the share of renewable energy in the national energy mix; and an analysis of sector strengths and weaknesses in specific areas relevant to the sector such as policy, planning, institutions, finance, monitoring (data and accountability), capacity and partnerships.

This document highlights the rapid assessment and gap analysis of the energy and related sectors of the Republic of South Sudan, with particular reference to the three objectives of "Sustainable Energy for All."

1.1.4 Objective of the study

The purpose of Rapid Assessment and Gap Analysis is to provide:

- A brief overview of the energy situation in the Republic of South Sudan (Section 1.2) within the context of its economic and social development and poverty eradication,
- A review of where South Sudan is in terms of the three SE4ALL goals (Section 2),

- An outline of the main challenges and opportunities vis-à-vis the three goals of SE4ALL where the major investments, policies and enabling environments will be required (Section 3)
- A sound basis and background for an Action Plan that may follow as part of the SE4ALL activities in the country

1.1.5 Methodology used

The Rapid Assessment and Gap Analysis was conducted through a comprehensive desk review of available documents on the South Sudan and stakeholder consultation covering Government ministries and departments, South Sudan Electricity Corporation, and development partners in South Sudan. The activity included a situation analysis, with baseline data on sustainable energy production, distribution and utilisation, and covered an assessment of national initiatives on (1) universal access to electricity; clean fuels and devices for cooking/heating; and mechanical power; (2) improvements in energy efficiency; and (3) increasing the share of renewable energy in the national energy mix; and an analysis of sector strengths and weaknesses in specific areas relevant to the sector such as policy, planning, institutions, legal and regulatory framework, finance, monitoring (data and accountability), capacity and partnerships.

1.2 COUNTRY OVERVIEW

1.2.1 Geography

The Republic of South Sudan known as the world's youngest nation is a landlocked country, located in North-Eastern Africa with Sudan in the north, Ethiopia in the east, Kenya in the south-east, Uganda in the south, DRC in the south-west and Central Africa Republic in the west. The country is formed by 10 states as shown in the figure. It is a land of expansive grasslands, swamps and tropical rain forest straddling both banks of the White Nile.



Fig. 1.2 A: Map of South Sudan and its neighbouring countries

1.2.2 History

As Sudan prepared to gain independence from joint British and Egyptian rule in 1956, southern leaders accused the new authorities in Khartoum of backing out of promises to create a federal system, and of trying to impose an Islamic and Arabic identity. In 1955, southern army officers mutinied, sparking off a civil war between the south, led by the Anya Nya guerrilla movement, and the Sudanese Government. The conflict only ended when the Addis Ababa peace agreement of 1972 accorded the south a measure of autonomy. But, in

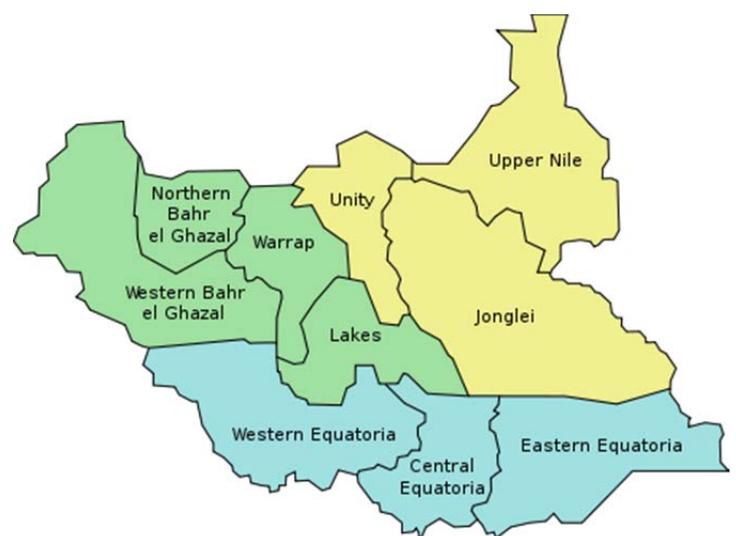


Fig. 1.2B: States of South Sudan

1983, the south, led by the Sudan People's Liberation Movement (SPLM) and its armed wing, the Sudan People's Liberation Army (SPLA), again rose in rebellion when the Sudanese Government cancelled the autonomy arrangements. At least 2 million people are thought to have lost their lives and more than four million were displaced in the ensuing 22 years of guerrilla warfare. Large numbers of South Sudanese fled the fighting, either to the north or to neighbouring countries, where many remain.

The conflict finally ended with the 2005 Comprehensive Peace Agreement, under which the south was granted regional autonomy along with guaranteed representation in a national power-sharing government. The agreement also provided for a referendum in the south on independence in 2011, in which 98.83% of southern Sudanese voted to split from Sudan. The new country's total land area is 644,329 square kilometres.

1.2.3 Socio-Economy

South Sudan's economy is one of the world's most underdeveloped. The country has little infrastructure with just a few kilometres of paved roads. All villages in the country have no electricity or running water. The little available electricity in urban areas is produced using costly diesel generators. The country depends largely on imports of goods, services and capital from the north Sudan, Uganda and Kenya. Despite these disadvantages, South Sudan has abundant natural resources and hopes that its newly-gained independence will help its economy in the upcoming years.

Most South Sudanese sustain themselves through subsistence agriculture. Around 2005, the economy began a transition from rural dominance and urban areas have seen rapid development.

South Sudan is the most oil dependent country in the world, with oil exports accounting for almost the totality of exports, and for around 80% of gross domestic product (GDP). While an estimated 75% of all the former Sudan's oil reserves are in South Sudan, the refineries and the pipeline to the Red Sea are in Sudan. Under the 2005 accord, South Sudan received 50% of the former united Sudan's oil proceeds, which provided 98% of the country's budget revenue. But that arrangement was set to expire with independence, on the 9th of July 2011.

GDP per capita of South Sudan in 2010 was equivalent to US\$1,505, while it was around US\$1,845 for 2011. GDP of 2011 was \$19.17 billion and the population was around 8.3 million, according to the 2009 census. The GDP per capita is much higher than its East African neighbours, mainly due to oil production. Sudden suspension of oil production in January 2012 has reduced GDP per capita drastically. Gross National Income (GNI) per capita was much lower at US\$888 in 2011 (Sub-Saharan Africa average is USD 1,176), reflecting the large income outflows to oil companies. On current reserve estimates, production is expected to reduce steadily in future years (compared to pre-shut-down levels) and to become negligible by 2035. The budget for 2012-2013 was SSP 9bn (around \$3bn), supplemented by \$1bn of development assistance, and another US\$ 300 million of humanitarian assistance.

Outside the oil sector, livelihoods are concentrated in low-productivity, unpaid agriculture and pastoralists work, which accounts for around 15% of GDP. 85% of the working population is engaged in non-wage work, chiefly in agriculture (78%).

The South Sudanese economy has been plagued with high inflation in the 12 months following independence, reaching 80% during the year, but price increases were expected

to be moderate in the end of 2012 at 17%. Over the past year, inflation has been driven mostly by increases in food prices. Limited local food production and a high reliance on imported foods, in combination with depreciation of the South Sudanese Pound (SSP) and the border closure in the North, have driven price increases in the past year.

All economic issues were seriously affected by the decision of the Government of South Sudan (GoSS), on January 20, 2012, to shut down all its oil fields as part of its dispute with Sudan over a range of post-secession issues. The GoSS has adopted 'austerity measures' in response, involving cut of around 30%, mainly to government consumption, transfers to the states, development budget and 50% cut to housing allowance but without touching the wages and salaries. In Addis Ababa on September 27, 2012, an agreement was reached between Juba and Khartoum on the mechanism to market oil, which had raised the hope that the oil production may resume early 2013. However, a disagreement on the manner of implementation of the agreement stalled the agreement until mid-March 2013, when the two countries agreed on the matrix of implementing the agreement. A deal in March 2013 provided for Sudan to resume pumping South Sudanese oil in May 2013.

As per the national baseline household survey of 2009, South Sudan has an estimated population of 8.3 million which is very young, with 16% under the age of five-years-old, 32% under the age of 10-years-old, 51% under the age of 18-years-old and 72% under the age of 30.3 years old. The population is largely rural with 83% residing in rural areas (some reports indicate that the current population is 10.31 million alleging that in 2009 the census was not well done by the officials in Sudan for Southern Sudan and the fact that South Sudanese have been returning home to date). The average number of people per household is 6.5. The largest household size is in Unity State with an average of 7.8 people in each household, followed by Upper Nile and Lakes states with an average household size of 7.6 people. The states with the lowest average of household size in South Sudan are Western Bahr Al Ghazal State with 5.4 and Western Equatoria with 5.5.

South Sudan contains many tribal groups (with more than 200 ethnic groups) and uses many more languages than Sudan. The major ethnic groups present in South Sudan are the Dinka at more than 1 million (approximately 15 percent combined), the Nuer (approximately ten percent), the Bari, and the Azande. The Shilluk constitute a historically influential state along the White Nile, and their language is fairly closely related to Dinka and Nuer. The South Sudanese practice mainly indigenous traditional beliefs, although some practice Christianity, as a result of Christian missionary efforts.

Only 27% of the population 15-years-old and above is literate. In 2009 there were 129 students per classroom. The literacy rate for males is 40% compared to 16% for females. The infant mortality rate is 105 (per 1,000 live births), maternal mortality rate is 2,054 (per 100,000 live births), and only 17% of children were fully immunized. Fifty-five percent of the population has access to improved sources of drinking water but 38% of the population has to walk for more than 30 minutes one way to collect drinking water. Eighty percent of the population does not have access to any toilet facility. Meanwhile, 15% of households own a phone (59% in urban areas compared to eight percent in rural areas.) South Sudanese want to see marked improvements in these indicators, and in job opportunities and economic prosperity, and have high expectations that independence will deliver them.

1.2.4 Oil industry

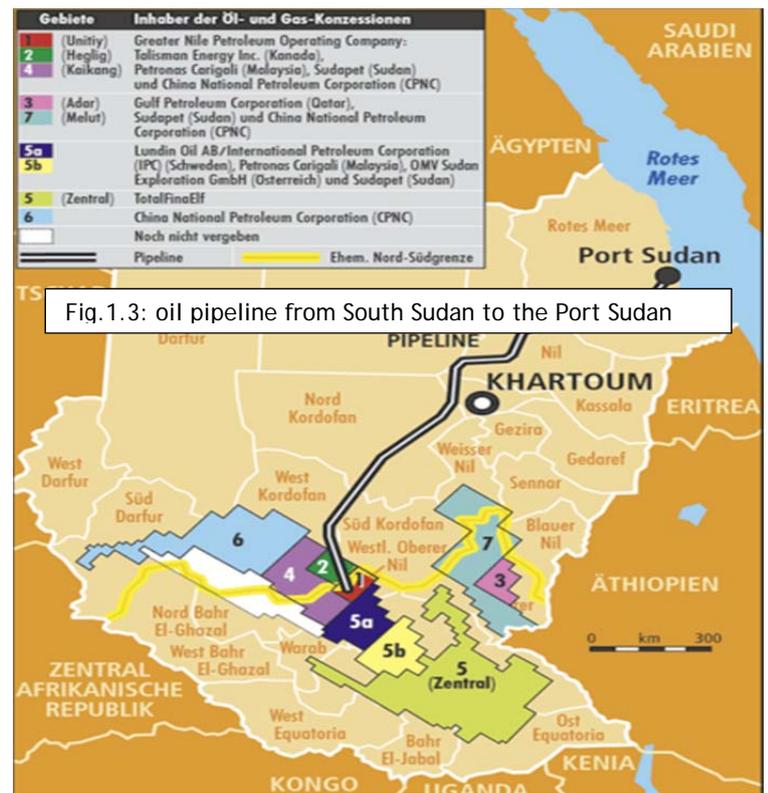
Sudan as a whole has 6 billion barrels of oil reserves (3rd in Sub-Saharan Africa) and 3 trillion cubic feet of natural gas reserves. Most of these hydrocarbon resources are located in the South, which has an estimated 75% of Sudan's known oil and gas reserves and a similar proportion of current production. Prior to independence, South Sudan produced 85% of Sudanese oil output. The oil revenues, according to the Comprehensive Peace Agreement (CPA), were to be divided equally for the duration of the agreement period of six years (2005-2011). Since South Sudan relies on pipelines, refineries, and port facilities on Red Sea State in North Sudan (fig.2), the agreement stated that the Government in Khartoum would receive 50% share of all oil revenues. Oil revenues constitute more than 98% of the Government of South Sudan's budget and this has amounted to more than \$8 billion in revenue since the signing of the peace agreement.

Oil and other mineral resources can be found throughout South Sudan, but the area around

Bentiu is commonly known as being especially rich in oil, while Jonglei, Warrap, and Lakes have potential reserves. During the autonomy years from 2005 to 2011, Khartoum partitioned much of Sudan into blocks. Blocks 1, 2, and 4 are controlled by the largest overseas consortium, the Greater Nile Petroleum Operating Company (GNPOC). GNPOC is composed of the following players: China National Petroleum Corporation (CNPC, People's Republic of China), with a 40% stake; Petronas (Malaysia), with 30%; Oil and Natural Gas Corporation (India), with 25%; and Sudapet of the Central Sudan Government with 5%. The other producing blocks in the South are blocks 3 and 7 in eastern Upper Nile State. These blocks are controlled by Petrodar which is 41% owned by CNPC, 40% by Petronas, 8% by Sudapet, 6% by Sinopec Corp and 5% by Al Thani. Another major block in the South, formerly called Block B by the North Sudanese Government, is claimed by several players. Total of France was awarded the concession for the 90,000 square kilometre block in the 1980s but has since done limited work invoking "force majeure". Various elements of the SPLM handed out the block or parts thereof to other parties of South Sudan. The wealth-sharing section of the CPA states that all agreements signed prior to the CPA would hold; they would not be subjected to review by the National Petroleum Commission (NPC), a commission set up by the CPA and composed of both Khartoum and Southerners and co-chaired by both President al-Bashir of Khartoum and President Kiir of South Sudan. However, the CPA does not specify who could sign those pre-CPA agreements.

1.2.5 Natural resources

South Sudan exports timber to the international market. Some of the states with the best known teak trees and natural trees for timber are Western Equatoria and Central Equatoria. In Central Equatoria, some teak plantations are at Kegulu; the other, oldest



planted forest reserves are Kawale, Lijo, Loka West, and Nuni. Western Equatoria timber resources include mvuba trees at Zamoi. Some of the agricultural products include cotton, groundnuts (peanuts), sorghum, millet, wheat, gum arabic, sugarcane, cassava (tapioca), mangos, papaya, bananas, sweet potatoes, and sesame.

One of the major natural features of South Sudan is the River Nile whose many tributaries have sources in the country. The country is also rich in minerals like petroleum, iron ore, copper, chromium ore, zinc, tungsten, mica, silver and gold.

1.2.6 Agriculture

South Sudan is rich in agricultural land and has one of the largest populations of pastoralists in the world. However, since 1999, when Sudan first started exporting oil, agricultural production in the country has declined. According to the World Bank, the average annual growth rate of the agricultural sector between 2000 and 2008 was only 3.6 percent, which is considerably lower than the 10.8 percent growth rate of the previous decade. The UN Food and Agriculture Agency (FAO) carried out an extensive satellite land cover survey that showed that just 4.5 percent of the available land was under cultivation when South Sudan became independent.

