SUSTAINABLE
ENERGY FOR ALL

Rapid Assessment Gap Analysis
Suriname

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Rapid Assessment and Gap Analysis Energy Sector Suriname

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Table of Content

List of Acronyms 4
Executive Summary 6
Section 1: Introduction 7
1.1 Country Overview 7
1. Basic socio-economic data 7
1.2 Situation in the Energy Sector 8
2. Energy supply 8
3. Energy demand 12
4. Energy and economic development 13
5. Energy strategy and relevant targets 14
Section 2. Current situation with regard to SE4ALL goals 15
2.1 Energy access vis-á-vis Goal of SE4ALL 15
6. Overview and assessment 15
7. Modern energy for thermal applications (cooking, heating) 15
8. Access to Electricity 17
9. Modern energy for productive uses 20
2.2 Energy Efficiency vis-á-vis Goal of SE4ALL 22
10. Overview and Assessment 22
11. Energy intensity of national economy 22
2.3 Renewable Energy vis-á-vis Goal of SE4ALL 23
12. Overview and Assessment 23
13. On-grid and off-grid renewable energy 25
14. Use of renewable energy sources (RES) for thermal applications (cooking/ heating) 25
15. Use of RES for productive activities 25
16. Consolidated Summary 25
2.4 SE4ALL Goals 26
17. Goals 27
Section 3: Challenges and opportunities for achieving SE4ALL goals 29
3.1 Institutional and Policy Framework 29

18. Energy and development 29
19. Thermal energy for households 30
20. Power sector 30
21. Modern energy for productive sector 32
22. National monitoring framework for SE4ALL 32
3.2 Programs and Financing 33
23. Thermal energy 33
24. Power sector 33
25. Modern energy for productive use 34
3.3 Private Investment and enabling environment 34
26. Thermal energy for household 34
27. Power sector 35
28. Modern energy for productive sectors 35
3.4 Gaps and Barriers 36
29. Thermal energy for households 36
30. Power sector 36
31. Modern energy for productive sectors 37
32. Summary 37
Annex I: Main projects/ programs and their sources of financing 39
Annex II: Main investments in the electricity sector 40
Bibliography 43

List of Acronyms

ABS	Algemeen Bureau voor de Statistiek General Bureau of Statistics)
bbl/day	barrels per day
BOE	Barrel of Oil Equivalent
BTU	British Thermal Unit
DEV	Dienst Electriciteit Voorziening (Department for Rural Energy of the Ministry of Natural Resources)
E-15	Ethanol-15 (a mixture of 85% gasoline and 15% ethanol)
EAC	Energie Advies Commissie (Energy Advice Commission)
EBS	Energie Bedrijven Suriname (Energy Company Suriname)
ECLAC	Economic Commission for Latin America and the Caribbean
EE	Energy Efficiency
EIA	Energy Information Administration
ENICK	Electricity Supply Nickerie
EPAR	Electricity Supply Paramaribo and Surroundings
ESCO	Energy Service Company
GDP	Gross Domestic Product
GoS	Government of Suriname
GWh	Giga Watt hours
HEI	Higher Education Institutes
HFO	Heavy Fuel Oil
HPP	Hydro Power Plant
HVGO	Heavy Vacuum Gas Oil
IDB	Inter-American Development Bank
IAMGOLD	International African Mining Gold Corporation, a gold mining company
IPP	Independent Power Producer
km^2	Square kilometre
Kema	Keuring Van Electrotechnische Materialen (Verification of Electrical Engineering Materials)
kV	kilovolt
kW	Kilowatt
kWh	kilowatt hour
lbs	Pound
LPG	Liquefied Petroleum Gas
MNH	Ministerie van Naturlijke Hulpbronnen (Ministry of Natural Resources
MW	MegaWatt
MWh	Mega Watt hour
OGANE	Department of gas within EBS

O&M	Operation and Maintenance
PAHO	Pan American Health Organization
R&D	Research and Development
RE	Renewable Energy
SEFS	Sustainable Energy Framework for Suriname
SRD	Suriname Dollars
SPCS	Staatsolie Power Company Suriname
SCFD	Standard Cubic Feed per Day
SURALCO	Surinam Aluminium Company
SIDS DOCK	Small Islands Developing States cooperation; a platform to assist SIDS to develop sustainable energy
SE4ALL	Sustainable Energy for All
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar

Executive Summary

The power sector in Suriname consists mainly of two types of power systems: individual thermal power plants and a hydro power plant. Electricity is thus produced by this hydropower plant (the Afobaka Hydropower Plant) and private and public thermal generators. Other sources of renewable energy used in Suriname include solar, biomass and wind energy.

Total primary energy supply (2010) is 5,668,080 BOE . The demand in electricity is expected to increase due to the welfare of the population, resulting in an increase in residential demand and production activities. The projected energy demand to 2022 is estimated at 500 MW with an annual growth rate of 6%[1]. Total installed electricity capacity 2013 is app. 274 MW[2], whereby 125MW is assigned to Afobaka hydroelectric power plant, according the EBS-SURALCO power purchase contract).

