



UNITED
NATIONS

A



**United Nations Conference
on New and Renewable Sources
of Energy**

**Nairobi, Kenya
10-21 August 1981**

Distr.
GENERAL

A/CONF.100/NR/ 8 *

12 March 1981

ENGLISH ONLY

UN LIBRARY

MAR 31 1981

UN/SA COLLECTION

NATIONAL REPORT SUBMITTED BY
LIBERIA **

* National reports are reproduced by photo-offset and issued in the languages of submission only. This document will receive full distribution at Headquarters. Only two copies per delegation will be available at the Conference site.

** The designations employed, the presentation of material and the views expressed in this paper are those of the submitting Government and do not necessarily reflect the practices and views of the Secretariat of the United Nations in any of these respects.

81-07063

PROSPECTS FOR NEW AND RENEWABLE
ENERGY SOURCES IN LIBERIA

Presented by:

The National Energy Committee

PROSPECTS FOR NEW AND RENEWABLE ENERGY SOURCES
IN LIBERIA

December 1980

TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
ENERGY CONSUMPTION IN LIBERIA	2
I. PETROLEUM AND PETROLEUM PRODUCTS	3
a. Crude Oil Importation	3
b. Consumption of Petroleum Products	4
II. ELECTRICITY	4
a. Power Generation	4
b. Power Production	5
III. LIBERIA'S HYDRO POTENTIALS	6
IV. NEW AND RENEWABLE ENERGY RESOURCES	7
a. Wood, Charcoal and Kerosene	10
b. Wind Energy	12
c. Solar Energy	13
d. Mini-Hydro	13
CONCLUSIONS.....	13
TABLES	17 - 23

THE PROSPECT OF NEW AND RENEWABLE SOURCES OF ENERGY IN LIBERIA

I N T R O D U C T I O N

Liberia is a West African Country situated between the Republic of Sierra Leone on the West, the Republic of Guinea on the North and Ivory Coast on the East. It occupies an area of 43.000sq. miles. The landscape of the country is plateau almost all of which is covered with a tropical rain forest and having a general elevation of 1,500ft.

Large rivers flow across the country into the Atlantic Ocean perpendicular to the mountain belts. These rivers are proven to be suitable for hydroelectric power.

The climate and rainfall consists of two seasons; the heavy rainfall (rainy season) is on the average of 150 inches per annum, along the coastal region up to about 120mi. inland and the dry season is during the other half of the year (November to April), with some overcast of clouds.

The population density increases around the industrial cities and Mines while it is considered evenly distributed over the subsistence agricultural sectors.

The Liberian forest reserves can provide up to one million cubic meters of wood yearly; this is equivalent to over 200 GWH of electricity annually. The country has on going reforestation programs and this assured wood resource is seen as a possible energy reserve.

There are major emphasis by the Government to develop more hydro power for electrification, to extend the central grid and to replace where possible fire-

wood and charcoal use. The government is also supporting offshore oil and gas exploration.

ENERGY CONSUMPTION IN LIBERIA

There are reports of the utilization of non-traditional sources of energy, including sugarcane trash which is being used by the plant of the Liberia Sugar Corporation in Maryland County, and Lumber Scrap being used at the Liberia Timber and Plywood Corporation in Sinoe County. Unfortunately, no study has as yet been made on these two cases to test their energy sources reliability. However, the four major energy sources being used extensively in Liberia are:

1. Petroleum Products
2. Hydroelectricity
3. Firewood
4. Charcoal

The commercial energy sector in Liberia today primarily relies on oil based fuels which is imported, refined and distributed in the country. Electrification relies on hydro and heavily on fossil fuels. Firewood, charcoal, and some kerosene and LPG are used throughout the country in households for cooking. A preliminary 1979 energy supply and demand balance for Liberia in

thousands of crude oil equivalence per year including the percent of coverage of demand by various sources of energy is shown in table I.1.

The total energy on input bases for 1979 is 6.6073 million barrels of crude oil equivalence.

I. PETROLEUM AND PETROLEUM PRODUCTS

A. Crude Oil Importation

Crude oil importation in Liberia is carried on by the Liberian Petroleum Refining Company. The refinery which is a public corporation, is considered small by World Standards, having a daily refining capacity of 12 to 15 thousand barrels per day. It is, however, of average size for West African Countries.