South Sudan relies on food imports from neighbouring countries, such as Uganda, Kenya and Sudan. These come at a high transportation cost which, coupled with inflation, has caused food prices to rise dramatically in South Sudan. The declining agricultural production and the reliance on expensive foreign food supplies have contributed to a severe food shortage in South Sudan. Around 2.7 million South Sudanese were in need of food aid in 2012 according to the United Nations' World Food Programme (WFP). The government has begun to address the issue of agriculture and food security. The Ministry of Agriculture in South Sudan has announced its goal of boosting food production in South Sudan to two million metric tons per year by 2013. The country hopes to attract agricultural investors from Gulf Arab states, Israel, China, the Netherlands and fellow African countries in order to increase production of basic food items such as sugar, rice, cereals and oilseeds, livestock as well as cotton. Smallholder farming accounts for 80 percent of the country's cereal production. The government has chosen to focus on large-scale, private sector-led industrial agricultural schemes as a way to boost food production. Donor countries promote the idea that industrial farming is the key to improved food security in South Sudan. The United States Agency for International Development (USAID), for example, is working with Citibank, the IFC, the Corporate Council on Africa, and others to help the country market its resources and attract private capital in key sectors, including agriculture. This investment is intended to stimulate rural development and generate employment opportunities, increase food productivity, provide government institutions with new and sustainable sources of revenue, and help to diversify the economy.

1.3 ENERGY SITUATION

1.3.1 Primary energy consumption balance

Estimates on the contribution of oil and gas to South Sudan energy consumption mix were not readily available by the time of the study, but the total primary energy supply of the former united Sudan in 2007 was 14,675 thousand tons of oil equivalents (ktoe). Biomass was accounting 72.8%, oil and petroleum 26.3% and hydroelectricity 0.8 %.

The energy needs in South Sudan are predominantly met by biomass, consisting of the burning of charcoal, wood, grass, cow dung, agriculture residues, etc. According to the National Baseline Household Survey, over 96% of the population use firewood or charcoal as the primary fuel for cooking (which typically constitutes 90% of the energy used in a rural household). An average household in South Sudan burns about 3 tonnes of woody biomass per year for cooking, emitting nearly 2 tonnes of Carbon dioxide equivalent per year, as cooking is done mainly using three-stone open fires. Only about 1% of the population has access to grid electricity. Most of these consumers are in Juba, the capital city of the Republic of South Sudan, with the remaining in Wau and Malakal.

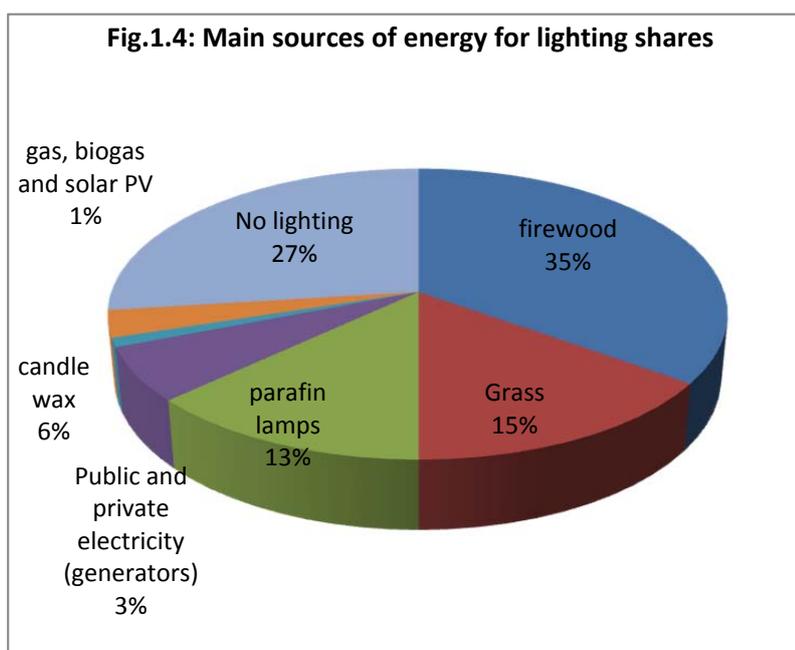
The fuel mainly used for cooking in homes and public institutions of South Sudan is firewood that is collected from the forests and bushes, mainly by women and children sometimes as far as 6 km away. Large tracts of unutilized bush land resulting from displaced populations are a common feature in South Sudan. As a result, availability of firewood is not a constraint today. This however may change in future as more trees are cut down.

Over 95% of the households in Juba cook with wood fuel or charcoal, the vast majority using charcoal. Those in the low-income housing areas, where 75% of the population lives, spend 10-15% of their average household income on charcoal per month.

1.3.2 Energy for lighting

Firewood is the most used source for lighting in South Sudan, used by 35 percent of population. Grass (15 percent) and paraffin lamps (13 percent) are the second and third most used source for lighting. 27 percent of the population has no source of lighting. There are big differences in use of lighting in urban and rural areas. 40 percent of the rural population use firewood as the main source of lighting compared to 10 percent in urban areas. In the urban areas, paraffin lamps and candles wax are the main source of lighting, being 50 percent combined.

Western Bahr Al Ghazal has the highest percentage of people using public or private electricity as the main source of energy (11%) followed by Upper Nile with 9%. Paraffin lamp is most used in Central Equatoria with 42 percent, followed by



Western Equatoria with 32 percent. Firewood is most used in Warrap with 85 percent, but is little used in Upper Nile and Central Equatoria. Grass for lighting is most used in Northern Bahr Al Ghazal with 26 percent, while candle wax is most common in Western Bahr Al Ghazal with 16 percent. In Upper Nile and Jonglei about half of the population is using no source of lighting.

1.3.3 Energy for cooking

In South Sudan, nearly 87 percent of the population use firewood as their main source for cooking. Only 10 percent of the population used charcoal as primary fuel for cooking (fig.1.5). 94 percent of the population in rural areas use firewood for cooking compared to 44 percent in urban areas. In urban areas charcoal is the most used source of cooking with 54 percent, compared to only 2 percent in rural areas (fig.1.6).

In Warrap State 97 percent of the population are using firewood as their primary source for cooking, compared to 63 percent in Upper Nile. Western Bahr Al Ghazal, Central Equatoria and Upper Nile have the highest percentage of the population using charcoal for cooking with 32, 25 and 21 percent respectively.

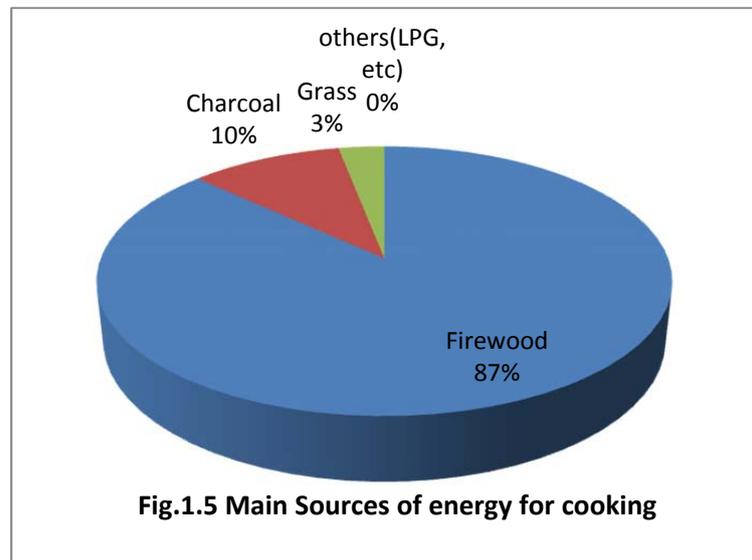


Fig.1.5 Main Sources of energy for cooking

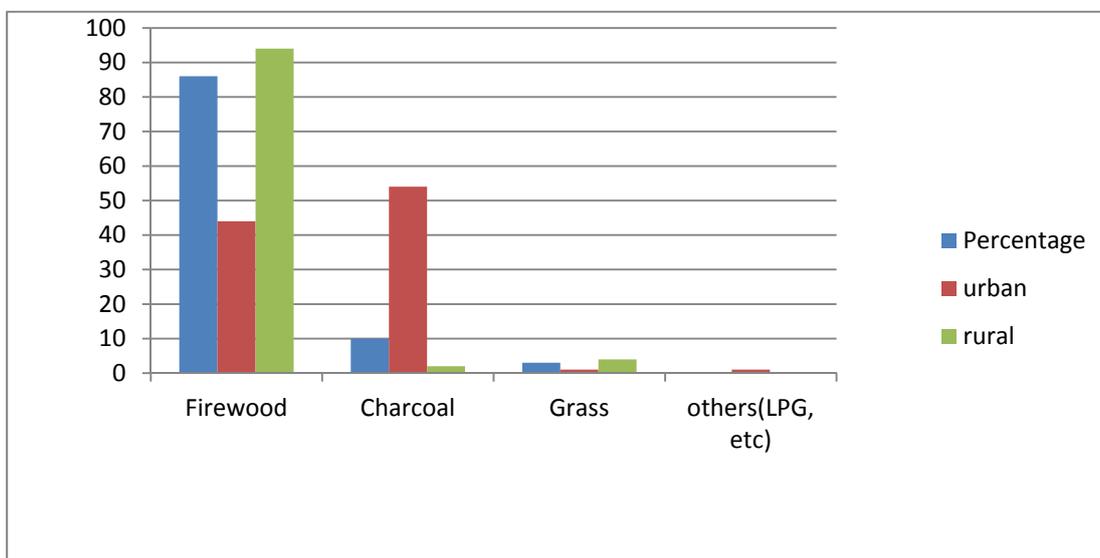


Fig.1.6 energy for cooking sources in rural and urban areas

1.3.4 Power sector

Electricity is an extremely scarce resource in South Sudan. Since the colonial period followed by Khartoum rule, there has never been an electricity transmission backbone. The only available network is in three isolated distribution systems located in three urban centres of Juba, Wau and Malakal.

In South Sudan electricity generation is done through power generators that use diesel and Heavy Fuel Oil (HFO). Installed capacity for the South Sudan is about 30 MW of which about 22 MW was operational until October 2012. Some mini grids are being done through donor funds e.g. NRECA/USAID funded projects. The total number of customers connected to the network is about 22,000. This represents an access rate of electricity of about 1% of the population. The remainder and the majority of the population rely on firewood, solar, kerosene, individual generators, etc.

At present, the grid-based electricity situation in South Sudan is characterized by routine power outages and lack of efficiency in the distribution systems. Despite the South Sudan Development Plan (SSDP) targets, the energy sector situation has not changed much from the pre-independence period. Per capita electricity consumption in South Sudan is about 1 - 3 kWh, the lowest compared to the rates in its neighbouring countries. The average per capita electricity consumption in Sub - Saharan Africa is about 80 kWh.

There is a dire need for electricity in Southern Sudan. All public sectors institutions, including hospitals and schools need to benefit from electricity.

1.3.4.1 Electricity Generation

Hydro-electric power was generated by three dams built in Sudan before the 1970. Since these are located in the northern part, there is no supply to South Sudan apart from a small town of Renk that is supplied from a 40 MW power plant in the North, but due to lack of grid and limited demand, the plant is underutilized.

The electricity production in South Sudan is established at 2,870 GWh/year including 140 GWh/year of off-grid rural systems, and the consumption is suppressed due to limitations of the supply of fuel and spare parts. South Sudan has been facing severe power outages since it seceded from Sudan. Most businesses in South Sudan rely on costly diesel generators. The capital Juba has experienced lack of power due to the oil shutdown and austerity measures as a result. Lack of spare parts and fuel had forced the country to shut off generators since October 2012 until today.

The same shutdown disrupted various projects which were about to secure funding because lenders declined to advance project funding until crude flows resumed in May 2013. Delayed projects included a deal to build \$300 million worth of power lines over three years to tap into Ethiopia's national grid, which China had shown interest to fund.

Grid-connected generation sources consist exclusively of thermal generators (diesel and heavy fuel oil). Total installed capacity for the whole country is 30 MW, of which, only 22 MW is currently operational (12 MW in Juba, 2 MW in Wau, 5 MW in Malakal, and three mini-grids). The electricity supply generally services urban customers and some commercial centers in the towns, whereas most of the industries and businesses rely on captive power for electricity needs. Apart from the three (3) government-run distribution networks mentioned above, there are also donor funded (NRECA/USAID) mini-grids in the towns of Yei (1.2 MW), Kapoeta (0.8 MW) and Maridi (0.8 MW) (table 1 below).

Table 1: Power plants in South Sudan

City	Installed Capacity (MW)	Year of installation	Comment
Juba	5	2007	Emergency diesel power plant (Cummins) financed by the ROSS. Never came to operation
	12	2010	Dual fuel power plant supplied by Wartsila. Not operational from February 2013 up to now.
Wau	6		Not operational: no fuel, no spare parts.
Malakal	8		Not operational: no fuel, no spare parts.
Yei	1.2	2008	Implemented by NRECA under Sudan infrastructure project, financed by USAID
Kapoeta	0.88	2011	
Maridi	0.88	2011	
Yambio	2.8	Under construction. The network funded by GOSS is about 50% complete but poorly installed by the contractor	
Bor	2.8	Newly delivered generators, installation not completed.	
Rumbek	2.8	Under construction	
Bentiu	5 planned	Funds to be mobilized by the GOSS	
Aweil	5 planned	Funds to be mobilized by the GOSS	
Kwajok	5 planned	Funds to be mobilized by the GOSS	
Torit	5 planned	Funds to be mobilized by the GOSS	

1.3.4.2 Grid Network

There is no transmission back-bone or any interconnected grid network in South Sudan. The supply system consists of 3 isolated distribution networks in the state capitals of Juba, Wau and Malakal totalling about 15 km of 11 kV lines plus some electrified commercial centres (mini-grids implemented by communities and donors). As a result, electricity sales over the recent past years have been very low (Table 2).

Year	2000	2001	2002	2003	2004	2005
Grid sales (GWh)	1,408	1,489	1,757	1,928	2,496	2,730
Off-grid sales(GWh)	82	63	80	89	106	140
Total sales(GWh)	1,490	1,552	1,837	2,017	2,602	2,870

1.3.5 Oil products

Though there are plans for refineries in the future, South Sudan imports fuel for its power generators and transport sector and the situation is likely to remain so for the 3-5 years to come until its refineries are operational. South Sudan current demand for heavy fuel oil (HFO), gasoil (diesel), gasoline (petrol) and kerosene (jetA1) is around 25-30 million litres per month. That is roughly 4000 - 5000 barrels per day. The demand in oil products is

expected to double in the coming two years given projections of growth in industries like roads, oil Exploration and Production and agricultural schemes. Due to suspension of trade with Sudan after the shutdown of the landlocked country's oil industry in January 2012 in a row with Khartoum over export fees, the oil products are currently imported from the port of Mombasa (Kenya) and are transported by trucks through Kampala (Uganda).

There are three blends or types of crude oil in South Sudan namely Nile, Thar and the Dar blends. The blends differ in chemical composition/profiles and the location where they are drilled. The Nile blend is generally considered as being of a better quality (and thus more expensive) than the Dar blend which requires much more processing; cannot be transported independently; and produces much more pollutants. The Thar blend, found in TharJath in Unity State, is less known internationally and (like Dar blend) needs a little more work before it could be sold as a usable product.

South Sudan is investing in its own refineries and pipelines to avoid dependency on Sudan. The first South Sudan refinery in Melut, in Upper Nile State, aims at refining 10,000 barrels a day of the Thar blend and will mainly cater for the domestic needs. This refinery is expected to be commissioned by end of July or first week of August 2013.