In Suriname there is no regulatory energy sector framework. The Ministry of Natural Resources (MNH) has the primary responsibility for the sector, but has limited technical and financial resources and insufficient autonomy. No dedicated energy regulator exists in the country. With the exception of colonial legislation regulating electricity concessions and a technical regulation for the supply of power, there is also no regulatory framework for the energy sector.

The following table summarizes the current situation of Suriname in relation to the objectives of SE4ALL:

Objective 1: **Universal access**	In terms of electricity, 85% of households in Suriname has access to electricity networks and approximate 16% of the households uses wood for fuel to cook. The aim is to have in 2033 100% of households having access to energy.
Objective 2: **Renewable Energy**	More than Fifty percent (50%) of the country's total energy supply is generated through its hydropower system Although Suriname has a significant potential in the use of solar energy, and considerable opportunities in the area of other renewable sources of energy, it is still not well developed. The aim is to focus on the aggressive development of indigenous renewable energy resources and to increase the percentage of renewables in the energy mix.
Objective 3: **Energy Efficiency**	No energy efficiency framework is available, resulting in low energy efficiency of technologies applied at large production enterprises. The aim is to have in 2033 a modernized energy infrastructure consisting of energy-efficient plants and distribution systems.

[1] ECLAC, Final draft 'Suriname's National Energy Policy 2013 – 2033'

[2] IDB report (SU-L1035), SUPPORT TO THE INSTITUTIONAL AND OPERATIONAL STRENGTHENING OF THE ENERGY SECTOR, August 27th, 2013.

Section 1: Introduction

1.1 Country Overview

1. Basic socio-economic data

Suriname is the smallest and the youngest sovereign country in South America that achieved independence in 1975. With an area of 163,820 square kilometres (km^2) and a population of approximately 541,638 (ABS,2013), Suriname borders the Atlantic Ocean in the north, the Republic of Guyana in the west, the Federative Republic of Brazil in the south, and the French Département Guyane in the east. Suriname has a tropical climate with abundant rainfall, an average temperature of 27.4 Celsius and high humidity.

A large part of the population lives in the coastal area along the Atlantic. Approximately 66% of Suriname's total population is concentrated in the urban area (capital Paramaribo and Wanica), and 21% in the other rural districts (ABS, 2013). The interior of Suriname (the Hinterland; districts Marowijne, Brokopondo and Sipaliwini) are sparsely (13% of the total population) inhabited, predominantly by Amerindians and the Maroons in small (mainly) tribal communities along rivers in the interior. The overall population density is 3.3 people per km^2, which makes Suriname a very low populated country.

Suriname is endowed with many natural resources including soil, water, forests and mineral ores. Its economy is dominated by the mineral and energy sectors (gold, oil, and alumina) which account for approximately 30% of GDP. Agriculture and manufacturing, though relatively small, remain important goods producing sectors. The service sector, 45% of GDP, is driven primarily by trade and transport activities. The tourism sector is 15% of GDP. The informal sector is also significant and may increase current estimates of GDP by up to 16% according to the Bureau of Statistics.

Suriname is one of the few Caribbean countries to post positive growth during last ten years[3]. Strong performances in the oil and gold sectors and continued infrastructure development contributed to real GDP growth of 4.5% in 2012 (4.1% in 2010 and 4.7% in 2011)[4]. GDP growth is mainly driven by continued buoyant commodity export prices (gold, petroleum, and alumina), elevated government spending and large capital investments in the mineral and energy sectors. Growth is expected to average around 4.5% in 2013[5]. In 2012 the gross domestic product

[3] ECLAC's flagship report 'Economic Survey of Latin America and the Caribbean 2009-2010'
[4] Statistics from the Central Bank of Suriname, Internet Feb 2013
[5] ECLAC, Economic Survey of Latin America and the Caribbean ▪ 2013

(GDP) per capita was estimated at 4,479 USD (constant 2005 US$).The contributions to the GDP as of 2010[6] are as follows:

- Primary sector (agriculture and mining) = 16%,
- Secondary sector (industry, energy, construction) = 28%,
- Tertiary sector (services) = 38%
- Informal sector 18%.

Poverty

The total labour force in 2012 is determined at 215,788. The number of employed and unemployed individuals in 2012 was 188,229 and 27,559 respectively (unemployment rate of 12.8%), although in reality the unemployment rate is much higher. There is a much higher participation in the economy by men than by women, and the total participation ratios are low (only 56% of the working age population claim to be formally employed). Many individuals work in the informal sector. The number of households counted during the census in 2004 (ABS, census 2004)[7] was 123,463. Male heads of households are approximately double the number of female headed households.. With a HDI of 0.684 Suriname is only ranking 105 (out of 179) in the 2013 Human Development Report. Notwithstanding the economic growth in the past ten years, the country remains below the regional average of 0.741 (Latin America and the Caribbean). Urban poverty exists but the main disadvantaged groups are the Maroons and Amerindians living in the vast interior of the country[8]. According to the PAHO, 69.2% of Suriname's population are living under the national poverty line[9].