Importation of crude oil is presently under a three-year contract between "Petroleum" of Saudi Arabia and the Liberian Petroleum Refining Company. Meanwhile, there are negotiations going on with Nigeria, Mexico and Algeria for similar contracts. The Refinery imports crude oil once a month with an addition of one shipment each quarter of a year. The total imported is on the average of 405,000 barrels per month. The cost of crude oil in 1979 was \$120 million, approximately 20 percent of total national imports.

Below is a listing of the yearly crude oil importation in Liberia between 1975 to 80 as reported by the Refinery.

<u>Year</u>	<u>Total Crude in Barrels</u>	<u>Percent Increased</u>	<u>Cost in US. Dol.</u>	<u>Percent Increased</u>
1975	1,488,712		4,830,000	
1976	1,559,850	4.56	5,950,000	18.82

1977*				
1978+	2,904,808	46.63	8,460,000	29.67
1979	3,807,558	23.71	225,956,000	92.7
1980++	4,927,500	22.72	117,570,150	1.4

- * No crude oil importation in 1977 due to the Refinery break down.
- + Percent increase in 1978 is calculated for the increase over 1976
- ++ Projected by LPRC.

B. Consumption of Petroleum Projects

Approximately half the crude oil is refined to fuel oil, primarily for the use of the mines. Another 20 percent is diesel that is shared between the mines and the Liberian Electricity Corporation (LEC). The balance is distributed among transport, residential use and other small consumers. (see Table I.2.

II. ELECTRICITY

A. Power Generation

The Liberian Electricity Corporation (LEC) transmits and distributes electricity to several communities in Liberia. The LEC presently operates a power grid within the Monrovia area consisting of an 11MW Diesel, a 64MW Gas Turbine and a 64MW Hydro installation. It has recently added a 26MW Marine diesel generator and will add two 13MW units in 1981.

The LEC also operates nine out stations which are not directly connected with the Monrovia system. The diesel generators in these towns range in capacity from 300 KW up to 2MW with the majority being small units. The total non-grid installed capacity is approximately 7 MW. In addition, several of the large towns have various diesel generators owned and operated privately. Many smaller towns are reported to have small diesel sets in the 10-100KW range, owned and operated by private entrepreneurs.

The iron mines and rubber plantations have an installed capacity of 143MW. This capacity is dedicated to the plant operations and local use.

B. Power Production

The most significant developments in the LEC systems date back to 1963 when a new diesel plant consisting of 6 sets with a total of 13MW was commissioned. From that time until the present (November 1980) a total of 155MW of thermal and hydro facilities have been installed in addition.

<u>Plant</u>	<u>Installed Capacity</u>	<u>Type of Engines</u>
Bushrod Plant	13MW	Diesel (Medium Speed)
Faulkner & Walker	64MW	Hydraulic Turbines
G.T.	64MW	Gas Turbines
Luke Plant	<u>27MW</u>	<u>Diesel (slow speed)</u>
Total	168MW	

In 1977, the peak demand in the LEC system was 74.3 MW and the total energy generated was 433.3 GWH. It has been estimated that by the year 2000, the minimum energy requirement in Monrovia will be approximately 1895 Gwh, while the entire country will need about 4,304 Gwh, corresponding to a demand of about 309MW and 67MW respectively. The 1895 Gwh is considered the maximum expected in the Monrovia system while 7304 Gwh is the maximum estimated for the entire country corresponding to a demand of 309MW and 1076MW respectively.

At the present time, the Faulkner and Walker hydro plant on the St. Paul River is only adequate to handle the normal demands with some thermal generation being added for peaking, simply because the plant is a run of the river and has no storage facilities, therefore it is not possible to be utilized fully during the dry season. The LEC, nevertheless in 1979 generated about 70% of the total power in the Monrovia system by this plant.

III. LIBERIA'S HYDRO POTENTIALS

There are considerable plans for the further development of hydro power in Liberia. A 1975 preliminary study on Hydro-Electric power Development in Liberia by the Japanese International Cooperation Agency (JICA) indicated that all of the major rivers in Liberia had some hydro potential. (see Table III.1) However, more detailed studies on three major rivers (Mano, St. Paul and the Cavalla Rivers) have indicated higher potentials than those suggested by the

JICA report.