A second refinery in Bentiu, Unity State will refine the Nile blend - a better quality blend which is also much more marketable than the other two. A third refinery has been approved by the council of ministers, and is yet to be launched in Akon for the Thar blend. South Sudan has created the first oil company known as Imatongas Petroleum Company.

The Thangrial refinery in Melut will produce enough products to meet the current demand and have surplus for export - but the refinery is designed to produce more of HFO (to be used as an alternative for the costly diesel generators), less of gasoil (currently 70% of the demand) and might not produce lighter products like petrol. The refinery could produce excess HFO for export, but - depending on the demand - South Sudan might still have to import lighter products like petrol and probably diesel.

1.3.6 Energy demand

The current demand for electricity is estimated at 300MW which is expected to rise to over 1400MW by 2030. According to the 2007 power master plan for Sudan, Juba Regional Grid maximum expected demand will be 94 MW in 2020 and 304 MW in 2030. It is important to note that the last power master plan study was prepared for the whole Sudan by PB Power UK for NEC Utility in Khartoum in 2007 and the Study had no demand survey work undertaken in South Sudan. Hence, there is a need to undertake a power master plan for the new nation, taking into account the recent developments.

The demand for electricity has been steadily increasing with new economic opportunities in the post-independence era. The growth of the electricity sector in South Sudan is not restrained by demand but lack of supply. In the major cities there is a substantial amount of suppressed demand and captive generation used by the private sector will increase the load as a step function if supply sources are made available.

Based on current economic development plans and assuming they will be implemented, South Sudan will have a total of load demand of nearly 100 MW by 2016 with energy sales of nearly 200 GWh by 2016.

1.3.7 Sustainability of the electricity utility and subsidies

Energy sector in South Sudan is fully subsidized. Fuel to run the generators and spare parts are bought by the Ministry of Finance and Economic Planning. Salaries of staff of the Electricity Corporation are also paid through the GoSS budget. Even before all the power plants were shut down, the utility was not able to collect revenues from customers. The main customers including government buildings, military camps, hospitals, water supply utility, airport, etc do not pay electricity bills, although they are supposed to pay. In addition to that, 80% of the little collected revenues are deposited in the Ministry of Finance and Economic Planning.

The current tariff of electricity is not cost reflective. The production cost is around USD 0.70/kWh. There are three types of customers with different tariffs. Commercial category pays SSP 70 cts (USD 0.21), Domestic category pays SSP 50 cts (USD 0.15) while the Government establishment should pay SSP 80 cts (USD 0.24). Although the government establishments are expected to pay higher prices, they are the most defaulters.

1.3.8 Energy strategy and relevant targets

The goal of eradicating extreme poverty in the coming decades in south Sudan will not be achieved unless substantial progress is made on improving energy access. To meet the goal, millions of people need to be provided with electricity and clean cooking facilities. All this will require huge investment which is not yet available in the near future. Due to the lack of electricity in South Sudan, the Government has prioritized power projects in its development agenda. The high political leadership including the South Sudanese parliament prioritizes electricity. The Government is mainly focused on increasing generation capacity through hydropower development while other energy sources such as solar and wind are often stated as too expensive and difficult. South Sudanese electrification strategy prioritizes the use of indigenous resources namely oil and hydro to provide electric power for the basic services and to meet the development needs of the Republic of South Sudan. A new financial, institutional and technological framework is required, as is capacity building in order to scale up access to modern energy services in south Sudan. The Ministry of Electricity and Dams is committed to laying out the legal and policy framework as well as plans for achieving affordable, reliable and efficient means of generating, transmitting, distributing and supplying electricity in the shortest time possible.

The GoSS's public policy goals related to the electricity sector can be categorized as follows:

- (i) **Grid based access enhancement:** the GoSS's target is to increase the number of customers connected to the grid from 22,000 to 48,000 by 2016. The MED and SSEC will expand the distribution network to connect many households, using prepaid meters. SSEC is also focussed on sound operations and maintenance of its distribution system to increase efficiency and to offer a higher quality of service to its customers
- (ii) **Increasing generation capacity:** MED and SSEC plan to increase South Sudan's installed capacity to at least 96 MW by 2016. In the short term the added capacity is planned to be derived from the upgrading of the existing thermal power plants as part of emergency solutions to the current energy crisis. The GoSS will also supply thermal generators to the 7 unelectrified state capitals of Bor, Yambio, Rumbek, Torit, Kwajok, Aweil, and Bentiu. Additional 40 MW is also urgently required for the capital Juba. In the medium term, the GoSS is planning to develop its vast hydropower potential.

- (iii) **Establish Regional Interconnections:** the MED and SSEC plan to participate in a bilateral interconnection with Sudan by construction of 220 kV line from Renk to Malakal as well as reinforcement of the local distribution network. This will be able to import 140 MW from Sudan by 2016. Due to lack of demand today the connected people in Renk can only consume 5 MW from Sudan. Malakal is situated in the Upper Nile region, over 500 km from Juba and it will not be possible to utilize 140 MW until extensive transmission lines are built to other parts of the country. Therefore, this connection may be used to supply the closeby towns of Bentiu (capital of Unity State), Fangak, Al Nassir and Jokow in addition to the major load in Malakal. The Government is also planning to import power from Ethiopia and it will also be connected to Ugandan grid. The regional interconnections will also ensure the stability of the network and reliability of power supply as a result.

In its efforts to boost generation capacity and scale up access to electricity, South Sudan has laid the strategic plan with the following key actions:

1.3.8.1 Immediate actions of the power sector

Immediate actions to be undertaken by the GoSS, as soon as the budget is received, most probably in December 2013 will include procurement of fuel and spare parts for the thermal power plants in Juba, Wau, Malakal, Yambio, Bor, Bentiu and Rumbek.

1.3.8.2 Short Term actions of the power sector

As a new nation, the Government will embark on a process of technical and institutional capacity building. The Government will focus on laying the foundation of growth for the future with the following key action items:

- i) Legal and regulatory framework will be enacted to include measures to promote grid and off-grid programs, including partnership with the private sector;
- ii) A comprehensive sector-wide capacity building program will be carried out to address the capacity constraints faced by the sector institutions.
- iii) Generation program will continue on expansion and focus also on long - term planning and project preparation for least-cost transmission program.
- iv) Distribution program will continue for the planned urban areas and initiate the planning process of new distribution networks in the state capitals without power grids.
- v) Access enhancement program will continue on planned grid-based connectivity and also launch of off-grid programs, such as, solar lighting and efficient cooking;

1.3.8.3 Medium Term actions of the power sector

Government will focus on implementing the following identified strategic projects:

1. Construction of power lines for supply of 50 to 100 MW electricity from Western Ethiopia (Gambella area) to Nasir, Malakal, Pibor, Akobo and all towns in the Eastern parts of South Sudan. The cost of extension of the grid from Gambella to

Malakal town with upgrade stations in Nasir and Ulang is estimated to cost USD 322 million. China Heavy Machinery Corporation has offered to build the power lines through loans from China and a provisional agreement has been signed between China and South Sudan. This project has been prioritized by the Ministry of Finance and Economic Planning for funding through Chinese loan. When China Heavy Machinery Corporation gets the loan this year (the Chinese Government is reluctant in approving the loan as they suspect a possible oil shut down again in August 2013), South Sudan may receive reliable power by 2015.

2. Construction of Fula (I) Power Plant: This project will be constructed on the basis of Public Private Partnership (PPP). The Ministry has discussed with Norwegian Government for possible support. In response the Norwegian government has agreed to fund construction of the Hydro Plant through a Norwegian agency called Norfund. The cost of the project has been estimated at USD 150 million and Norway has agreed to raise about one hundred and twelve million dollars (USD 112 million), which is 75% of the cost of the plant. The other 25% (i.e. USD 37 million) will be met by Government of South Sudan. This hydropower project will supply 40 Megawatts to Nimule town, villages along Juba-Nimule highway as well as Juba town. Work on the project is expected to start within this year (2013) and electricity power from this facility is expected to reach Juba by mid-2015.
3. Construction of Tharjath Thermal Power: The construction of this thermal power plant is planned to take about two years. The power plant will be fuelled by direct crude from Tharjath oil fields. Since there is Dar blend crude in abundance, this will provide cheap and reliable fuel for the power plant and consequently cheap and reliable electricity for almost half of South Sudan. The project is estimated to cost USD150 - 200 million. The power plant will produce 300 MW, which will be enough to cover the whole of Central South Sudan up to Wau area. The Ministry is currently discussing with relevant Indian Government authorities as well as Chinese companies for funding and construction of the power plant.
4. Construction of Sue mini hydro plant: This plant is envisaged to produce 15 MW to supply Wau, Aweil and Kwajok towns. The cost of construction has been estimated at USD 130 million. The GoSS requested many interested companies to visit the Sue site in Wau, and the Ministry is discussing possible funding and implementation of the project with a number of companies. It is likely to be the most expensive project given its installed capacity and out of the companies that visited the site none of them is willing to invest in the project.
5. Extension of grid from Renk to Malakal: South Sudan is currently buying electricity from Sudan for Renk town. The purchased electricity was planned for consumption in Renk, areas along the Renk-Malakal road and Malakal town, but since the line to Malakal is not yet constructed, South Sudan is paying for un-utilized electricity because Sudan authorities can only sale bulk quantities of electricity. The Ministry is currently discussing with interested investors for extension of the grid from Renk to Malakal. The authorities in Sudan have shown interest in the project because they need Dar blend crude from Adar Yel oil fields to run their 500MW power plant in Rabak/Kosti.

1.3.8.4 Long Term actions of the power sector

The Government will implement the following strategic projects:

6. **Construction of Bedden dam on the Nile:** Beden Hydro Power Dam is the biggest and most expensive project the Government of the Republic of South Sudan has embarked to implement. This Hydro Power Dam is planned to supply a total of 540 MW power and is estimated to cost USD1.4 billion. A group of companies from China, called Gezhouba Group have offered to construct the dam with loan from Exim Bank of China. Towards that, the Ministry of Electricity and Dams (MED) signed a preliminary agreement for the construction of the dam. This was followed up with discussion with authorities of the Exim Bank of China. The contract will come into force when CGGC gets the necessary funding from China Government and approval of the relevant authorities of the government of the Republic of South Sudan. Another condition, which is worth noting, is that the Chinese authorities have informed the Government of South Sudan (GOSS) that they only fund 85% of all projects. The Government of South Sudan is expected to pay 15% as a sign that it is committed to implement the project. If funding is secured, it will take 80 months to complete the construction of the dam i.e. about seven (7) years.
7. **Grand Fula Dam:** While the policy paper was being finalized, the Council of Ministers approved the construction of Fula dam as a top priority. The Ministry of Electricity and Dams signed an Engineering Procurement Construction (EPC) contract with AAE Systems of California (USA) for funding and construction of the dam. All relevant papers were sent to the concerned authorities and are now being reviewed by the Ministry of Finance and the Ministry of Justice. The proposed dam is expected to produce about 890 Megawatts and costs about USD 1.8 billion. Construction of the dam is expected to take about seven years.
8. **Construction of the National grid:** While the GOSS is planning to build hydro Power plant and dams, it is vital that it plans to build the national electricity grid to be implemented simultaneously with the construction of the power plants and dams. Construction of the National electricity grid to connect major towns of South Sudan is estimated at the cost of USD 500 million. This project is already under discussion with Chinese companies.

Table 3 gives a summary of short to medium term power generation projects.

Sno.	Project	Construction period	Project status
1	Import of 50-100MW from Ethiopia	2-3 years	The feasibility study has been completed; an Environmental Impact assessment study still in progress
2	40 MW Fula hydro project	2-3 years	The feasibility study is completed, Environmental Impact assessment study is completed, funds committed
3	200-300 MW Tharjath crude fired power plant	2-3 years	Terms of Reference (TOR) for feasibility study prepared
4	Kinyeti hydro project (upgrading)	16 months	Contract expired, Feasibility study completed
5	12-15MW Sue Hydro power project	2-3 years	Feasibility study completed, funding not yet secured
6	540 MW Beden hydro power project	6-7 years	Feasibility study completed, Environmental Impact assessment completed, EPC contract signed with CGGC
7	410 MW Lakki hydro project	5-7 years	Feasibility study completed, Environmental Impact assessment completed, no contractor yet identified.
8	230 MW Shukoli hydro project	5-7 years	Feasibility study completed, Environmental Impact assessment completed, no contractor identified yet
9	890 MW Grand Fula hydro project	6-7 years	Feasibility study completed, Environmental Impact assessment completed, contract awarded to AAE Systems

Once the above projects are implemented, around 2400MW can be secured and the electricity poor country will become an exporter of power.

1.3.9 Rural Electrification

Rural electrification is one of the areas that received little attention in the old Sudan. Today there is a need to extend the current electricity supplies in urban populated centres to the rural communities. The rural electrification program will be implemented under the theme of: "Taking Towns to the People", as suggested by the late Dr John Garang, the founder of South Sudan.

The Ministry of electricity and Dams (MED) has a plan to create and establish a department for Rural Electrification that will formulate national rural electrification plans. The establishment of this department has not taken place due to austerity measures that are currently in place. The plan for creation of the Rural Electrification Department includes

estimates of resources needed to jump start the rural electrification program in targeted areas. It is worth noting that the Ministry of Electricity and Dams will work in coordination with State governments for successful implementation of the rural electrification program.

1.3.9.1 Rural Electrification fund:

To achieve the implementation of rural electricity program, the Ministry of Electricity and Dam has proposed to establish a fund to be known as “**Rural Electrification Fund (REF)**”. It is envisaged that the fund shall be financed mainly from monies appropriated by the National Assembly. Funds may also be received from donations or loans accessed by both the Ministry of Electricity and Dams and Ministry of Finance and Economic Planning. The Ministry of Electricity and Dams and South Sudan Electricity Corporation (SSEC) will administer rural electricity funds in accordance with procedures and regulations issued in the upcoming South Sudan Electricity Act.

1.3.9.2 Rural Electrification Committee:

Under the Energy Policy, the Ministry has proposed to set up a Rural Electrification Committee, to be chaired by the Minister of Electricity and Dams at the National level. This Committee shall be composed of the following:

1. Minister of Electricity and Dams - Chair
2. Minister of Finance and Economic Planning - Member
3. Minister of Agriculture, Forestry, Rural development and Cooperatives - Member
4. Minister of Commerce and Industry - Member
5. State Minister responsible for Electricity - Member

In accordance with policies and National strategic plans, the Ministry of Electricity and Dams shall prepare investment plans for rural electrification in consultation with the Rural Electrification Committee. The Ministry of Electricity and Dams, in consultation with Rural Electrification Committee, will coordinate with the State Governments to plan and implement a rural electrification program to extend electricity services to smaller towns, villages and population clusters in rural areas. The rural electrification shall be implemented through thermal (diesel), solar PV, wind and mini hydropower plants.