1.2 Situation in the Energy Sector

2. Energy supply

Primary energy sources

Suriname is endowed with many energy sources including crude oil, hydro energy, biomass, solar energy and wind energy. Although the country has a significant potential in the use of solar energy, and considerable opportunities in the area of other renewable sources of energy, it is still not well developed. Solar- and wind energy sources are used on small scale mostly in the hinterland. Energy from biomass is most potential as Staatsolie (State oil company) is

[6] Second National Communication Suriname, 2013
[7] In this report, data from the last census of 2004 is used, since the next household census has yet to take place in 2014.
[8] www.ecu.europa.eu, Feb 2013
[9] Under this national poverty line where 2,400 calories per day for an adult indicate/delimit poverty, 69.2% of population has no access to this amount of consumption.

currently conducting a study in generating ethanol from sugar cane. The main energy sources currently used in Suriname are crude oil and hydro energy.

Total primary energy supply (2010) is 5,668,080 BOE[10]. The projected energy demand to 2022 is 500 MW with an annual growth rate of 6%. Totalinstalled electricity capacity (2013) is 274 MW. This installed capacity, connected to the system includes generation from the EPAR grid (EBS: 82 MW, Staatsoile: 28 MW, hydropower: 125 MW) the ENICK grid: 17 MW and the rural districts power systems: 22 MW[11].

Power sector

The power sector in Suriname consists mainly of two types of power systems: individual thermal power plants and a large hydro power plant. Electricity is thus produced by this hydropower plant (the Afobaka Hydropower Plant) and private and public thermal generators. The Afobaka Hydropower Plant at lake Brokopondo has an installed capacity of 189 MegaWatts (MW), of which only 125MW is assigned to Afobaka hydroelectric power plant, according the EBS-SURALCO power purchase contract

Since 1999 the contribution of hydro power to the grid is at least 700 GWh, and in extra raining seasons this amount is increased by 15-20% contractually. EBS, the national power company, supplies the rest of the Paramaribo area (North-Center region: EPAR) through diesel generators with an approximate peak load of 139 MW (2010). Nowadays a substantial part of the generators is fuelled with Heavy Fuel Oil (HFO). Since August 2009 extra thermal power of average 60 MW is generated in the thermal power station of EBS and backed up by SPCS (Staatsolie Power Company Suriname). SPCS is an IPP which is in operation since 2006 and is owned by the State Oil Company of Suriname (Staatsolie).

The districts in Suriname, typically in the coastal areas, are provided with electricity by EBS through the ENICK grid, with independently operated power systems. The ENICK grid provides district Nickerie (The Northwest area) and the Northeast area around Moengo and Albina.

About 430,000 people (app. 79% of the total population) in Suriname receive electricity from these grids. In 2012, EBS had 136,988 registered customers (connections), of which 121,981 (89%) were residential, 13,952 (10%) commercial, and the remainder industrial and other. Table I below shows the number of EBS connections in whole Suriname.

[10] ECLAC, Final draft 'Suriname's National Energy Policy 2013 – 2033'.
[11] IDB report (SU-L1035), SUPPORT TO THE INSTITUTIONAL AND OPERATIONAL STRENGTHENING OF THE ENERGY SECTOR, August 27th, 2013

Number of connections	2009	2010	2011	2012
Residential	111,497	115,324	119,316	121,981
Commercial	12,357	12,915	13,491	13,952
Industrial	955	947	947	952
Other sectors	82	92	93	103
Annual number of connections	**124,891**	**129,278**	**133,847**	**136,988**

*Table I: Number of electricity connections from EBS in whole of Suriname.*Source: EBS,2013

The next figure shows the electricity usage in Suriname in 2012 (48% residential, 34% industrial/ commercial and 18% other sectors).

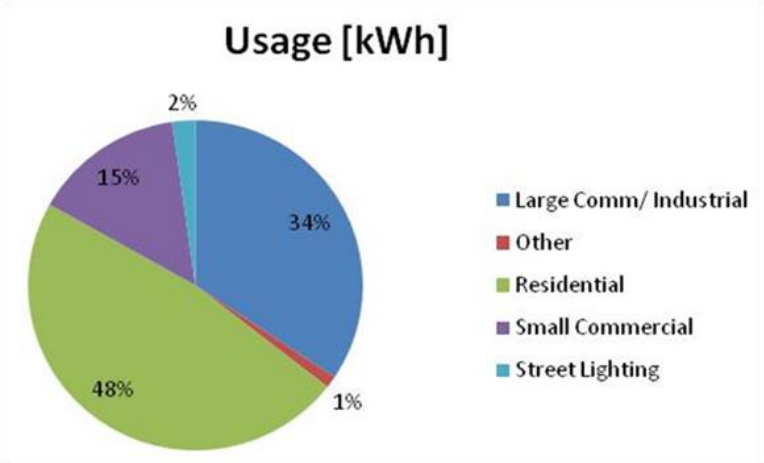

Figure I: Electricity usage in Suriname in 2012

Small power systems exist in the interior of Suriname that is providing electric power to local villages, which are owned and operated by the Department for Rural Energy of the Ministry of Natural Resources (DEV). In 2012 an estimated total of 130 villages had a diesel unit installed by DEV[12].