The Mano River has been shown to be capable of supporting a 160MW plant, the Cavalla 450MW plant depending on the dam height, while a storage basin with a potential well over 1,000MW have been identified on the St. Paul. (See Table III.2). This potential of the St. Paul River is not; however, located at one site. There are a total of six sites on the river suitable for hydro electric power, by staging development (Table III.3) power can be put on stream as and when it is needed. Considering the fact that the St. Paul's potential alone is capable of supplying the power needs of Liberia up to the rivers are considered, these would be found capable of supplying the power needs of the country well into the next century.

IV. NEW AND RENEWABLE ENERGY RESEARCH

Because of continuing energy demand growth and the foreseeing shortages in the supply of petroleum, there is a serious need to introduce energy conservation activities and to develop Liberia's Alternative energy, in particular renewable energy sources.

Toward this end, renewable energy potentials identified are solar energy, wind energy, bio-gas, wood, charcoal and hydroelectric. In addition, there are considerable potentials for conservations by means of improved practices in the utilization of wood and charcoal. The introduction of bio-gas, wind energy,

solar energy, and minihydro projects are strongly considered positive steps toward energy self sufficiency. Recognizing this fact, the National Energy Committee and the Bureau of Hydrocarbon has embarked upon the following programs:

1. Assessment of the demand, consumption and distribution of firewood, charcoal and other alternative sources of energy in Liberia.
2. The construction of pilot project of Bio-gas digesters.
3. The cooperation with the University of Liberia in the pilot study projects for solar and wind energies.
4. Studies on energy conservation, environmental impacts and protection strategies, and demand and supply options.

Attention should be drawn to the fact that new and renewable energy research in Liberia, is very new. Most research projects are in the planning stage or waiting to be implemented.

The government and other parties involved in the Liberian economy do not have sufficient data about the energy sector, especially renewable energy, to

properly plan for its development or to manage and regulate its course. This lack of data also directly affects other sectors of the economy and could lead to serious problems in the future. This fact has been recognized and the government is attempting to do something about it through data collection programs. Although there is an immediate need for an energy sector plan.

1. Data on energy use or on the implication of energy plans to other sectors of the economy does not exist. Planning for most sectors often does not include energy considerations other than fuel costs.
2. A National Energy Commission has been formed to produce a national energy plan, but it has just begun its work.
3. Emphasis on conservation and demand management is only beginning and is currently not widely practiced.
4. Some data on rural energy use has been collected.
5. References and literature on renewable energy are not available.

6. Renewable energy training is just beginning in the University and there is a need for more training resources.

A. Wood, Charcoal and Kerosene

As a result of escalating prices of petroleum products, there has been a shift to more traditional sources of energy, especially household users both in the Urban and Rural Areas. The principle traditional sources used today include 1) Firewood, 2) Charcoal and 3) Kerosene, Firewood, Charcoal and Kerosene are particularly being used in homes and small industries. The Bureau of Hydrocarbon is presently conducting a comprehensive study on the extent of usages of these sources of energy. A preliminary study of ten rural cities indicated that there is a high demand for these sources; and surprisingly, availability of the products is a major constraint. Although a ten city sample is insufficient to arrive at a meaningful conclusion, several trends were noted:

1. There is a scarcity of petroleum products, wood and charcoal in Most markets which would indicate that the utilization of energy sources is based on their availability.
2. There is a need for better distribution system to meet the demand of local markets.

3. That sawmills could process wood scrape for utilization as an energy source in rural areas.
4. It would appear that of the three commodities, charcoal is the preferred commodity and as such, and industry could be developed for processing charcoal.
5. The types of coal pot used as charcoal stove and the iron and stones tripods used as wood stoves need serious improvement for better efficiency.

The report further revealed that in Monrovia the average per capital use of wood is $0.04\text{m}^3/\text{yr.}$ of which 47.93% is in the form of charcoal.

In the rural towns such as Sanyea up to 5.5m^3 of wood per year is used per capital. Of this later figure, only 0.15 percent is in the form of charcoal. The pattern of consumption of wood fuel in Monrovia and selected cities and towns in Bong County and Gibi Territory is shown in Table IV.1 and IV.2. Analysis further shows that the cost of firewood, charcoal and kerosene for a family of five is about \$262 per annum. It is known that the 1979 gross domestic product (GDP) is 913 million dollars. Base on a 1979 population estimate of 1,7735 million, the per capital GDP for the year is \$514.80. Thus 10.2% of the family's annual budget is being spent for these energy products.