1.3.10 Eastern Africa Power Pool

The Eastern Africa Power Pool (EAPP) has been established to develop a regional power pool and facilitate trade of power among Eastern African countries including South Sudan. Sudan is a member to the EAPP but South Sudan is not yet. Currently, the member states of EAPP include Burundi, Rwanda, DRC, Egypt, Ethiopia, Kenya, Tanzania, Libya and Sudan. The potential new members are Uganda, Somalia, Eritrea, Djibouti and South Sudan. The GoSS is planning to join the pool by signing the Intergovernmental Memorandum of Understanding and its utility SSEC will need to sign an Inter Utility Memorandum of Understanding. The GoSS is planning to import power from Ethiopia and Uganda in the short term, but also to export once its planned hydropower projects are onboard. Ethiopia has a regional comparative advantage in hydropower which can be generated at much cheaper cost than any other countries in the region. It has a potential of around 45,000 MW which is enough to meet the current region’s demand. The planned interconnection of Ethiopia-South Sudan consists of a 335 km of 230 kV transmission line from Gambela to Malakal and a 700 km of 500 kV transmission line from Dedesa to Juba via Tepi. Another option to be considered is the interconnection with Uganda. Currently,

Uganda has expanded its transmission network at 220 kV towards its northern border up to Gulu which is only 75 km from the border town of Nimule, which is 200 km from Juba. Although Uganda is currently facing power shortfalls, the Bujagali power plant is expected to be fully commissioned shortly. In addition, other hydro projects such as Karuma 200 MW and Isimba 120 MW are in pipeline for construction. The ongoing interconnections between Uganda and Kenya as well as Kenya and Ethiopia can enable the wheeling of power from Ethiopia if a Uganda-South Sudan interconnection is available. Furthermore, the major hydropower sites in South Sudan are concentrated close to Nimule at the Ugandan border. An interconnection between Juba and Gulu with intermediate stations for the new hydro power plants can allow for limited power flows to South Sudan in the initial years and power export to Uganda in the longer term. Currently, discussions are ongoing on such an interconnection under the Nile Equatorial Lakes Subsidiary Action Programme (NELSAP) which is part of the Nile Basin Initiative (NBI).

It is important to note that these interconnections will not only be used to import or export power to or from South Sudan but will also ensure stability of the interconnected network.

1.3.11 Cooperation with Egypt in increasing access and building human capacity

The GoSS called for Egypt's assistance in implementing development projects in South Sudan to enhance the lives of local communities. As a result, the Government of Egypt (GoE) launched an initiative to generate electricity in some South Sudan towns. This initiative aims to strengthen relations between Egypt and South Sudan on both the governmental and societal levels. The initiative consists of the following component:

- (1) Generating electricity in towns that are deprived of electricity;
- (2) Building technical local capacities in the fields of construction, operation and maintenance of electrical power projects.
- (3) Training and reinforcing capacity of administrative cadres in South Sudan.
- (4) Electrification of several towns in South Sudan, and supplying several houses, hospitals, and utilities with electricity.

The two governments have agreed to establish four power plants in four South Sudan cities in two stages.

Stage I: Establishment of a power plant with a capacity of 2x1 Megawatts, and its necessary distribution networks in Wau city on the western bank of the Jur River.

Stage II: Establishment of three power plants in three cities: Yambio (West Equatorial State), Bor (Jonglei State), Rumbek (Lakes State) with capacity of each is 2x1.4 Megawatts each. South Sudan committed to construct electricity distribution networks in the three mentioned cities. It was agreed that after the completion of each project, its administration will be handed over to the South Sudanese side. The projects are still under implementation.

This was the first co-operation project between Egypt and South Sudan in the field of electricity and energy in the last ten years. Work started on Jur River in Wau city, Northern Bar Gazar State, by adding two additional generating units 2*1MW to the two already installed generating units that had stopped functioning completely in 2003, in addition to installing distribution networks to feed governmental facilities and households. After the success of this project, the two governments agreed to replicate this experience

in three other cities that lack access to electricity; Bor, Rumbek and Yambio. Before determining the targeted cities in the second stage, the two governments agreed that the GoE would establish three power plants in three cities while the GoSS establishes their distribution networks.

In terms of capacity building, two engineers from these cities received training on operation and maintenance processes in a supplying company in Denmark. The administration of the project in Wau city has been handed over to the South Sudanese side, while continuous follow-up and consultancy occurs between the two sides to ensure sustainability. The initiative focused on developing local technical and administrative cadres in South Sudan through consultancy, follow-up and training programmes. In addition, knowledge gained from this experience added to Egypt and South Sudan understanding of how to strengthen mutual co-operation, and South to South Co-operation (SSC) with other actors.

Section 2: Current situation with regard to SE4ALL goals

2.1 MODERN ENERGY ACCESS vis-à-vis GOAL OF SE4ALL

There are two good indicators of energy poverty at the household level in south Sudan namely lack of access to electricity and the reliance on the traditional use of biomass for cooking. Access to modern energy services can be defined as household access to electricity and clean cooking facilities. Cooking facilities include clean cooking fuels and stove, advanced biomass cook stoves and biogas systems.

2.1.1 Modern energy for thermal applications (cooking, heating)

The number of people relying on the traditional use of biomass for cooking and heating in South Sudan is over 96%. This is one of the greatest challenges for the country. It is expected that the number of southern Sudanese relying on biomass will rise in the coming two decades. This is linked to household air pollution from the use of biomass in inefficient stoves.

2.1.1.1 Use of improved cook stoves

Improved wood fuel cook stoves in rural area

Traditionally, especially in rural South Sudan, villagers, largely women and girls, have to spend hours foraging for fuel woods and inhaling toxic smoke (often with infant babies strapped to their backs). The toxins in smoke cause serious respiratory illnesses, such as pneumonia, emphysema, lung cancer and bronchitis. At the same time, cutting down trees for fuel woods is contributing to Sudan's catastrophic loss of forest and global climate change.

As mentioned earlier in this report, over 95% of the households in Juba cook with fuel wood or charcoal, the vast majority using charcoal. Those in the low-income housing areas, where 75% of the population lives, spend 10-15% of their average household income on charcoal per month.

During the last ten years the savannah forest and many of the government forest reserves near Juba have been depleted. It has been estimated that Juba needs 25 square miles of forest to supply its yearly need for fuel, yet there is not 25 square miles of reserve. The supply of wood, mostly for charcoal, comes from a large unmanaged area with no re-

planting. A 40 kg sack of charcoal costs US\$ 12.00 while it was costing US\$ 2.50 in 1977. The standard of living of most of Juba's inhabitants denies them the use of electricity, gas or kerosene cooking stoves. Like many urban areas of Africa, metal cooking stoves (which are none energy saving) exist in one form or another.

There have been a few initiatives to promote wood fuel improved cook stoves. One of these initiatives was Hope Ofiriha's Onura Clean Cook stoves Project to set up 10 small women groups to train women on how to make and market clean and efficient cook stoves made in clay in Onura. These stoves use less fuel inputs and generate much less smoke than traditional ones. Such initiatives need to be promoted and disseminated throughout the country.

Improved charcoal cook stoves in urban area (Juba)

Traditionally women in Juba cooked on three stones until the 1950s when the wire stove (fig. 1.8) spread southwards from northern Sudan. Later a stove combining Sudanese and East African ideas was produced. However, these stoves are not fuel efficient. In recent years a number of models of fuel efficient stoves have developed. The design chosen for introduction in Juba by the Department of Community Development (DCD) is a modified version of UNICEF Nairobi's 'Umeme Jiko' called in Sudan 'Kanun el Jadid' meaning 'new stove' (see fig.1.9). It is designed in such a way as to be recognisable as an adaptation of the traditional East African metal stove

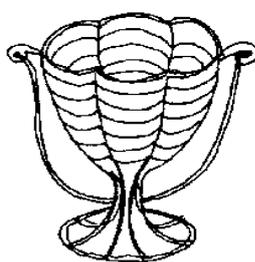
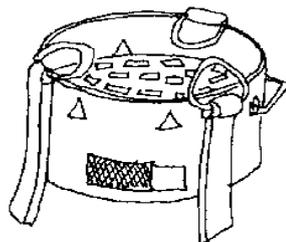


FIGURE 1: WIRE STOVE
from
North
Sudan

FIGURE 2:
Stove combining
Sudanese and
East African
features



supports on which the lip of a small
pot or saucepan rests
(large pots sit
on top)

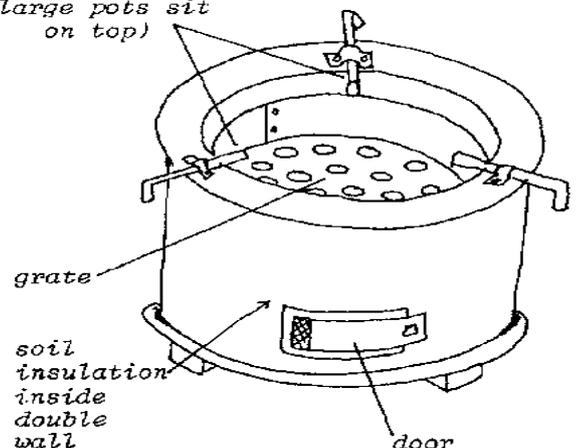


Fig. 1.9 Kanun el Jadid

The improvements are in the insulated walls filled with earth and the placement of the saucepan into the firebox. The soil insulation reduces heat loss by directing it upwards onto the base and sides of the lowered saucepan.

In Konyo-Konyo, Juba's largest open-air market, the metalworkers have proven their abilities to produce the 'Kanun el Jadid'. These workers have a thriving area where assorted household items are made, and as there is no imported equivalent to local stoves these men produce stoves for the majority of Juba's population.

A bag of charcoal which lasts a family 10 days would last 16 days if the new stove is used. In addition the new stoves are stronger and will last longer.

2.1.1.2 Promotion of LPG

Upon the onset of local production of Liquefied Petroleum Gas (LPG) in Sudan, the Government of National Unity adopted a fuel-switching policy to increase the uptake of LPG amongst the population. The price of LPG was reduced by 50 percent and LPG appliances were exempted from import duty. As a result of this intervention the use of LPG, particularly by the domestic sector, increased from about 31,000 metric tons in 2000 to 274,000 metric tons in 2006. In addition, there was significant uptake in use by the industrial and automotive sectors, amongst others. So as to protect supplies and ensure its policy commitment to supporting the household and services sectors with clean energy, the government removed subsidies for LPG to the country's industrial sector.

Despite the success in uptake, it is clear that the benefits of LPG have not been equally spread. Poor households in the peripheries of large towns and rural areas still have little to no access to clean energy. The consumption of LPG was largely concentrated in Khartoum state, which constituted about 75 percent of overall consumption in 2006. The other states had minor shares, with the central states of Gezira and Sinnar accounting for 14 percent together; with the remaining states, including the then Southern Sudan were consuming the rest. LPG use, therefore, remains insignificant in South Sudan, given the cost of transportation and poor transport infrastructure. So far there is only one oil company known as IMATONGAS that is working on building bulk storage and bottling facility for LPG in Juba to reduce the cost. This facility will include the first LPG filling plant of its kind in South Sudan.

Expanding the use of LPG in South Sudan would be a clear solution to help address the depletion of forest resources and the associated risks and to set South Sudan on a Green Economy pathway.

2.1.1.3 Promotion of biogas

Biogas technology was introduced in South Sudan in 2001 through a UNICEF/OLS-supported Biogas Pilot Project at the Rumbek Secondary School. In February 2001, UNICEF/OLS engaged the services of a Kenyan based company known as Project Assessment Services (PAS) to identify an appropriate biogas system for South Sudan. PAS was also required to construct and demonstrate the working of the biogas plant at Rumbek Secondary School. The choices of biogas plants available for selection included the floating drum system (fairly common in neighbouring Kenya), the fixed dome system (not common in Kenya) and the Tubular Plastic Bio digester (TPB). The TPB system has not been tested in Kenya but some work had been done and documented by Preston in neighbouring Tanzania (BuiXuan

An et al 1997). PAS imported a 7m³ TPB unit from Vietnam to South Sudan with training material. 20 students and 2 Teachers of Rumbek Secondary School were trained, first on the theory of biogas and then on installation of the TPB. The team involved in this activity then became known as the Rumbek Secondary School Appropriate Technology Club (ATC). Under the supervision of the UNICEF consultant, the members of the ATC installed the TPB near one of the school kitchens. Subsequently, the team fed the digester with cow dung at the rate of 20 kg (1 bucket) per day. On the 25th day, the plant was tested by lighting the burner and the result was successful. This was the first ever practical experience with biogas technology in South Sudan. This TPB plant is today used as a biogas demonstration for the local community and visitors. It is also used to cook breakfast for 50 students. The ATC students and teachers operate and maintain the TPB plant on a daily basis. In 2002, UNICEF/OLS supported installation of 2 more 12.7m³ digesters at Rumbek School, (ie: phase 2 of the biogas project). The aim was to reduce firewood use for cooking in the School by up to 80%. Currently, the School uses about 50 tonnes of firewood per year to cook for 400 students. The target group for training in phase 2 of the biogas project were the cooking staff in the School.

The Biogas plant has performed satisfactorily for purposes of demonstrating that Biogas technology works.

A Biogas Technology Community Awareness workshop named "towards intensified use of Biogas in South Sudan" was held in Rumbek between 13 and 15 of February, 2002. The workshop objective was to gauge the level of acceptance of Biogas technology by the South Sudanese community taking Rumbek County as a microcosm. Participants were shown the TPB installation Video and conducted on a tour of the Pilot Plant at Rumbek School where the working of the plant, including the fertilizer use, was explained. Participants felt that biogas technology could:

- Considerably reduce expenditure on Kerosene and Charcoal for the war impoverished communities by using cow dung which is locally available
- Reduce the time spent by women to look for firewood in the forest and remove the common risk of snakebites while collecting firewood
- Improve soil fertility by adding organic matter from the digester for vegetable gardens and so enhance nutrition and improve household food security
- Create an opportunity for youth employment by imparting skill (biogas technology will be an employable skill once the technology is widely adopted by communities).
- Provide the communities with a clean non pollutant fuel for cooking and lighting and protect the environment by reducing tree cutting for firewood
- The general mood of the 3-day stakeholder participatory workshop pointed towards an enormous potential for adoption of the biogas technology in South Sudan.

The GOSS needs to plan to promote the use of institutional biogas in schools with hostels, prisons, hospitals and military barracks, as biogas digesters can also use human waste, apart from cow dung.

The Government would also need to look at how it can subsidize and promote the use of domestic biogas systems for households farmers with two cows and above as it has proven to work in some other countries like Rwanda and Nepal.

2.1.2 Access to electricity

The percentage of the population with access to electricity is very low, only about 1% of the population has access to grid electricity. Most of these consumers are in Juba the

capital city with the remaining few in Wau and Malakal. The total number of customers connected to the electricity network is 22,000 (includes 1,500 customers of NRECA/USAID). The remainder of the population does not have access to any modern sources of energy. They rely on firewood as their primary source of energy which impacts negatively on human health and the environment.

The few who are connected to the grid have to pay a high cost for the service at an average tariff of US\$ 0.22/kWh. The cost of power supplied is USD 0.70/kWh. The cost of household connection is around USD 500-600. Due to the extensive and prolonged outages, mainly due to lack of generation capacity which resulted from fuel shortages and lack of spare parts for generation plants, the quality of service and supply of electricity is low. Most large scale private companies resort to expensive self-generation or have stand - by generators. According to recent surveys, before austerity measures, 70% of businesses in South Sudan had their own diesel generators for power supply (today 100% of business use their own generators, until funds are available to run the SSEC power plants). The resulting high costs and productivity losses is a major hindrance to the growth of industrialization which is urgently needed to boost the fledgling economy.

After the independence of South Sudan, the emergency plan included the Rehabilitation of existing power plants of Juba, Wau and Malakal, Electrification plans of the other 4 state capitals which did not have electricity, Electrification of secondary towns, Establishing legal, institutional and regulatory framework and Capacity building and Training.

In 2005, National Rural Electrification Cooperative Association (NRECA) of USA was engaged by USAID to assist the Ministry of Energy and Mining develop a national electricity policy for Southern Sudan, construct a diesel generation and distribution system in Yei and establish an independent operating utility, and provide training. This role was extended in 2008 to include assisting in drafting of electricity act and establish other electricity systems in Maridi and Kapoeta.