[12] According to a listing by MNH (May 2012), 96 villages received a total of 724 barrels of diesel fuel in that month (144,800 liters). The total installed generating capacity was 4,512-kW, ranging from 7-kW to 132-kW. Typical diesel capacities are 30-kW to 60-kW per village. KEMA identified a total of 110 villages served in 2008, with a fuel demand of 150,552 liters and 4,221-kW capacities. These figures coincide fairly well. KEMA counted a population of 21,465 people over 53 villages; data for the remaining 47 villages were lacking. The combined lists give a total of 133 villages and some villages are no longer served, possibly because they have been connected to the grid or because people have migrated permanently or temporarily. (See document: "Suriname Power Sector Assessment and Alternatives for its Modernization", prepared by KEMA Consulting for MNH and financed by IDB (ATN/SF-9038-SU), December 2008).

The following figure provides a schematic overview of the different systems currently in operation (Kema, 2008).

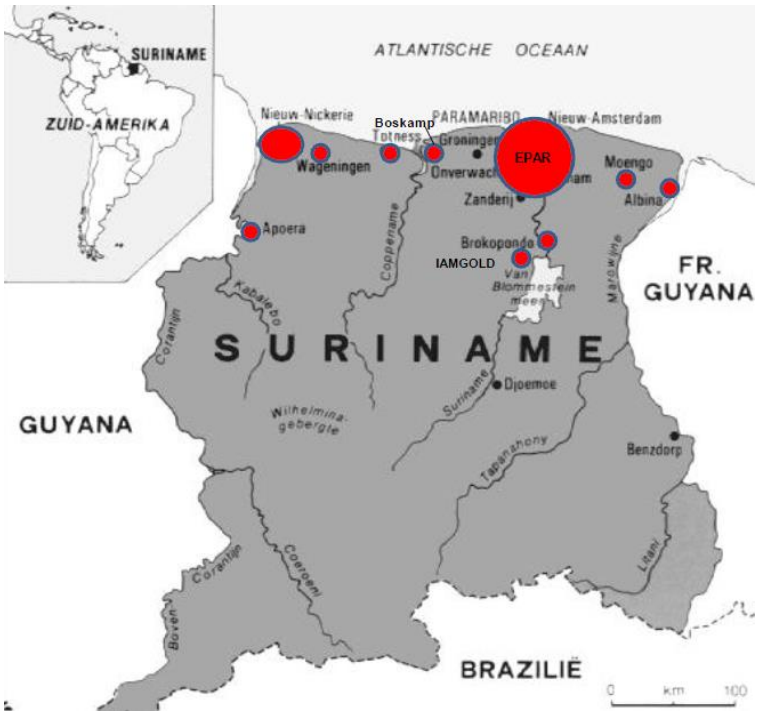

Figure II: overview of the different systems, EPAR, ENICK etc.

Table II gives an overview of the energy imported, produces and consumed in Suriname. Whereas table III provides statistic information from Staatsolie about their production of the energy sources in Suriname..

Petroleum products (in thousand Barrels per day)	2008	2009	2010	2011
Consumption	14	14	14	14
Net Exports/ Imports (-)	2	1.33	1.33	1.42
Refinery Capacity	7	7	7	7
Proved reserves	0.088	0.088	0.088	0.088

Table II: Overview of energy imported, produced and consumed in Suriname.
Source: EIA, Energy Information Administration, January 2013 (International Energy Annual, Short Term Energy Outlook)

Description	2008	2009	2010	2011
Gas production (x1,000 SCFD)	550	590	537	526
Crude Oil Production (x milj barrels)	5.5	5.86	5.80	5.99
Electricity Generation (x kWh) SPCS	3.1	38,679,157	79,602,998	48,159,310
Energy production (Back-up Production in Saramacca) (x kWh)	-	539	675	870

Table III: Production of energy sources in Suriname by Staatsolie.
Source: Staatsolie Maatschappij Suriname (State Oil Company)
Note: The produced gas is for own use
SCFD= Standard Cubic Feed per Day

3. Energy demand

Energy demand is mainly concentrated in Paramaribo and its surroundings, followed by the region Nickerie. In the country's energy supply system there is an overall (known) shortage of at least 106 GWh/year (20% of the annual consumption) and the energy is unequally distributed [Naipal, 2005; Tractabel, 2000]. In the inland and other less developed parts, wood is used as main energy source. The number of households using wood or charcoal for cooking is about 16% of households. Electricity in these parts can only be generated if barrels of diesel are flown in.

The electric power growth rate in Suriname is approximately 6% annually. Demand for electricity in Suriname is continuously rising as a direct effect of economic development. Between 1970 and 2009 the demand in the EPAR system has risen from 22 MW to 170 MW (from 123 GWh/year to around 1,000 GWh/year). According to figure I the demand in the EPAR system in 2012 is around 1,219 GWh. Forecasts shows that power demand for Suriname is expected to increase by 500 MW by 2022. The level of electrification is estimated at 85 percent with high coverage along the coast. About 15 percent of the population in the interior lacks access to electricity[13].