The Bureau of Hydrocarbon in collaboration with the University of Liberia Engineering Department has completed plans for programs in solar and wind.

energy research. The scope of the programs are:

1. Wind energy
2. Solar energy
3. Minihydro

B. Wind Energy

The program for wind-powered installation for rural projects in Liberia have emphasized the need for the design of simple equipment that can be fabricated locally. The objectives of the programs are:

1. To conduct pilot project using wind-powered water pumping installation to demonstrate the feasibility of harnessing wind energy in Liberia.
2. To study the wind pattern in the Monrovia area as a prelude to a nation-wide pattern study.
3. To use the wind data to determine the forms, sizes and sites of possible wind powered installations in Liberia.

Besides driving water pumps, wind power finds application for other uses such as generation of electricity, grinding coffee (common in the country) and threshing rice. The program is considering that a later phase of this study would consist of fabricating and testing model wind driven devices for electricity and other energy needs of the Liberian people.

C. Solar Energy

Due to the absence of global solar radiation information for Liberia, the present solar energy programs in Liberia consists of solar energy data collection and the building of locally constructed solar collectors.

D. Mini-Hydro

The United States Agency for international Development is at the present time installing a mini-hydro plant in a rural city of Lofa County. It is hoped that this pilot program will provide the information necessary for a meaningful mini-hydro program in Liberia.

The German Technical Assistance Program to Liberia is financing a feasibility study on locations for mini-hydro throughout the country for the Liberian Electricity Corporation.

C O N C L U S I O N S

In view of the rising prices for imported oil to meet the energy needs and the consequent drain of the nations foreign exchange, Liberia is placing major emphasis on the development of new and renewable energy technologies as part of

its rural and urban development programs. There are, however several existing constraints limiting the speedy implementation of the programs. Paramount, among these are:

1. Technology: Present technological advances in the new and renewable energy sources development are not available. It must be noted however that several individuals including researchers, government and industrial agencies, and institutions such as the University of Liberia and the Cuttington University College have shown considerable interest in developing the technical know-how of their personnel in the area and are open minded to the transfer of the technologies.
2. Financial: Due to a recent change in government, Liberia is in a transition stage where the financing of its development programs are being rearranged. The nation is in a low financial situation, such that the existing energy programs need assistance both from international and other donors.
3. Education and Training: The training of both management and

policy makers, as well as Lower level technicians and specialists in the development and transfer of new and renewable energy technologies is seriously needed.

The higher institutions of learning in the country have expressed interest in introducing energy technology courses to their students, but are lack of funds, instrumentation, and staff to do so. Government agencies and other corporations concerned with the energy sector do not have personnel trained in the disciplines. The Bureau of Hydrocarbon, which is a Government Agency concerned with the development of these energy sources is presently lack of staff in this area and needs training assistance for its personnel.

Rural Energy: If our development goals must be attained, the public should be protected against insufficient supplies instability of prices, and prolonged interruption of services. Due to the dispersed nature of Liberia rural population, technologies for producing energy from sources that are renewable needs to be on small scale and decentralized. Small bio-digesters, wood fired steam generators, mini-hydro electricity activities, energy conservation programs and labor saving devices in rice production are areas with potential high energy saving or generating impacts and therefore should be explored.

Industrial Issues: Several industries (such as wood processing companies, mining concessions, sugar factory, and others) are developing in the country. At

present, the consciousness of the need to install energy saving devices, and those that will rely on new and renewable energy sources is not shown. Very few have developed plans to replace, were possible, there energy consumption with renewable sources, Government needs to require a number of them to do so.

The Government promises of greater social justice for the poor and a better life for the rural population implies more energy especially electricity, additional fuels, and stabilized prices. The new emphasis on energy has already been initiated by the formation of the National Energy Committee together with the recommendations of the DSI report.

The U.S. Agency for International Development (USAID) has shown a lot of interest in the Liberian energy problems and it is anticipated that this interest will continue to grow. Other agencies and financial institutions that have shown interests in the energy and rural problems here are Kreditanstalt Fur Wiederaufbau, European Economic Committee, Japan International Cooperation Agency, Economic Commission for Africa, to name a few. It is assumed that they will also continue to show interests and that it will be possible to call on them for assistance in developing new and renewable sources of energy in Liberia.