The GOSS established Southern Sudan Electricity Corporation (SSEC) as a subsidiary of the Ministry of Energy and Mining (MED) and mandated it to be responsible for generation, transmission, distribution and sales of electrical energy to consumers in Juba, Malakal and Wau. It currently has approximately 22,000 domestic customers but no industrial or commercial consumers.

Electricity sector is fully subsidized by the GoSS. Electricity Utility (SSEC) works as a department of the Ministry of Electricity and Dams. Even the salaries of the staff are provided by the Ministry of Finance and Economic planning. Big consumers of electricity including the Government institutions, hospitals, military camps, airport, etc do not pay for electricity consumed. Revenues from electricity are very negligible and even the little collected is submitted to the Ministry of Finance and Economic Planning (80% of SSEC revenues).

Due to insufficient generation capacity the country knows black outs and load shedding especially in the capital city where the demand is growing fast. Since December 2012 up to now, all the power plants are shut down due to lack of fuel and spares parts. Until the austerity measures are lifted, probably by Dec 2013, there is no power supply in Juba. Currently, in many areas, investors must provide their own electricity, either via generators or through autonomous renewable energy systems such as solar panels.

Today, the share of renewable energy in the national power generation mix is null. All the generation capacity comes from diesel and HFO generators.

2.1.3 Modern energy for productive uses

With new development program that are expected in South Sudan after its independence, more modern energy for productive use will be required to run socio-economic development in rural areas. Currently there are a few water supply systems powered by solar in remote area.

2.1.3.1 Solar Powered water supply systems

Due to lack of clean water in the region, South Sudan has adopted solar-powered water pumping systems. One of the

known solar powered water supply project is the project to supply water to 55,000 people in the Akobo County, Jonglei state, in the north-eastern part of South Sudan, close to the Ethiopian border. The project was financed by the International Committee of the Red Cross (ICRC) to supply water to displaced people. Under the project, three water points were constructed and handed over to the Akobo county authorities. The solar-powered water systems pump approximately 90,000 litres of water every hour, guaranteeing the population a regular and ample supply of water. Backup generators have been provided to ensure production during the rainy season. The facilities are connected to a distribution network of 11 sites that supply 55,000 people.

In terms of availability of technologies for productive applications, one might mention that in addition to solar PV, micro wind farms can be developed for water pumping and irrigation in rural areas. Communities, NGOs and donors are able to mobilize the required financing for such solutions.

2.2 ENERGY EFFICIENCY vis-à-vis GOAL OF SE4ALL

So far there are no any known initiatives for energy saving in South Sudan. All the efforts of the Government are focused on power supply. However, the draft electricity policy prepared by the Ministry of Electricity and Dams, to be adopted by the cabinet, provides for energy efficiency and conservation programs.

In petroleum industry, exploration companies are flaring gas as they are only interested in oil and other by-products that are not commercially viable such as gas are flared into atmosphere. There is a need to collect that gas and use it for heating purpose as an energy efficiency measure for environmental protection.

2.3 RENEWABLE ENERGY vis-à-vis GOAL OF SE4ALL

South Sudan has high potential for renewable energies to generate electricity, including small-scale and large scale hydropower, solar photovoltaic, and wind, biomass, geothermal and waste-to-energy. However, there is no renewable energy power plant operational in South Sudan. All the generation plants are fuelled by diesel and HFO.

The GoSS, in its electricity policy and strategy has prioritized the use of indigenous energy resources for power production.

Fig. 1.10 Solar powered water supply systems in Akobo



2.3.1 Hydropower

South Sudan has vast untapped hydropower potential. The river Nile runs by Juba, and has the potential of 15000 MW from the Uganda border (Nimule), 170 km south of Juba. At the moment, there are about 2,105 MW of potential hydropower project sites under various stages of pre-feasibility and feasibility studies (mini hydro projects area included). The hydropower project can be developed step-wise to meet the growing demand, which will enable the government to have political freedom by reducing general electricity subsidies but still have room for a poverty focus.

The following hydro power projects are in pipeline:

Short term projects

1. Fula 40 MW Hydropower Project: the feasibility study is completed, Environmental Impact assessment study is completed and the project expected time for completion is 2.5 - 3 years. The project is financially supported by the Norwegian Government. It will cost around 150\$ million and 75% of the costs will be met by Norfund, a Norwegian agency with the South Sudan government meeting 25%. The public- private partnership will also have Norfund manage the whole process with South Sudan government set to get a finished product.
2. Upgrading of Kinyeti 2MW mini hydro power Project: Feasibility study completed, the GoSS is sourcing for Finance for construction and commissioning.
3. Sue River 15 MW mini Hydro power Project: Feasibility study completed, the GoSS is sourcing for Finance for construction and commissioning.

Long - term Projects

1. Bedden 540 MW Hydropower Project: The Biden Hydropower Station is located on River Bahr al-Jabal, a section of the Nile River between Nimule and Juba, Central Equatorial State, South Sudan, 30 kilometres away from Juba, the country's capital. Feasibility study completed, Environmental Impact assessment completed and the project expected time for completion is 80 months. It will cost around \$1.5bn and the Chinese Government agreed in principle to fund it. On January 20th, 2013, CGGC and the Ministry of Electricity and Dams of South Sudan signed an EPC contract in Beijing for the Project. The project is expected to fundamentally remove the power supply bottleneck in South Sudan after completion.
2. Lakki 410 MW Hydropower: it is located 77 km downstream of Uganda border. Feasibility study completed, Environmental Impact assessment completed. The project's expected time for completion is 5 - 7 years.
3. Shukoli 230 MW hydropower project: it is located 46 km downstream of Uganda border at the upstream end of the Yeroba Rapids. Feasibility study completed, Environmental Impact assessment completed. The project's expected time for completion is 5 - 7 years.
4. Grand Fula 890 MW Hydropower Project: Feasibility study completed, Environmental Impact assessment completed and the project's expected time for completion 8 - 12 years.

It is also important to highlight that an additional 16 mini hydro power sites have already been identified and detailed feasibility and design works have been completed for eight small hydroelectric power plants ranging from 3 to 11 MW of installed capacity.

2.3.2 Solar

As part of rural electrification, it is planned to develop large-scale solar thermal and small-scale solar photovoltaic power generation, given South Sudan's access to an average of more than 10 hours of sunshine per day year round, with radiation on the horizontal surface of about 5 - 6 kWh/m²/day. The main barriers to solar energy in South Sudan are the initial and running costs of the technology, according to the South Sudan-American Friendship and Trade Association.

One of the famous projects in off-grid solar systems is the IndiGo pay-as-you-go solar project in Nimule. Eight19 has partnered with WorldVenture, an international charitable organisation, to deploy the solar systems in rural villages in the region of Nimule in South Sudan. Eight19 deployed around 1000 units to the region. The IndiGo units, which consist of a battery, a solar panel, lights and a phone charging device, have brought clean, affordable and renewable power to off-grid communities in South Sudan. Go Solar Energy Ltd based in Juba is doing private installations of solar panels.

The Government of the Republic of South Sudan is already using solar street lighting in Juba and is planning to expand this program in other cities.

With support of UNDP, the Government has installed solar PV in some of the police stations in rural areas.

As discussed in the previous chapter, solar PV is used for water pumping in three locations to supply water to displaced people in Akobo.

There is a pressing need for off-grid power in South Sudan, where people even burn grass for lighting despite the smoke health hazard and fire risk. They are just so desperate for an affordable way to have light at night. Solar lighting technologies (solar lanterns, solar home and institutional systems) have been successfully implemented in many rural areas in Africa and must be introduced in South Sudan as a fast, economical and scalable way to provide efficient lighting to many rural households. These Solar lanterns cost around USD 40 to 60 and the payback time would be less than one year and provide other benefits such as cell phone charging, powering radio, etc. Some surveys indicated that the cost of lighting in Sub-Saharan Africa has been estimated to be between USD 50 and USD 80 per household per year.

2.3.4 Wind

The annual average wind velocity in South Sudan is about 2.5 m/s in South Sudan. This wind regime is not attractive for investments compared to standard wind velocity of 5 m/s to develop large scale wind farms, but one can develop small wind turbines which are promising device for electricity generation and pumping water in South Sudan. Small wind turbines can be used to supply residents with electricity and mechanical power in rural area. Electricity is used to supply homes, telecommunications, and refrigeration. Mechanical power is used for pumping water and irrigation for small farms.

2.3.5 Geothermal

Given its geographical location, South Sudan has abundant geothermal resources but there are no studies conducted on the identified sites in South Sudan. The country has shown an interest in partnering with Kenya's Geothermal Development Company (GDC) to assist it in exploring and developing its own geothermal energy resources. Three potential sites have been identified for further development with support from GDC. GDC would undertake surface exploration studies. Geothermal Exploration and Development has been prioritized in the 5 year action plan of the Ministry of Electricity and Dams.

2.3.6 Biomass

Biomass is the most renewable energy used in South Sudan. Wood fuel and charcoal are the conventional sources of energy for most people in South Sudan. Other unprocessed biomass fuels, such as dung and crop residues are the main sources fuel for daily cooking and heating, especially in rural households. Wood resources are essentially considered "free resources" that can be used without limitation in South Sudan and this has led to the depletion of forests and created an urgent need for large-scale use of efficient stoves and better demand-side management of wood energy. The total forests area is estimated to be 75 million hectare while animal waste in the form of dung is estimated to be 4.5 million tonnes per year in South Sudan. Biomass has not yet been used for electricity generation in South Sudan though the potential is there.

Summarized problem Statement

One of the major problems that hinder the socio-economic development of South Sudan is lack of access to modern energy services, including electricity and clean fuel and cooking facilities. South Sudan remains the energy poorest country in the world. There is no initiative known in energy efficiency in this country. Apart from solar PV used in remote area for water pumping, lighting a few police stations and street lighting in Juba, the use of renewable energy is null despite the abundance of renewable energy resources.

2.4 NATIONAL SE4ALL GOALS

South Sudan National goals and objective in regards to Sustainable Energy for All: Provision of Quality, reliable and cost effective energy services available to industry and to the whole population throughout the country. The power sector development action plan has six key components for the decade ahead: (i) to meet existing and projected demand for power, undertake a major program of expansion in generation capacity from the current 30 MW (22 MW available) to about 580 MW by 2025; (ii) extend the national transmission and distribution grid to link all ten state capitals and link the South Sudan grid to those of Ethiopia, Kenya and Uganda; (iii) expand access to electricity to provide 75% of urban households with access to electricity from the national grid by 2025, compared with only 1% at present; (iv) complete a major restructuring of SSEC to convert it into a fully-fledged, and financially sound, state enterprise that has the capacity to enter into take or pay contracts with private suppliers of electric power; (v) strengthen the enabling environment for private investment in power generation and attract private investors to operate as independent power producers (IPPs) within South Sudan; and (vi) strengthen the existing regulatory arrangement for the electricity sector. The electricity consumption will also increase from the current 25 kWh to about 140 kWh per capita per year by 2020. The total cost for the proposed program for electricity and rural energy

during 2011-2020 is USD 2.480 billion. The assumption being that 870 million will be mobilized from the private sector for the expansion of generation capacity, with the Government and donors providing the balance of the required funds.

In medium term, the GOSS outlined a USD 700 million energy investment plan 2013-2016 in the SSDP. The sector plan focuses on grid-based expansion to 48,000 customers (all 10 state capitals will be electrified), investment in expansion of thermal generation capacity to 96 MW, as well as the expansion of distribution networks. SSDP also describes plans to import 140 MW power from Sudan via a 220 kV interconnector line. It is important to note that the initially designed 2010-2013 SSDP was pushed to 2016 since it has not been able to implement it mainly due to oil shutdown and the aftermath consequences.

Section 3: Challenges and opportunities for achieving SE4ALL goals

3.1 INSTITUTIONAL AND POLICY FRAMEWORK

3.1.1 Energy and Development

Energy will serve as a prime mover of socio-economic development of the Republic of South Sudan.

3.1.1.1 Vision 2040

The South Sudan Vision 2040 is motivated by collective aspiration for a better society by the year 2040. The aspiration is “Towards Freedom, Equality, Justice, Peace and Prosperity for all” and the Guiding Principles and Values include Democracy, Rule of Law; Socio-Economic Development; and International Relations. These are well articulated in the vision, mission and core values of the strategic plan as well as the subsequent thematic/priority areas of the plan. This Vision shall guide the energy sector strategic thinking and policy-making processes in South Sudan. It will form the rallying point around which all the people of South Sudan can unite and collectively contribute to the ultimate achievement of their better life.

3.1.1.2 South Sudan National Development Plan 2013-2016

This is a medium term framework for poverty reduction and economic development of South Sudan towards achieving its vision 2040. It sets targets for socio-economic development. Energy related targets were outlined in the Economic Development Pillar, which was one of four key pillars of the SSDP. It calls for an ambitious investment program of USD 700 million for the energy sector aimed at more than doubling the number of customers and tripling the total installed generation capacity of the country by 2016. The SSDP also calls for electrification of all 10 state capitals, expansion of the local distribution networks, and installation of the regional interconnections. Top priorities of SSDP include: (a) peace-building and actions that enhances security, (b) improving and expanding social services, and (c) rural development built on infrastructure expansion. These are the priorities most consistently highlighted in consultations with the states and they directly and sustainably improve the lives of people throughout South Sudan.

It is important to note that this SSDP was drafted in 2010 for 2010-2013 but later on conducted to 2013-2016 due to unavailability of funds for implementation.

3.1.1.2 Other energy related policies

Agriculture policy

The agriculture policy provides for an increase of cultivatable area by 50% to 4 million hectares by 2020. This will be equivalent to about 6.2% of the total area of the country. The harvested area would be increased from about 37% of the cultivated area at present to about 63% by 2020 and irrigated area would increase from 1% of the cultivated area to about 10% by 2020. This agriculture programme would require intensive energy.

Forestry policy

The policy aims at ensuring a sufficient and sustained forest resource base and flow of forest goods and services to support livelihoods and socio-economic development for the present generation without compromising this endowment for future generations. This policy is based on guiding principles aimed at developing a forward-looking and vibrant forest sector in South Sudan:

- (i) The policy must be consistent with provisions of the 2011 Transitional Constitution of South Sudan;
- (ii) The commercial, community, and conservation values of forests and tree resources are all equally important to South Sudan;
- (iii) All forests and tree resources of South Sudan will be managed sustainably, equitably, and in an integrated manner to ensure benefits to present and future generations;
- (iv) Permanent forest estates will be established and managed to ensure conservation of biodiversity and a steady flow of benefits;
- (v) Forests and tree resources will be managed in accordance with established criteria and indicators for sustainable forest management;
- (vi) Appropriate policies, legislation, and institutional reforms will be adopted and implemented to support rapid growth of the forest sector;
- (vii) Industrial and other plantations will be sustainably management to meet the growing wood demands;
- (viii) There will be increased participation and benefits for communities in forest management through collaborative management schemes;
- (ix) Partnerships are essential to enhance efficiency, transparency, accountability, and professionalism, and to build confidence and trust among forest stakeholders;
- (x) Tree-based industrial development (forest products processing) will be promoted and supported to increase economic benefits from forest resources;
- (xi) Forestry institutions and services will be strengthened to increase productivity, achieve household food security, alleviate poverty, and contribute to the macro-economy of South Sudan;
- (xii) There will be sustained commitment to regional and international forest-related agreements and conventions; and
- (xiii) Management of forests and tree resources will be guided by best knowledge, information, and practices.