Figure I shows the national growth of the electricity consumption in kWh for Suriname, starting from the year 2000.

[13] The electrification rate is only estimated in percentage of the population, not in number of households.

	Districts bedrijven including Nickerie (kWh)	EPAR (kWh)	Total national Energy demand (kWh)
year			
2000	53,540,590	577,300,000	630,840,590
2001	52,964,457	611,700,000	664,664,457
2002	55,110,993	662,400,000	717,510,993
2003	59,429,177	715,100,000	774,529,177
2004	69,081,193	772,500,000	841,581,193
2005	70,998,573	816,100,000	887,098,573
2006	72,315,774	805,800,000	878,115,774
2007	74,434,700	838,474,212	912,908,912
2008	76,216,070	917,803,107	994,019,177
2009	84,529,782	1,000,051,357	1,084,581,139
2010	94,016,497	1,078,819,377	1,172,835,874
2011	97,275,941	1,166,710,229	1,263,986,170
2012	86,345,458	1,218,873,370	1,305,218,828

Figure III: National growth of the electricity consumption in kWh, 2000-2012. Source website www.ebs.sr, retrieved February 8th.

In the period of 1982 to 2006 load-shedding became an inevitable practice due to frequent shortage of supply in the EPAR grid. This created an inconvenience for business, industry and households.

Table V below shows the total consumptions per sector. These sectors are nationally adapted and used as such by ABS, the Statistic Office of Suriname.

Annual Electricity Consumption (MWh)	2012
Total production	1,305,219
Residential	573,191
Commercial	327,262
Industrial	379,488
Other*	25,278

Table V: consumption of electricity per sector. Source: EBS(*includes streetlights)

4. Energy and economic development

No information available on this item.

5. Energy strategy and relevant targets

The primary sector will grow significantly during the period 2015-2025 years. Suriname has aspirations of becoming a major player in the agriculture sector, providing mainly the Caricom market with products. Also the mining sector will be developed significantly in future years. There are plans to develop the energy sector faster in the near future. Due to economic development, the demand for energy will grow and Suriname needs to invest in this sector.

The medium-term economic outlook for Suriname is favourable. Growth prospects for the coming years look promising. Major new gold and bauxite mines are to be opened in 2014-2015, providing further impetus to economic growth and government revenue.

Suriname has just recently signed a contract to build a new greenfield 63 MW power plant. This project forms the keystone building block in the long-term development plans for Suriname's regional electricity expansion program, recently tabled by EBS, to secure a more stable, efficient and environmentally responsible electricity supply for the inhabitants of the capital city region of Paramaribo.In Suriname there is no regulatory energy sector framework. The Ministry of Natural Resources (MNH) has the primary responsibility for the sector but has limited technical and financial resources and insufficient autonomy. Recently stakeholders within the energy sector (EBS, Staatsolie) are in the process of developing policy for regulating, strengthening and expanding the energy sector.

Section 2. Current situation with regard to SE4ALL goals

2.1 Energy access vis-á-vis Goal of SE4ALL

6. Overview and assessment

Suriname is the greenest nation on earth where the south tropical rainforest and sparsely inhabited savanna are covering almost 80% of the country. Most of the population (ca. 86%) lives in the northern coastal zone, especially in the capital, Paramaribo. The rest of the population lives in the interior (the hinterlands).

The interior of Suriname is sparsely populated but has nonetheless a number of small communities, some of which are supplied by the electricity department of the Ministry of Natural Resources (DEV). Due to a lack of adequate infrastructure in the interior many villages have limited or no access to electricity and are not connected to the grid. In the inland and other less developed parts, wood is used as main energy source. Electricity in these parts can only be generated if barrels of diesel are flown in. In 2012 an estimated total of 130 villages had a diesel unit installed by DEV[14].

7. Modern energy for thermal applications (cooking, heating).

Heating facilities in households are inapplicable in Suriname due to the tropical temperatures. Thermal energy for households is mainly in the form of imported LPG gas (cooking gas). LPG gas is shipped to Suriname from Trinidad. In Suriname the gas is pumped into boltanks and through a system cylinders it can be filled and distributed.

The use of cooking gas is by far the most important fuel used for cooking by households in Suriname: 87% of the households in the capital (Paramaribo) and adjacent district Wanica (where app. 66% of the total population of Suriname lives) uses LPG gas for cooking. The demand over the whole country can be illustrated by the following figures: 70% are the domestic users, the commercial users (bakeries, restaurants, hotels) counts for 17.6% and the industrial users (heating & welding purposes) counts for 3.4%.

[14] According to a listing by MNH (May 2012), 96 villages received a total of 724 barrels of diesel fuel in that month (144,800 liters). The total installed generating capacity was 4,512-kW, ranging from 7-kW to 132-kW. Typical diesel capacities are 30-kW to 60-kW per village. KEMA identified a total of 110 villages served in 2008, with a fuel demand of 150,552 liters and 4,221-kW capacities. These figures coincide fairly well. KEMA counted a population of 21,465 people over 53 villages; data for the remaining 47 villages were lacking. The combined lists give a total of 133 villages and some villages are no longer served, possibly because they have been connected to the grid or because people have migrated permanently or temporarily. (See document: "Suriname Power Sector Assessment and Alternatives for its Modernization", prepared by KEMA Consulting for MNH and financed by IDB (ATN/SF-9038-SU), December 2008).