TABLE I.1
PRELIMINARY 1979 ENERGY SUPPLY AND DEMAND BALANCE FOR LIBERIA
(10³ BARRELS OF CRUDE OIL EQUIVALENT PER YEAR)

Energy Demand Category	Total Energy on input basis	Percent of total	Percent of Coverage of Demand by various Sources			
			petroleum	hydro	firewood	charcoal
DIRECT HEAT						
Industrial	1905*	28.8	100			
Domestic	2139	32.4			65.1	34.9
TRANSPORT						
Road	541.4	8.2	100			
Ship	31.0	.5	100			
Air	319.7	4.8	100			
ELECTRICITY GENERATION						
LEC - Petro	282.8	5.8	100			
Hydro				100		
Private	452.0	6.8	100			
OTHER						
Naptha	16.4	.2	100			
Asphalt	19.1	.3	100			
Refinery	95.4	1.4	100			
TOTAL	6607.3	100.0				

* Data on industrial wood use is not available, however, this figure could be larger.

TABLE 1.2
CONSUMPTION OF PETROLEUM PRODUCTS BY SECTOR IN 1979

Consuming Sector	Product	Quantity BBL	Percent
Land Transport	Gasoline	541,436	14.22
Air Transport	Jet Fuel	319,650	8.40
Residential	Kerosene	4,261	.11
	LPG	4,256	.11
Ships	Bunker Fuel	30,986	.81
Refinery	Fuel Gas	95,405	2.51
Mining Comcessions (mostly electricity generated)	Fuel Oil	1,904,266	50.00
	Dieseal	451,983	11.87
Electricity Generation (LEC)	Fuel Oil	34,600	.91
	Diesel	348,200	9.14
Road Construction	Asphalt	19,104	.50
Other	Naptha	16,455	.43
		22,587	.63
Total		3,791,014	99.58

TABLE III.1
TABLE 6-7 SUMMARY OF PROPOSED HYDRO-ELECTRIC POWER DEVELOPMENT SCHEME

		MANO RIVER		LOFA RIVER		ST. PAUL		ST. JOHN RIVER		CESTOS RIVER	
Item	Unit	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1
Type of Generation		Dam Type	Dam Type	Dam Type	Dam Type	Dam Type	Dam Type	Dam Type	Dam Type	Dam Type	Dam Type
Catchment Area	km ²	7,600	6,300	8,590	8,180	20,780	16,010	15,610	11,160	10,400	7-250
Annual Inflow	10 ⁶ m ³	8,606	7,077	8,467	8,061	15,832	15,250	15,250	10,902	4,834	3,347
Dam Type		Rock-fill	Rock-fill	Rock-fill	Rock-fill	Rock-fill	Rock-fill	Rock-fill	Rock-fill	Rock-fill	Rock-fill
Height	m	30	45	25	30	28	25	25	40	20	30
Crest Length	m	500	360	400	400	950	600	450	350	500	1,700
Power Production											
Effective Head	m	21.8	35.0	17.3	21.8	18.3	17.3	17.3	29.9	18.0	15.0
Maximum Discharge	m ³ /s	67	129	70	106	167	70	127	159	108	122
Installed Capacity	KW	12,000	37,000	10,000	19,000	25,000	10,000	18,000	39,000	16,000	25,000
Annual Energy Production)	10 ⁶	98.5	295.5	83.2	154.5	*229.5	83.6	149.0	308.1	125.7	188.6

TABLE III.2
HYDROELECTRIC GENERATION

Plant	Installed Capacity (MW)	Primary Energy GWh/Year	Fuel Replacement Energy GWh/Year	Installed Cost \$ (1978)
Vi-SP4	134	600	158	423,919,600
Mt. Coffee	128*	640*	88*	47,430,500+
SP2	214	1,047	166	188,406,400
SPO	188	942	131	202,317,100
SP1B	120	589	88	141,709,800
SP3	108	496	105	126,262,200
SP1A	204	1,015	140	279,204,500
T1	6	32	-	52,343,500
T2	10	56	-	92,892,000
T3	18	102	-	226,424,000
V2	29	165	-	80,631,000

* Mt. Coffee total plant including existing units plus addition

+ Mt. Coffee addition only.