Whether the Government likes it or not, South Sudan will continue relying on biomass for cooking and therefore one of the important strategic actions is to plant more biomass and increase the forestry coverage.

Environmental policy

South Sudan's energy resources include wood fuel, hydropower, natural gas and oil. Their improper exploitation and use may cause undesired effects on the environment. This during the construction of hydroelectricity plants may include the displacement of local people from their ancestral lands; diversion of water courses and changes in the level and pattern of water flow, with consequent changes in aquatic biodiversity and erosion of river banks. Combustion of fossil fuels produces carbon dioxide which is one of the leading greenhouse gases (GHG) contributing to global warming. Further, the absence of a reliable and renewable energy source from e.g. hydroelectric plants or dams on the River Nile has compelled most South Sudanese to use electric generators. It is estimated that, Juba Town currently has between 5,000 - 10,000 small to medium generators with 21 varying output performances or power and being used at the household level and public institutions. The amount of carbon dioxide emission may be close to 20-80 tons per annum. Moreover, the ensuing noise from the powered generators and from the noxious fumes produced can lead to mental and emotional stress as well as respiratory disorders.

The environmental policy provides guidance as follows: (1) Compensate people who traditionally have either lived permanently or seasonally transited through areas where concessions have been given for hydrocarbon, mineral exploitation or hydropower explorations; (2) Promote research in and the use of renewable and alternative sources of energy (*wind, solar, biogas, biofuels and hydropower*); (3) Ensure the conduction of a comprehensive Environmental Impact Assessment (EIA) prior to any project execution, clearly focusing on the negative impacts, their mitigation, management and remediation.

(4) Promote in all production sectors, technologies and processes that use energy sources efficiently and sustainably; (5) Ensure that electricity is accessible and affordable to reduce dependency on biomass (fuel wood and charcoal); (6) Reduce carbon emissions into the environment (*air, water and soil*) and promote the use of high-performance, low-noise, low-fuel consuming electric generators; (7) Set adequate provisions for restoration and rehabilitation of all areas affected or the landscape disfigured by mineral extraction operations and quarrying activities; (8) Protect river banks through the construction of embankments and avoid sand harvesting close to the banks and in vegetated watershed areas.

Communication policy

The policy provides for development of a national communications grid for ICT based on a fibre optic network linked to the submarine cable now in operation along the eastern seaboard of Africa. Low density rural communities would benefit from the network through the design and implementation of a policy of universal access for the country. Communications sector has six key objectives: (i) establish access to the global communication network of submarine cables; (ii) build a national fibre optic broadband network that is linked to the global network; (iii) improve and expand access to communications throughout South Sudan, including rural communities by implementing a policy of universal access; (iv) promote competition among service providers to ensure that costs of service delivery are not inflated; (v) consolidate arrangements for regulation and oversight of the industry; and (vi) expand the range of e-applications that are available to the population at large and to educational and other institutions throughout the country. Almost half of the population would have access to voice communications by 2020 from the current 12%. And 60-70% of educational, health and government institutions would have access to ICT services by 2020.

Transportation policy

There is an urgent need to improve connectivity and in so doing improve access to basic services throughout the country as support to integration of domestic markets. A high priority is therefore given by the GoSS to development of basic infrastructure, especially road networks, to improve this connectivity and provide enhanced support for agricultural development throughout the country. Based on the SSDP the Government attaches high priority to the rehabilitation and upgrade of the road network of the country. Upgrade and improvement of basic infrastructure for other modes of transport, including in particular water transport and associated port facilities on the Nile River and navigable tributaries, and civil aviation services for domestic and international air traffic with particular attention to upgrading the status of air traffic communications and safety in South Sudan to a standard consistency of the International Civil Aviation Organization (ICAO). These initiatives would be complemented by further investigation of the costs and benefits associated with the expansion of the existing railway network to link South Sudan to Uganda and Kenya, and the possible construction of a pipeline for the transport of oil to an international port in Kenya or Djibouti. Weak transportation infrastructure impedes movement of equipment and labour, especially that South Sudan is a landlocked area.

Transportation policy would take into account the energy efficiency in the transport sector.

Water Supply policy

Water supply policy provides for the following main three sets of activities: (i) rehabilitation of the very large number of rural water points that are not functional at the present time, and construction of about 11,000 new water points to provide 65% of rural population with access to improved water by 2020; (ii) rehabilitation and construction of new urban water supply facilities sufficient to ensure that 70% of the urban population have access to improved water by 2020 from the current 15% today; and (iii) early implementation of a major programme of technical support and training that will strengthen capacities at the national, state and county levels for provision of water services. Water supply systems are one of the main energy consumers.

Sanitation policy

Sanitation policy calls for the following interventions: (i) rehabilitation of a majority of the existing urban and rural sanitation facilities; (ii) construction of new facilities in urban and rural areas sufficient to provide 60% of urban households and 40% of rural households with access to improved sanitation by 2020, thereby raising the national average from the current 14% to 45% by 2020; (iii) implementation of a series of reforms that will strengthen coordination and implementation of sanitation programs and expand funding for these programs; (iv) provide improved sanitation facilities for all health centres and schools; and (v) develop hygiene education programs for urban and rural communities and introduce similar programs into schools curricula. Sanitation facilities will need energy to operate and a good sanitation policy provides room for generation of biogas from waste (waste to energy)

Housing policy

One of the challenges in South Sudan is the scattered population. The grid systems will be difficult or costly to be implemented. Another question is if the households can afford the connection, the houses themselves are not energy efficient friendly.

3.1.2 Energy Governance in the Republic of South Sudan

Institutions in charge of energy sector within the context of economic and social development in the country include:

1. **The Office of the President** that gives the supreme guidance
2. **The Ministry of Finance and Economic Development** in charge of micro economic planning of the Government. The same ministry also provides financing to the energy sector institutions.
3. **The Ministry of Petroleum and Mining:** it governs the oil and gas sectors, both upstream and downstream activities. Composed of 4 directorates, in charge of (1) implementing the policies established by the Commission on petroleum respecting the management and development of the petroleum sector, guided by the Petroleum act (2) negotiate petroleum agreements in accordance with the Act,(3) Sign, manage and, if applicable, terminate the petroleum agreements on behalf of the Government after approval by the Petroleum Commission,(4) Manage petroleum resources on behalf of the Government, (5) Manage the relations of the Government with petroleum companies operating in the country, (6) Develop the necessary technical capacity and competence of personnel involved in petroleum activities,(7) Provide technical expertise and support to the Commission, (8) Initiate legislation and make rules and regulations respecting the development and management of the petroleum sector pursuant o section 99 of the Act, (9) Provide for the transportation, processing, refining and distribution, including the relevant infrastructure relating to these activities and provide for the marketing and selling of Government entitlement of crude oil and its derivatives.
4. **The Ministry of Electricity and Dam** that handles the power sector business in generation, transmission and distribution. It also handles dams for irrigation. The same ministry acts as a regulatory body in the power sector.
5. **The Ministry of Commerce** that is in charge of trade and investment in the energy sector. The trade of oil products such as diesel, petrol, HFO, LPG, etc. is regulated by the Ministry of commerce. The Department of investment Promotion in the country that would attract investors in the energy belongs to the Ministry of Commerce.
6. **Ministry of Agriculture and Forestry, cooperatives and rural development** is involved in the biomass sector. It has planned to increase the forestry coverage for sustainability of biomass energy supply. It also has planned for rural development in terms of agriculture and energy for production.
7. **Ministry of Water and Irrigation:** the Ministry of Water Resources and Irrigation (MWRI) was created in October 2005. MWRI mandate includes safeguarding and conserving of fresh water systems; carrying out and supervision of hydrological studies; flood control and irrigation works; and ensuring provision of safe water and improved sanitation. Its Vision is sustainable harnessing and accountable for management of water resources that respond to water related public-health needs, livelihoods and development aspirations in an equitable manner. Its Mission is drawing up of policies, standards, guidelines and plans for water resources management, development and utilization; and provision of improved sanitation and hygiene services.

3.1.3 Thermal energy for households

Relevant policies, strategies and plans and institutional framework

There are no specific policies for energy for cooking and heating in South Sudan. There is no institution in charge of biomass as source of energy. All the initiatives in biomass subsector including the efficient use of biomass like promotion of improved cook stoves, improved charcoal production methods, etc are not coordinated by any Government institution today. There are no policies and plans on alternative fuel other than biomass such as the use of LPG, biogas, briquettes, etc, and there is no institution in charge.

Forestry policy has been elaborated by the Ministry of Agriculture, Forestry, Cooperatives and Rural Development. Forestry is not dealt with as sources of energy but rather as an ecological stability tool in supporting agricultural productivity and thereby contributing significantly to food security and to poverty alleviation among rural communities.

3.1.4 Power sector

3.1.4.1 Policies, Plans, laws and Regulations

Draft South Sudan National Electricity Policy

The draft national electricity policy has been prepared by the Ministry of Electricity and Dams and will soon be approved by the cabinet.

As per the draft policy, the following are the main policies and strategies that will guide the development of electricity in the Republic of South Sudan:

- i) The power sector in South Sudan shall consist of a mix of public and private sector service providers that engage in electricity generation, transmission, and distribution enterprises.
- ii) Encouraging development of electricity through renewable power sources e.g. hydro, wind, biomass, solar and geothermal.
- iii) Construction of hydro power plants and dams to supply cheap, reliable and sustainable electricity to meet domestic, commercial and industrial demands in South Sudan.
- iv) Construction of electricity transmission grid to supply electricity to targeted parts of South Sudan.
- v) Put in place policies for attraction of independent power producers (IPPs) for the development of the electricity supply sector.
- vi) Encourage local and foreign investors to invest in the field of electricity generation and supply through private- public- partnership (PPP) investment.
- vii) Seek loans from foreign sources for the development of electricity sector in South Sudan
- viii) Development of human resources working in the electricity sector with a view to achieving efficiency in the delivery of electricity in South Sudan

Draft Electricity Sector Strategic plan

Electricity Sector Strategic plan has also been formulated by the Ministry of Electricity to implement the policy but it is not yet approved by the cabinet.

Draft Electricity bill

The draft electricity bill has been prepared by the Ministry of Electricity and Dams and approved by the Ministry of Justice. It needs to be approved by the cabinet before it is submitted to the parliament for adoption.

Electricity Regulations

A draft Electricity Licensing Regulations document has been prepared by the Ministry of Electricity and Dams and has to be approved and signed for enforcement of the electricity bill once adopted. There are no any other regulations developed yet

3.1.4.2 National Institutions involved in Power Sector

The Ministry of Electricity and Dams (MED)

This Ministry was established after the South Sudan became an independent nation on the 9th July 2011. Its main mandate is the generation, transmission, distribution and oversight of the electricity services. The same ministry also serves as a Regulatory Body whose role is to balance the interests of the service providers and the consumers, and to ensure that all parties abide by established rules through implementation of performance standards, tariff setting etc. The Functions of the Ministry include the following:

- Development of sector policies for:
 - Hydropower Development
 - Geothermal exploration and development
 - Thermal power development
 - Solar, wind, and bio-mass development.
- Development of programs for Rural Electrification.
- Promotion of energy efficiency and conservation
- Mobilization of requisite financial resources for generation and distribution expansion, operation and maintenance of these facilities;
- Security of electricity supply through diversification of sources and mixes in a cost effective manner;
- Completion of the legal, regulatory and institutional frameworks to create both consumer and investor confidence;
- Enhancing and achieving economic competitiveness and efficiency in energy production, supply and delivery;
- Promotion of the development of power plants through public private partnership (PPP) interventions;
- Overseeing the organizational, technical and managerial capability of South Sudan Electricity Corporation (SSEC);
- Provision of training to SSEC technical staff in operation and maintenance of power plants and distribution networks.
- Implementation of major projects in transmission (anything above 33 kV) and other large hydropower and regional integration projects.

Annex 2 gives the structure of the Ministry of Electricity and Dams (MED)

South Sudan Electricity Corporation (SSEC)

SSEC is a semi-autonomous national electricity utility. However, at the moment, it functions as a unit of the Ministry of Electricity and Dams with all its expenditures and revenues being part of overall government annual budget. The utility is involved in generation, distribution and sale of electricity and revenue collections.

State Electricity Distribution Companies (SEDC)

The existing state electricity distribution companies (in Yei, Maridi, Kapoeta, etc) will continue to manage and operate the local electricity power distribution services (as rural electricity cooperatives).

Ministry of Finance and Economic Planning

The Ministry of finance plays a crucial role in the power sector development as it finances both the operating costs and investments in the new projects.

Ministry of Petroleum and Mining

The Ministry of Petroleum and Mining is involved in supplying petroleum products or fuel for power generation as well as in the upstream oil exploration activities

3.1.5 Modern energy for productive use

South Sudan, being a new nation has no policies and strategies to develop modern energy for productive uses. There is no active Government institution involved in coordination of the on-going initiatives. The Ministry of Electricity and Dams and other specific Ministries such as the Ministry in charge of agriculture and rural development, Ministry of Water and irrigation and development of small and medium enterprises, etc, need to elaborate related programs and policies in a harmonised way.

3.1.6 National Monitoring framework for Sustainable Energy for All

There are no clear monitoring systems for the implementation of energy policies. The involved partners in SE4All will need to design a monitoring framework once a clear national program and action plan has been set. The Ministries and implementing agencies will need to create data management systems and recruit and train the staff on the management of these information systems as well their functioning.

3.2 PROGRAMS AND FINANCING

As a country that is coming out of the war, there are no specific programs in increasing access to modern energy for cooking and heating or for productive use in South Sudan. There is need to develop these as the country develops.

The programs and projects indicated for power generation, transmission and distribution will be financed through the approved government budget and the private sector. The SSDP energy investments call for USD 700 million worth of new projects and financing for these projects has not yet been secured. It is anticipated that a portion of this investment will come from bilateral and multilateral donors as grants. However, the Government will also need to raise its own funds in order to fully finance the plan. The possible financing sources could be Multilateral Development Banks such as the World Bank, AfDB,

Commercial investment banks and the private sector. The GOSS will consider alternative strategies for resources mobilization, which will include but not limited to:

- Engagement with current and potential development partners such as Norfund, World Bank, AfDB and Multi Donor Trust Fund (MDTF) etc. with view to secure financing for our electricity generation and distribution programs and projects. Bilateral cooperation with both South-South Cooperation and South-North Cooperation will be encouraged. The example of South Sudan-Egypt cooperation was a good one.
- Given the context of South Sudan, much of the financing is expected to be raised via donors or concessional financing. Typical terms for concessional loans are 0.75% charge on a 40 year loan with 10 year grace period (World Bank International Development Agency, IDA terms). Commercial loans can be as high as 6% interest with 10 year repayment schedule.
- Encouraging the private sector participation through Public - Private Partnerships (PPPs) strategies and mechanisms;
- Enhanced networking and collaboration with non-state civil society organizations and communities;

The electricity utility, SSEC, should be able to finance part of its operations (power plants, transmission and distribution, commercial, etc) from its generated revenues from sales in short term and plan to implement cost recovery tariffs in the long run once the hydro projects are operational. It is recognized that the production cost is very high today due to the price of diesel and HFO that are burnt for power production.

Annex1 indicates the projects and their sources of financing.

3.3 PRIVATE INVESTMENT AND ENABLING BUSINESS ENVIRONMENT

Today there are no private companies involved in the power sector and in modern energy for productive use in South Sudan. Lack of clear legal and regulatory frameworks discourages the investors in the energy sector. The electricity bill and licensing regulations provides for the Ministry to regulate the sector and this distorts the electricity market as the policy maker should not be the regulatory body in the liberalized market.