OGANE (Department of EBS) is in charge of delivering LPG to households. OGANE distributes 90% of her propane in cylinders and 10% in bulk to commercial and industrial customers. On daily basis 3000 cylinders are filled with LPG, which is distributed in 3 types of cylinders: 20 lbs, 28 lbs and 100 lbs. The cost of these cylinders is shown in table VI.

Gas bottles	Deposit	Cost for LPG
20 (lbs)	SRD 187.50	SRD 35.75
28 (lbs)	SRD 215.00	SRD 48.50
100 (lbs)	SRD 800.00	SRD 372.00

Table VI: cost of cylinder (source: www.nvebs.com, april 2013)

Between 2008 and 2011 the amount of cooking gas increased by 11%. Table VII shows the total cooking gas production between 2008 and 2011.

Year	Cooking gas (LPG) in kg
2008	13,769,478
2009	14,294,697
2010	14,754,150
2011	15,285,138

Table VII: Cooking gas production 2008-2011 (source: ABS, Environment Statistics 2012)

The distribution chain of cooking gas in the coastal strip of Suriname is well developed. Approximately 340 outlets are serviced by the filling plants at Livorno Paramaribo and Longmay Nickerie.

To the South, the Lelydorp and Para areas have good coverage and our sales capability on the stretch Paranam – Brownsweg- Atjoni is being developed fast. Unfortunately, this cannot be said of the Sipaliwini region, where transport is a challenge.

Also wood and charcoal are used as a source for fuel used for cooking. Table VIII shows the number of households by kind of fuel used for cooking in 2004 .

Cooking fuel	Number of households	Percent
Gas	97.166	78,7%
Wood and Charcoal	19.941	16,2%
Petroleum	916	0,7%
Electricity	995	0,8%
Other	181	0,1%
Doesn't cook	937	0,8%
Don't know	3.327	2,7%
Total:	**123.463**	**100%**

Table VIII: number of households by kind of fuel used for cooking in 2004. Source: Stichting Energie en Duurzame Ontwikkeling Suriname, Aanzet tot rapportage van energie-indicatoren voor duurzame ontwikkeling in Suriname, 2011

8. Access to Electricity

The Suriname energy sector is mainly controlled by EBS, a state-owned public company, which produces electricity for the Paramaribo region and surroundings. Electricity is generated by diesel driven internal combustion engines Nowadays a substantial part of these generators are fuelled with Heavy Fuel Oil (HFO) supplied by Staatsolie (State Oil Company). The EBS receives electricity from hydro power generation from the Afobaka Power Plant and diesel thermal electricity from EBS own generators, Staatsolie and Suralco.

However the capacity of the EBS is not enough to supply all electrical energy to these areas. Therefore the EBS depends on the Government, which provides it with electricity from the Afobaka hydro site under the terms of an agreement with SURALCO, an aluminium producer that built and operates the facility.

Since 1999[15] the contribution of hydro power to the grid became at least 700 GWh, and in extra raining seasons this amount is increased with 15-20% contractually. Suriname is covering more than 50% of her electricity demand with this renewable energy source for years.

The Suriname power sector consists of a number of individual power systems. Some of these systems are interconnected while others are operated as an electrical island. Table IX gives an overview of the different systems.

Power system	Area	Demand 2011 (GWh)
EPAR system	Paramaribo and the surroundings	1,167
ENICK system	New Nickerie in West Suriname, and the surroundings	68
Rural District Power Systems (operate as isolated power systems)	Albina, Moengo, Boskamp, Coronie, Wageningen, Apoera	29
Rosebel Gold Mines	Is supplied with electric power via a dedicated 161 kV overhead power line coming from Afobaka Hydro power Plant	193
Brokopondo distribution system	This system feeds some villages in the Brokopondo district from the 13.8 kV system at the Afobaka Hydro Power Plant and several small power systems exist in interior of Suriname.	-

Table IX: Overview of the various power systems

Not all households in Suriname have sustainable access to electricity supply (distribution) network. ABS, the statistical office of Suriname, doesn't provide data on 'households without

[15] In 1999 Suralco closes its smelter, resulting in a increased contribution of hydropower. EBS purchases increased substantially from 50-MW in 1996 to 120-MW in 2007.

access to electricity', but for the year 2004 this indicator is estimated in the following report 'Aanzet tot rapportage van energie-indicatoren voor duurzame ontwikkeling in Suriname, 2011 from Stichting Energie & Duurzame Ontwikkeling Suriname.'[16]

Year	Population Suriname (MId- year)	Estimated number of households in Suriname	Population in the interior (mid year)	Estimated number of households in the interior	Ratio population interior/ Total population (%)	Estimation of households without electricity (%)
2004	492.829	123.463	64.993	17.651	13,19%	14,30%

Table X: Households without access to electricity in 2004. Source: Stichting Energie en Duurzame Ontwikkeling Suriname, Aanzet tot rapportage van energie-indicatoren voor duurzame ontwikkeling in Suriname, 2011

Electrification level in Suriname is estimated at 85%, with 79% of the population connected to the national grid and 6%, which live in the Hinterland, reliant on diesel unit installed by the Department for Rural Energy. Most of these villages rely on small diesel generators between 6pm and 10 pm installed by the DEV[17]. The remaining app. 15% of the population have no access to electricity and are not connected to the national grid.