TABLE III.3
MOST ECONOMIC HYDRO EXPANSION PLANS

Year	FORECAST		MINIMUM FORECAST	
	<u>No. Advancing</u>	<u>Advancing</u>	<u>No. Advancing</u>	<u>Advancing</u>
1986	V-1-SP-4, Mt. Coffee	V-1-SP-4 Mt. Coffee	V-1-SP-4, Mt. Coffee	V-1-SP-4, Mt. Coffee
1987		SP-2		SP-2
1988		SP-0		
1989				
1990	SP-2			
1991				
1992		SP-1B		
1993				
1994				
1995				
1996	SP-0	SP-3	SP-2	SP-0
1997				
1998				
1999				
2000				
2001	SP-1B	SP-1A	SP-0	SP-1B
2002				
2003	SP-3			SP-3
2004				
2005	SP-1A		SP-1A	
2006				
2007				
2008			SP-3	
2009			SP-1B	
2010				

Note: For a normal forecast, plants would come on line as indicate - Column a. If advanced i.e. the increase in demand is more than anticipated Column 2 would apply. For a minimum forecast columns 3 & 4 would apply.

TABLE VI.1
CONSUMPTION FIGURES ON FIREWOOD, CHARCOAL AND KEROSENE OF MONROVIA AND SELECTED TOWNS IN
BONG COUNTY AND GIBI TERRITORY BASED ON TOTAL POPULATION

Location	Population & Persons Interviewed	Total Houses & No. of Houses Interviewed	Percent of Houses Using			Amount of Comodity Used per year			Cost of Comodity in US \$		
			Wood	Coal	Kerosene	Wood/ Bundles	Coal/ Bags	Kerosene/ Gallons	Wood/ Bundles	Coal/ Bags	Kerosene/ Gallons
Baila	1281 309	153 37	100	0	100	131,712	-	19,220	32,928	-	34,596
Belefarai	842 427	123 64	100	9	100	33,552	37	6,217	8,388	56	11,191
Botota	1050 293	162 45	96	4	100	17,466	8	7,442	4,366	16	13,768
Gbarnga	6325 1112	569 100	90	64	87	226,108	37,755	29,088	769,581	56,633	46,541
Gbatata	3962 566	448 64	100	9	100	16828	728	25,137	8,414	1,828	43,390
Kakata	9992 651	1013 66	89	39	67	475,687	5,513	42,913	237,803	10,475	75,098
Monrovia*	306,464 5,592	31,650 580	41	73	67	2,370,164	2,041,833	5,542,987	2,370,164	5,104,583	8,591,630
Palala	1181 491	161 67	72	13	100	21,561	220	6,466	539	330	11,316
Salala	1073 577	167 90	87	7	82	47,212	43	5,474	11,803	75	9,580
Sanoyea	938 775	105 87	100	6	100	34,456	5	6,628	8,614	750	13,256
Totota	1199 416	156 54	98	20	87	50,818	159	12,248	25,409	398	21,434
TOTAL	334,307 11,219	34,707 1,254	88	22	90	3,425,564	2,086,301	5,703,820	3,482,820	5,175,144	8,861,800

* Survey conducted between December 1979 to January 1980-

TABLE IV.2
PATTERN OF CONSUMPTION OF WOOD FUEL IN MONROVIA AND SELECTED CITIES AND TOWNS
IN BONG COUNTY AND GIBI TERRITORY-SEPTEMBER 1979

Location	Fuel Wood in Cubic Meters	Charcoal in Metric Tons	Equivolent Charcoal coneerted to Fuel Wood	Total Wood in Cubic Meters	Charcoal as a share of total %	Average Wood per capital
Baila	4550	-	-	4550	0	3.6
Belefarai	2494	5	30	2524	1.19	3.0
Botota	726	2	12	738	1.63	0.7
Gbarnga	6309	259	1554	7862	19.77	1.3
Gbatala	343	29	174	517	33.66	0.1
Kakata	4975	23	138	5113	2.69	0.5
Monrovia	6,178	931	5,686	11864	47.93	0.04
Palala	1780	18	108	1888	5.73	1.6
Salala	4227	8	48	4275	1.13	3.0
Sanoyea	4078	1	6	4084	0.15	5.5
Totota	2564	7	42	2606	1.69	2.2
Total	38223	1283	7798	46021	13.48	2.0