In the current legal and regulatory arrangement, the following are the powers and Functions of the Minister:

1. To receive, process, and decide upon applications for licenses, including imposition of license conditions, regarding activities and installations subject to licensing pursuant to Electricity Bill;
2. To suspend, revoke, and renew licenses, and consent to the transfer of a license;
3. To grant, modify, suspend, or revoke exemptions from the obligation to hold a license;
4. To give directions of compliance; and
5. To impose sanctions and penalties.

An independent electricity regulatory body should be put in place to perform the above mentioned duties if the private investors have to participate in the sector. Effective separation of policy and regulatory functions implies that regulators should be independent from operators when they regulate. The draft electricity bill provides for such a separation and creation of an independent regulator.

The electricity bill is to be approved by the cabinet and parliament. In the absence of electricity bill (act), it is difficult for the GoSS to develop the sector and attract private investors.

There is still lack of legal and regulatory framework for the energy sector to function properly. Regulations such as feed-in-tariffs could be a great way for the GoSS to attract private investment in RE generation projects. Power Purchase agreements are also essential in attracting investors. These regulations should ensure commercial returns for private participants. A stable fiscal regime that provides incentives to investors is also important in attracting private financing. Private investors also want to see stable political and legal systems that ensure their property cannot be expropriated by change in laws.

There is interest in the international private sector to provide thermal power plant. By the time of this study, the MED had just signed a Memorandum of Understanding with Hyundai Heavy Industries, a Korean company in partnership with Octant Capital Africa (U), with an aim to build, own and operate a 50 MW thermal power plant and sell the whole energy output to SSEC.

Otherwise, the only private actors involved in the energy sector are charcoal producers who sell charcoal in Juba and in secondary towns. There are also producers of improved cook stoves. A program to organize the market of charcoal and improved stoves should be put in place. Associations of charcoal and improved cook stoves producers should be created and assisted by the Government.

3.4 GAPS AND BARRIERS

Though gaps are also described in the text, a summary of these is presented below.

3.4.1 Thermal energy for households

- Biomass is the main source of energy in most of households in South Sudan, counting 90%, but the biomass sector is neglected. There is no institution in charge of Biomass as source of energy. No Ministry in charge of policies and strategies on the use of biomass for cooking, brick and tiles burning and production of heat in general.
- The overall coordination of the activities in this subsector is lacking. There is no Government institution coordinating the programs of efficient use of biomass such as promotion of improved cook stoves, improved charcoal production methods. The Government should create a department in charge of biomass energy.
- The Ministry of Agriculture and Forestry handles forestry programs of the country for ecological purpose but does not handle biomass as a source of energy.
- There are no biomass energy policy, strategy and laws and regulations in place. These need to be developed.
- Regulations on wood resources harvesting are not in place.
- Charcoal production chain is not organized and the market is not regulated
- Private sector is not motivated to invest in wood plantation as a source of income.

In terms of **Alternatives to biomass fuel**, there are *no clear programs for the use of improved cook stoves, biogas and LPGs*.

The following are the main barriers for the widespread national use of LPG:

- The relatively large initial investment needed to acquire LPG appliances (cylinders and stoves);
- The higher price of LPG compared to wood fuel prices in parts of the country;
- The lack of infrastructure for LPG distribution;
- A general lack of information;
- Social and cultural issues

Major challenges and opportunities for the use of biogas as an alternative cooking fuel to wood fuel:

- South Sudanese own large herds of cattle that are grazed in open fields and kept overnight at cattle camps. It is possible to collect several tons of cow dung from one cattle camp every morning. However during the dry season, cattle camps are moved far from the towns and villages in search of pasture and water. There could be a shortage of cow dung for biogas during such times. Currently, this problem is being addressed by introducing the use of ox carts to transport dung from cattle camps to biogas plants.
- Water is a scarce resource in South Sudan. Currently, biogas plants are located where UNICEF-OLS has provided drilled or dug water points.
- The biggest challenge for the TPB technology is the local availability of the plastic tube and burners. These are currently imported from Vietnam and Cambodia. Efforts are being made to identify a manufacturer for the plastic tube and burners in Nairobi, Kenya. Local availability of the tubular plastic will further reduce the cost of the TPB and so make the technology affordable to households in South Sudan. The lightweight materials of the TPB will be easily and cheaply transportable by road (from Uganda or Kenya) or by air as opposed to large gas tanks of the floating drum biogas type. Hence business people in local shops can easily stock the TPB materials. Ease of installation and low specialized skill demand is an added advantage of the TPB vis-a-vis other common biogas plant types.
- The Government may however want to introduce the masonry digesters and use the locally available materials like cement, bricks and stones. Study tours could be arranged to neighboring countries to learn how the technology works
- Apart from the UNICEF/OLS project, there is no Government Programs on institutional and domestic biogas.

3.4.2 Power Sector challenges

1. As discussed earlier, the main challenge of the whole economy and social wellbeing in South Sudan is the limited or lack of access to electricity. Today only 1% of the population has access to electricity, which is even unreliable.

2. Lack of power generation capacity: Over the last ten months, there has been no generation at all due to lack of fuel (no budget for fuel import due to austerity measures as a result of the shutdown of crude oil supply to Sudan) and lack of spare parts to maintain the generators. When South Sudan became independent, Khartoum decided to block the supply of fuel to South Sudan. It is difficult to get enough fuel through import because of lack of hard currency. In addition, Kenya can only supply limited amounts of fuel that would not adversely affect its internal fuel supply. This has been and remains a great challenge to the establishment of industries in South Sudan. However, the first refinery will soon be commissioned.

3. High electricity prices mainly due to Diesel and HFO fuel based production is also a challenge for the country that is required to highly subsidize the end user tariff. This would be overcome by bringing on board new cheap generation fuel like hydro and domestic crude oil.
4. The main gap and barrier is the lack of sound legal and regulatory framework to attract private investments in the power sector. The lack of legal framework can make the country as a 'haven' for foreign investors, without giving benefits back. There is an increasing interest in hydropower development by the private sector. South Sudan needs to establish a stable legal framework. Advice to the South Sudanese government in this regard would be that it should strive for the legal protection of both its own interest as a state as well as of the interest of the local population.
5. Lack of Human Resources capacity across all the institutions. Given its historical background, the country still lacks capable technical people (engineers and technicians), managers and support staff with sufficient know how. The MED and SSEC have recruited some senior technical personnel from the former Sudanese electricity corporation into managerial positions; however, the austerity regime which is in force has made them unable to recruit more qualified personnel, which in turn has limited their capacity to carry out their work in a satisfactory manner.
6. A comprehensive capacity building master plan in the energy sector should be carried out starting from the public sector but later the private sector should also be tackled. There is an urgent need to develop a pool of skilled personnel in Government and private sector for management, operation and maintenance of electricity utilities in South Sudan. Technical assistance may be transitionally outsourced as the local capacity is being built. There is need to have a strong team that will be able to provide advice on negotiation of deals with the private sector that is coming in the energy sector.
7. Lack of funding for power projects is equally a major challenge to investment. Private sector and more donors should be approached with bankable project proposals for financing. Long term concessional loans will be encouraged based on IMF borrowing conditions for South Sudan.
8. Lack of legal frameworks regarding land rights and water resources are hindering the development of hydro projects.
9. Lack of a sound Public-Private Partnership (PPP) policy and law, and specific policies and regulations for private concessions in electricity.
10. There is a need to establish an Independent Electricity Regulatory Body and discharge regulatory role from the Ministry of Electricity and Dams. This would increase the confidence of the private sector to invest in generation projects. Currently, the Ministry of Electricity and Dam serves as a Regulatory Body for the electricity sector. There is a conflict of interest for the policy maker and implementer of the policy to act as a regulator of the sector and this discourage private investors.
11. It has been observed elsewhere that investing in a post-war country includes high-risk factors, and these are the concerns of the investors. This needs a clear plan of incentives to attract investors but also a strong negotiating team on the side of the GoSS who know the industry better.

12. In terms of increasing access to electricity in rural areas of South Sudan, the scattered population happens to be an important barrier. The universal access may not be met if the settlement or housing policy is not developed and the population is not encouraged to live in grouped settlement/villages. The grid systems will be difficult and costly.

13. In terms of Governance, the structure of the Ministry should be simplified to avoid long level of bureaucracy in decision making. Some of the roles and responsibilities can also be transferred to the implementing institutions. For example the department of engineering and grid operations can be merged with SSEC.

14. The GoSS will need to strengthen SSEC capacity to execute its mandate of generation and transmission grid development

15. The draft policy provides for the establishment of the Rural Electrification Management Committee and Rural Electrification Fund (REF) to support rural electrification including the state capitals and market towns. The approval process needs to be speeded up so that these can be operationalized.

16. The electricity utility is not financially sustainable and it is not a credit worthy utility that would be able to enter into Power Purchase Agreements (PPAs) with potential Independent Power Producers (IPPs). Government fully subsidizes the power sector. There is a need for the Government to create a real Electricity Utility and strengthen it financially and technically.

17. A deep diagnostic of the sector issues has not been carried out and there is no formal long term master plan for the sector (and associated resource mapping and feasibility studies).

3.4.3 Modern Energy for productive use sectors

There is no known program for promotion of modern energy for productive use in South Sudan. South Sudan has great potential for development of energy consuming nodes in rural areas such as agro-processing, carpentry, hair salons and other SMEs in rural areas. It is recommended that during the design of an electricity access scale up rollout program for the country, an accompanying program on productive use of power be elaborated.

It is not clear which ministry is in charge of such a program but the Ministry of Agriculture, forestry, cooperatives and rural development would be in charge, in consultations with the MED.

3.5 SUMMARY OF RECOMMENDATIONS

3.5.1 Recommendations with regard to Energy access

Power sector

- 1) The GoSS should feel that the country is in energy crisis situation and plan for emergency solutions including supplying fuel and spare parts for the existing power plants but also expanding thermal power plants in short term, while planning for long term least cost generation projects.
- 2) It is recommended that the GoSS take a holistic and long term perspective for energy sector development in order to reform and modernize the sector in a cost-effective manner. The GoSS should be vigilant in signing binding agreements with IPPs and make sure the deals are well negotiated. Technical assistance in transaction advisory services should be sought to avoid conflicts in the future. The same attention should be paid to the current EPC contractors who bring in funds from Exim Banks, as they may impose unnecessary high cost of construction that may affect the financial sustainability of the sector.
- 3) Institutional arrangement should be fine-tuned, the responsibilities of the Ministry that are related to grid planning and operations should be given to SSEC and the utility should be strengthened to deliver on its mandate.
- 4) Government need to assist SSEC collect revenues for its operations by adopting a strict bill collection policy including penalties for default and installation of prepared meters especially in government institutions, etc. There is need to reduce payment of arrears and make sure that customers pay on time.
- 5) The energy policy should be adopted and implemented and the electricity bill should be enacted to organize the power sector and attract investments.
- 6) A sound legal and regulatory framework should be enacted to include measures to promote grid and off-grid programs, including partnership with private sector
- 7) A deep diagnostic of the sector issues should be carried out and there should be a formal long term master plan for the sector (and associated resource mapping and feasibility studies).
- 8) A comprehensive sector-wide capacity building master plan should be carried out to address the severe capacity constraints faced by the sector institutions. At the first stage, it is highly recommended that GoSS outsource international experts to assist the MED, especially in the negotiations with the IPPs and the Contractors. This would prevent the GoSS from making inappropriate long term deals that would affect the country in the future.
- 9) Transmission and distribution programs should continue as planned both in urban and rural area. In addition to this, the GoSS is encouraged to speed up the interconnections.
- 10) The Government should also join the EAPP by signing both the Intergovernmental Memorandum of Understanding and its utility SSEC should sign an inter-utility Memorandum of Understanding establishing EAPP to be able to benefit from the power trade programs that have been initiated by the pool.
- 11) It is recommended that a comprehensive demand forecast study must be carried as first phase of developing a power master plan based on least cost generation for South Sudan.
- 12) It is recommended that the GoSS undertakes a training program that would focus on improving efficiency and capacity of the staff of SSEC and MED. Focussed training should include areas such as planning and design of infrastructure project, project implementation, procurement management, financial management, management of tools and systems, environmental and social impact mitigation, etc.

- 13) It is also recommended that in long run, the GoSS should look into possibilities to move away from vertically integrated electricity sectors to unbundling of the sector by dividing it along three functional lines: generation, transmission and distribution as a way of encouraging private investments in generation and distribution and speeding up access to electricity in a sustainable manner.

Biomass energy for thermal use

- 14) The Government of South Sudan needs to expand the mandate of the Ministry of Electricity and Dams to develop policies, strategies and legal and regulatory framework for biomass energy. Biomass being the main source of energy in the country should not be neglected.
- 15) The Government need to develop programs in planting more biomass as the country will continue relying on it for cooking in the coming decades, efficient use of biomass and alternatives to biomass (non solid fuels)
- 16) The GoSS need to conduct a baseline survey on the use improved cookstoves, biogas and LPGs
- 17) There is a need to test the existing improved stoves models, design at least 3 models, blend them and design a promotion program to disseminate ICS
- 18) There is a need to design a domestic biogas program for rural farmers with 2 cows and above and an institutional biogas program using locally available materials.
- 19) There is a need to conduct a study on the current charcoal production method and design an improved method for carbonization.
- 20) The Government need to raise public awareness and education on the use of alternatives to biomass (LPGs, biogas, kerosene, briquettes, etc), on the benefits of Energy efficiency, etc.
- 21) The recommended strategy to scale up LPG use in South Sudan would focus on:
- 22) Public awareness and consumer education on benefits of LPG and safety precautions of LPG use;
- 23) Government policies and initiatives to promote LPG market development, including strategy for full application of subsidies and national price stabilization;
- 24) Increased focus on women as primary beneficiaries in LPG scale-up activities, including capacity building support for WDAs;
- 25) Development of full cost recovery microfinance options to facilitate household access to clean modern energy such as LPG.