Year	Direct connections EBS	Direct connections NH and RO	Electricity via neighbours	Own generator	Other	No electricity	Unknown	Total
2004	94.451	3.205	4.158	1.058	4.170	10.248	2.867	120.157[18]
	78,61%	2,67%	3,46%	0,88%	3,47%	8,53%	2,39%	100%

Table XI: Number of electrical connections (direct connection to the EBS network, NH or RO) and others that do not fall into this category. Source: Aanzet tot rapportage van energie-indicatoren voor duurzame ontwikkeling in Suriname, 2011.

The diesel is provided free of charge, and there is no tariff regime in place. These generators are mostly used between 6pm and 10pm due to limited supply of diesel by the government. Table XII shows the number of electrical connections and table XII the household expenditure on housing, utilities and energy.

Household	Lower than the	Average	Higher than the

[16] Aanzet tot rapportage van energie-indicatoren voor duurzame ontwikkeling in Suriname, 2011 (translated in English: Towards reporting of energy indicators for sustainable development, 2011. Stichting Energie & Duurzame Ontwikkeling Suriname.

[17] REEEP Policy Database

[18] Regarding electrical connection it can be stated that EBS works with residential customers, but a 'home' may have more than one household and thus more than one connection.

expenditure	*median ($SRD_{2007/2008}$/month)*	*($SRD_{2007/2008}$/month)*	*median ($SRD_{2007/2008}$/month)*
Housing + water (80%)	11,43%	11,71%	11,80%
Electricity (20%)	2,31%	2,66%	2,78%
Transport	6,05%	12,06%	13,92%

Table XII: Household Expenditure on housing, utilities and transportation,resulting in an estimation of household expenditure and a percentage spent on energy. Source: Aanzet tot rapportage van energie-indicatoren voor duurzame ontwikkeling in Suriname, 2011.

Power generation costs of EBS in 2012 are estimated at 0.20US$/kWh, while the average tariff is app. 0.07US$/kWh, resulting in a direct government subsidy. EBS' low liquidity position requires financial support from the Government of Suriname.

Currently, every month about 150,552 litres of diesel are transported to the villages in the interior; the total operating costs for DEV in 2007 was estimated to be US$0.63 per kWh (Kema, 2008). The increasing costs of fuel prices put additional pressure on the security of supply and biomass (forest), and on government resources. In some villages, especially those that are located in the remote interior, the use of diesel generators becomes unfeasible due to the cost of fuel transportation and the difficulty of maintenance.

Sectoral distribution of energy consumptions and tariff prices	
Sector 2007	**Tariff Prices (2006)**
Households = 103,651 clients Consumption 3,733 Max 25 kVA	0.055 including reduced rate for those paying standing charges

Table XIII: Sectoral distribution of energy and tariff prices. Source: Aanzet tot rapportage van energie-indicatoren voor duurzame ontwikkeling in Suriname, 2011.

In the period of 1982 to 2006 frequent shortage of supply in the EPAR-grid led to load-shedding. This created inconveniences for business, industry and households. After rehabilitation and expansion of the power plant of EBS, the commissioning of the 161kV transmission infrastructures from Paranam to Paramaribo and the erection of a new IPP owned by the State Oil Company (Staatsolie), there were, for some period, no load shedding settings any more. However, a direct effect of economic development is the increase in energy demand which is continuously rising.

Between 1970 and 2009 the demand in the EPAR system has risen from 22 MW to 170 MW (from 123 GWh/year to around 1,000 GWh/year), see figure II. A large portion of the increase in demand for electricity is due to an increase in residential demand (due to urbanization and the

growth of house-building). Especially additional equipment such as air conditioners, hydrophores, washing machines, TVs, computers and electric stoves provide additional demand. Due to the lack of adequate investments in power generation e.g. large disturbances and fluctuations in the HPP, frequent load shedding is still occurring.