3.5.2 Recommendations with regard to Renewable energy and Energy Efficiency

If the country is to promote the use of Renewable Energy (RE) and Energy Efficiency (EE) successfully, the GoSS should focus on the following:

- 1) **Adopting a comprehensive Renewable Energy and Energy Efficiency Legislation:** this includes a Renewable Energy and Energy Efficiency framework law, secondary laws and decrees on RE and EE, and regulations on load management, building codes, equipment and fuel efficiency standards, energy audits for large energy consumers, legislation on import of appliances, and regulation for RE development, including feed-in-tariffs;
- 2) **Establishing a RE and EE Strategies and Action Plans:** the MED should establish a directorate in Charge of RE and EE or a completely new and autonomous RE and EE Agency to take the lead in developing these strategies and action plans and carrying out energy audits.
- 3) **Developing a financial Mechanism for RE and EE:** Special financial incentives need to be put in place in order to promote RE and EE. A list of actions has been tested

in various countries. Measures which have proven to be effective are: (1) favourable tax regimes for the import of RE and EE equipment; (2) Direct targeted subsidies for selected RE and EE programs, provided stable financing of these subsidies can be secured through surcharges on electricity or gasoline; (3) creation of compensation mechanism to finance the cost difference between the renewable energy and least-cost conventional energy, under a tariff system or a competitive tendering system; (4) investment credits and tax credits to induce consumers to buy energy efficiency equipment and to encourage development of renewable energy; (5) dedicated credit lines with selected commercial banks that are interested in investing in these areas (with micro finance institutions, MFIs)

- 4) Studies on wind, geothermal and biomass to generate power should be conducted to promote these renewable sources of energy
- 5) **Demand Side Management:** Promotion of Good housekeeping initiatives like to switch off lights when a room is not in use, closing of doors and window when air conditioners are on, constructing energy efficient buildings, etc. Promotion of Compact Fluorescent Lamps to replace incandescent bulbs, technical and commercial utility losses reduction, promotion of energy audits in industries, use of energy efficient appliances, promotion of Solar Water Heaters, etc

ANNEXES

Annex 1. Matrix of existing Projects and required financing for achievement of SE4ALL goals

Title	Lead Agency	Financier	Relevant SE4ALL Goal(s) (Access/Efficiency/Renewable Energy)	Brief description and time frame	Value, US\$
<i>Juba, Wau and Malakal Power Supply Project.</i>	MED	Chinese Exim Bank	Access	<p><i>-Supply of fuel and spare parts to rehabilitate existing generators and increasing the generation capacities of existing power plants;</i></p> <p><i>-Reinforcement and expansion of the existing grids which are dilapidated.</i></p> <p><i>Pre-feasibility and feasibility Study and Environmental Impact Assessment Study have been completed;</i></p> <p><i>A Commercial Contract Agreement has been signed with Chinese Company last year. Work did not start due to lack of funding.</i></p> <p><i>The project will take three(3) years</i></p>	150 million
<i>Ethiopia - South Sudan 220KV Transmission Line and Substations(From Gambella in Ethiopia - through Jekou to Malakal (Upper Nile State capital). Import of 50-100 MW</i>	MED	Chinese Exim Bank	Access	<p><i>-Construction of approximately 380km of 220kV transmission line inside the Republic of South Sudan and 100 km of 220kV transmission line inside the Federal Republic of Ethiopia;</i></p> <p><i>-Installation of:</i></p> <ul style="list-style-type: none"> <i>- 23 MVA, 220/33 KV substation at Jekou and</i> <i>- 90 MVA, 220/33KV substation at Malakal City.</i> <p><i>Pre-feasibility and feasibility Study and Environmental Impact Assessment Study have been completed; A Commercial Contract Agreement has been signed with China Heavy Machinery Corporation since January 21, 2012. And since then, the project construction phase has not started due to funding approval by the China - Exim Bank.</i></p>	322 million USD.

				<i>The execution period is 3 years</i>	
<i>Tharjath Thermal Power Plant</i>	MED	GOSS	Access	<p><i>Construction of a thermal power plant using crude oil in Tharjath , Unity State. Initially, the plant shall be designed as an open cycle with generation capacity of 240 - 300 MW;</i></p> <p><i>After construction of a refinery in Tharjath, the plant will be converted into a combined cycle with increased generation capacity up to 500 MW,</i></p> <ul style="list-style-type: none"> • <i>Pre-feasibility and feasibility Study and Environmental Impact Assessment Study are yet to be initiated;</i> • <i>Design and preparation of tender documents;</i> • <i>No contractor has been identified yet.</i> <p>Expected completion time: 3.5 years</p>	<i>150 million USD</i>
Tharjath - Rumbek 400 KV Transmission Line and Substations	MED	GOSS	Access	<ul style="list-style-type: none"> • Construction of approximately 180 km of 400 kV transmission line. This line will interconnect Tharjath Thermal Power Plant in the Unity State with Rumbek the capital city of Lakes State. • Installation of: <ul style="list-style-type: none"> - 60 MVA, 400/33 KV substation in Rumbek; - A double 400 kV busbar - 400 kV bay. • Pre-feasibility and feasibility Study and Environmental Impact Assessment Study have been conducted by individual companies which have expressed interest to invest in the project; • No contractor has been identified; • Funding for the project is not secured yet. <p>Expected completion time: Two (2) years.</p>	125,000,000
Juba- Ramchiel - Rumbek 400 KV Transmission Line and Substations	MED	GOSS	Access	<ul style="list-style-type: none"> • Construction of approximately 480 km of 400 kV transmission line to transmit electricity power generated from Tharjath Thermal Power Plant in the Unity State through Rumbek to Ramchiel and then to Juba the capital city of Central Equatoria State 	80,000,000

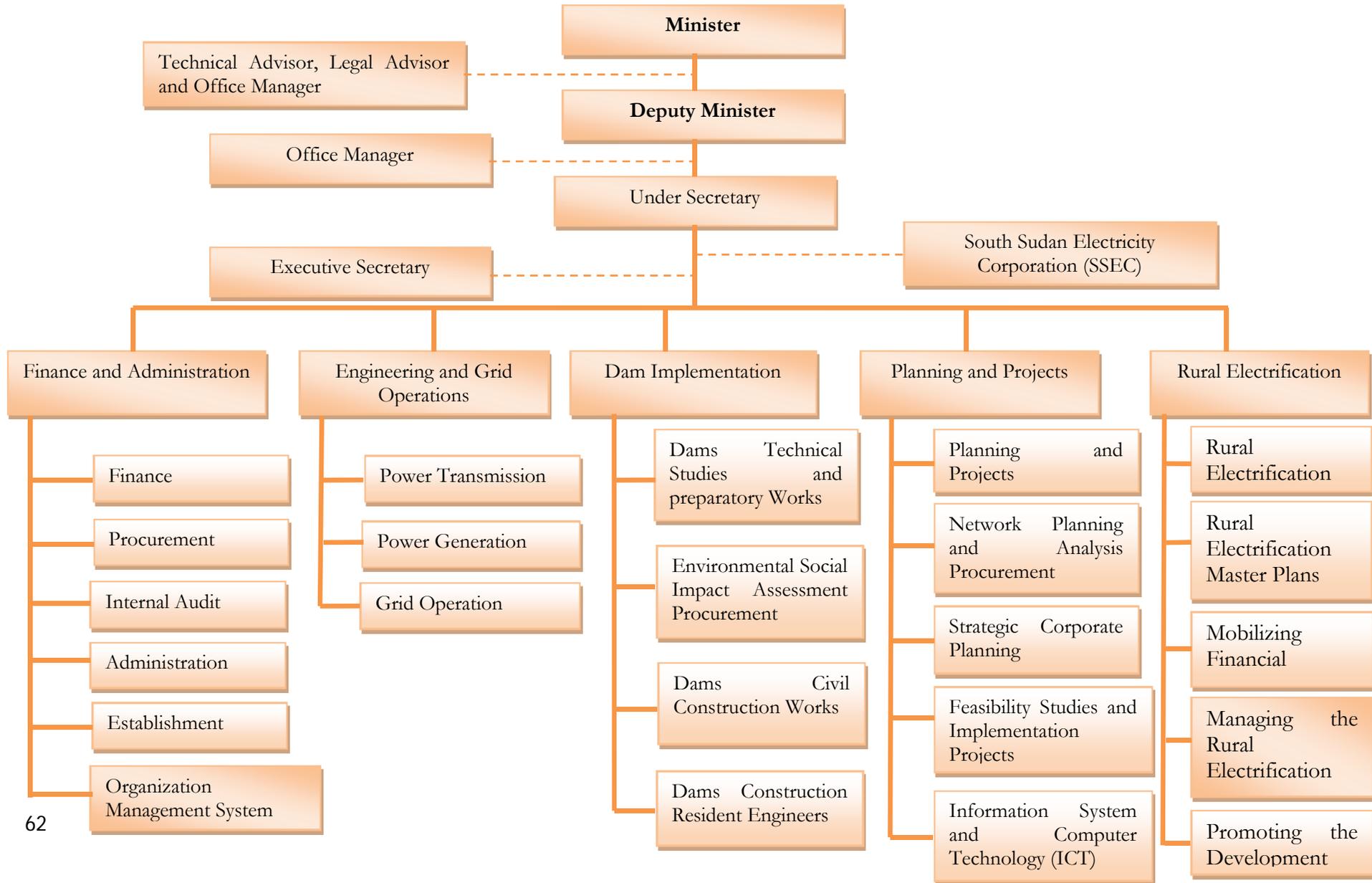
				<ul style="list-style-type: none"> • Installation of: <ul style="list-style-type: none"> - 60 MVA, 400/220 KV substation in Juba - A double 400 kV busbar - 90 MVA, 400 /220 step - down transformer; - Double busbar 220 kV ; - 2 x 220 kV bay; - 60 MVA, 220 / 132 kV step - down transformer; - 132 kV busbar; - 132 kV bay. • Pre-feasibility and feasibility Study and Environmental Impact Assessment Study are yet to be initiated; • Design and preparation of tender documents; • No contractor has been identified yet. • Expected completion time: Four (4) years 	
South - Sudan and Uganda grids interconnection 400 KV transmission line and substations	MED	AfDB	Access	<ul style="list-style-type: none"> • Construction of approximately 180 km of 400 kV transmission line; This line will be constructed from Juba 400 kV substation through Nimule town and up to Uganda, to evacuate power from the Grand HPP sites of Fula, Lakki, Beden and Shukoli to East Africa Power Pool for consumption of surplus power from South Sudan national grid • Installation of: <ul style="list-style-type: none"> - 23 MVA, 400/33 KV substation in Nimule; - A double 400 kV busbar • Pre-feasibility and feasibility Study and Environmental Impact Assessment Study are yet to be initiated; • Design and preparation of tender documents; • No contractor has been identified yet. • Expected completion time: Two (3) years 	27,875,000
Rumbek - Wau - Aweil 400 / 220 KV Transmission Lines and	MED	GOSS	Access	<ul style="list-style-type: none"> • Construction of approximately 122 km of 400 kV transmission line from Rumbek to Wau. This line will interconnect will emanate from Rumbek Substation and up to Wau where the voltage will be stepped down from 400 kV to 220 kV. From Wau substation a 220 kV 	41,250,000

Substations to evacuate power from the thermal power station at Tharjath to Western and Southern parts of the country				<p>transmission line will be constructed up to Aweil, the capital city of Northern Bahr el Ghazal State</p> <ul style="list-style-type: none"> • Construction of approximately 170 km of 220 kV transmission line from Wau up to Aweil; • Installation of: <ul style="list-style-type: none"> - 60 MVA, 400 /220/33 KV substation in Wau; - A double 400 kV and 220 kV busbar - 400 kV bay and 220 kV bays.41,250,000.00 • Pre-feasibility and feasibility Study and Environmental Impact Assessment Study are yet to be initiated; • Design and preparation of tender documents; • No contractor has been identified yet. • The expected completion period: Two (2) years 	
Juba - Torit - Kapoeta 220 KV transmission line and substations	MED	GOSS	Access	<ul style="list-style-type: none"> • Construction of approximately 560 km of 220 kV transmission line. This line will transmit power form Juba through Torit to Kapoeta cement factory • Installation of: <ul style="list-style-type: none"> - 23 MVA, 220/33 KV substation in Torit; - A double 220 kV busbar - 2 x 220 kV bays. • Pre-feasibility and feasibility Study and Environmental Impact Assessment Study are yet to be initiated; • Design and preparation of tender documents; • No contractor has been identified yet. • Expected construction period: Four (4) years 	85,350,000
South Sudan and Sudan grids interconnection	MED	GOSS	Access	<ul style="list-style-type: none"> • Construction of approximately 232 km of 220kV transmission line from Malakal up to Renk County. The transmission line 220 kV is in the Upper Nile state. It will connect Malakal and Renk substations • Installation of: <ul style="list-style-type: none"> - 60 MVA, 220/33 KV substation at Palouge; - 3 x 220 kV bays; 	37,250,000

				<ul style="list-style-type: none"> • Pre-feasibility and feasibility Study and Environmental Impact Assessment Study have been completed; • A Commercial Contract Agreement has been signed with China Machinery Construction Company in 2012. • Funding of project is to be secured. • The expected completion time: Three (3) years 	
Malakal - Ayod - Bor - Juba 400 KV Transmission Line and Substations	MED	GOSS	Access	<ul style="list-style-type: none"> • Construction of approximately 500 km of 400 kV transmission line. This line emanates from Malakal substation, passes through Ayod and Bor in Jonglei state, Juba the capital of Central Equatoria state. • Installation of: <ul style="list-style-type: none"> - 45 MVA, 400/33 KV substation at Ayod; - 60 MVA, 400/33 KV substation at Bor; - 90 MVA, 400/220 kV substation on the Eastern part of Juba; - 90 MVA, 220/132 kV substation on the Eastern part of Juba; - 3 x 400 kV double busbar in each substation; - 2 x 220 kV bays; - 1 x 132 kV bay • Pre-feasibility and feasibility Study and Environmental Impact Assessment Study have been done yet; • No contractor has been identified; • Funding for this project is required. • Implementation period: Four (4) years 	31,250,000
Juba 220 KV interconnection transmission Line	MED	GOSS	Access	<ul style="list-style-type: none"> • Construction of approximately 20 km of 220 kV transmission line Juba - Central Equatoria state • Pre-feasibility and feasibility Study and Environmental Impact Assessment Study have not been done; • The expected execution One year 	300,000
Construction of Fula (I) Power Plant	MED	Norwegian Government, GoSS and an	Access	Construction of the Hydro Plant through a Norwegian agency called Norfund. Norway has agreed to raise about one hundred and twelve million dollars (USD 112 million), which is 75% of the cost of the plant. The other 25% (i.e. USD 37 million)	150 million

		IPP		will be met by Government of South Sudan. The hydropower project will supply 40 Megawatts to Nimule town, villages along Juba-Nimule highway as well as Juba town. Work on the project is expected to start within this year (2013) and electricity power from this facility is expected to reach Juba by mid-2015.	
Construction of Sue mini hydro plant	MED	IPP	Access	This plant is envisaged to produce 15 MW to supply Wau, Aweil and Kwajok towns.	120 million
Construction of Bedden dam on the Nile	MED	Exim Bank of China(85%) and GOSS(15%)	Access	This Hydro Power Dam is planned to supply a total of 540 MW power A group of companies from China, called Gezhouba Group have offered to construct the dam with loan from Exim Bank of China. MED signed a preliminary agreement for the construction of the dam. The contract will come into force when CGGC gets the necessary funding. If funding is secured, it will take 80 months to complete the construction of the dam i.e. about seven (7) years.	1.4 billion
Grand Fula Dam	MED	IPP	Access	The Ministry of Electricity and Dams signed an EPC contract with AAE Systems of California (USA) for funding and construction of the dam. All relevant papers were sent to the concerned authorities and are now being reviewed by the Ministry of Finance and the Ministry of Justice. The proposed dam is expected to produce about 890 Megawatts and costs. Construction of the dam is expected to take about seven years.	1.8 billion

Annex 2. MINISTRY OF ELECTRICITY AND DAMS ORGANIZATIONA CHART



Annex 3. LIST OF OFFICIALS MET

1. Mr. Samuel Tabani Youziel, Director General for Power Planning and Projects, Ministry of Electricity and Dams
2. Eng. Evans Wudu, Ministry of Electricity and Dams
3. Mr Beck Awan Deng, Chairperson and General Manager of South Sudan Electricity Corporation
4. Eng. Elijah Mabror Bol, Director General of Human Resources, South Sudan of Electricity Corporation
5. Eng. Loboso Comas, South Soudan Electricity Corporation
6. Mr. Timothy Thwol Onak, Director General of Forestry, Ministry of Agriculture and Forestry
7. Jane Nimpamy, Energy specialist UNDP
8. Martin Dramani - Programme Analyst, UNDP
9. Balazs Hovath - Country Director, UNDP

NB: The rest see attached scanned copy of list of participants in the consultation and report validation workshop.

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