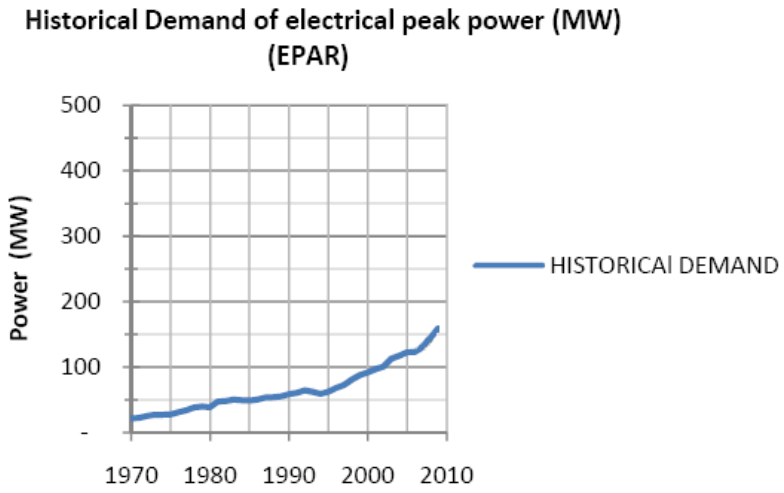

Figure IV:.Historical growths in peak demand for electric power (MW) of the EPAR network 1970-2009. (EBS, 2009)[19]

9. Modern energy for productive uses

The productive sector (large manufacturers) which is mainly located in Paramaribo and Wanica, generates its electricity from the national grid. Table XIV below shows the consumption of electricity per sector according to EBS. Table XV gives an overview of the sectoral distribution of energy consumptions and tariff prices.

Annual Electricity Consumption (MWh)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012

[19] FORNELIO H. FORSTER, A STUDY OF THE DETERMINANTS OF HOUSEHOLD'S DEMAND FOR ELECTRICITY: "A CASE STUDY OF NV EBS", FHR Thesis, 2010

Total production	774,529	841,581	887,099	878,116	912,909	992,592	1,069,913	1,157,486	1,218,217	1,305,219
Residential	331,360	357,100	386,230	382,773	386,958	415,611	456,548	504,472	534,468	573,191
Commercial	162,234	175,267	198,264	199,762	225,472	243,496	247,882	280,825	300,004	327,262
Industrial	164,964	169,088	175,189	219,728	228,739	247,890	345,820	349,482	361,234	379,488
Other*	115,971	140,126	127,416	75,853	71,740	85,595	19,663	22,707	22,511	25,278

*Table XIV: consumption of electricity per sector/ *= includes streetlighting.* Source: ABS, 2012 (from 2003-2008) and EBS, July 2013 (from 2009-2012).

Sectoral distribution of energy consumptions and tariff prices	
Sector 2007	**Tariff Prices (2006)**
Commercial (small) churches, social institutions (10,946 clients) consumption (13,094 kWh/year) Max 25 kVA	0.084 including reduced rate for those paying standing charges
Commercial (large) industry (1,127 clients) >25 kVA or High Voltage connection	0.078 including surcharges per kVA, high and low tariff, cost and reduced rates for those paying standing charges

Table XV: Sectoral distribution of energy consumptions and tariff prices. Source: Aanzet tot rapportage van energie-indicatoren voor duurzame ontwikkeling in Suriname, 2011.

The Ministry of Natural Resources (MNH) has the primary responsibility for the sector including rural electrification, with very limited resources to effectively undertake regulatory tasks. The tariff policy and the tariff adjustments are under its responsibility. The Energy Advies Commissie (EAC) is involved in the development of electricity tariffs but it only has an advisory role.

The grid operates according to the rainfall seasons. During periods of high water level in the Afobaka lake, EBS purchases low cost electricity from the Afobaka hydro site (HPP). When needed, EBS generates the necessary power at its Saramacastraat Power Plant. If more power is demanded, EBS purchased electrical power from the Staatsolie Thermal Power Plant. Afobaka HPP also supplies power to SURALCO and IMAGOLD (gold mining company) through dedicated lines. The largest companies in the gold and bauxite sector, as well as larger manufacturing companies, run their operations primarily on diesel-powered generators.

2.2 Energy Efficiency vis-á-vis Goal of SE4ALL

10. Overview and Assessment

The energy efficiency portfolio lies among the Department of Energy of the Ministry of Natural Resources, State Power Company NV Energie Bedrijven Suriname, (NV EBS) and the State Oil Company Suriname (Staatsolie Maatschappij). There is no official energy efficiency agency at the moment but each agency has its own efficiency programme approved by the Minister.

However, there are no laws, regulations or other regulatory instrument that promotes energy efficiency in Suriname. The only explicit energy efficiency policy is directed at the importation of used cars under five years old to encourage fuel conservation and reduction in carbon emissions. In addition, several implicit policies[20] are as well applied such as:

- Purchase of more hydro energy from Suralco;
- Instead of using diesel, EBS now uses locally-produced Heavy Fuel Oil or other Vacuum Gas Oil (HVGO) from the State Oil Company for power generation;
- Free installation of energy saving lamps for households. This is a 'once-only' activity carried out in cooperation with Cuba; (however there is no incentive to buy more lamps because of a lack of continuity despite the positive effects on energy consumption);
- Promoting the use of renewable energy in rural villages by the government.

Suriname's First ánd Second National Communication states that "An increase in diversification and energy efficiency in all sectors of economic activity is needed to reduce green-house-gas emissions"[21]. The National Communication therefore identifies several possibilities to improve the energy efficiency. One of them is improving the entire process of the energy generation – transmission – distribution - supply. Also by using cleaner energy and new technologies, especially in the Hinterlands, the energy efficiency will improve. Most important is the need to improve the management of the energy in the demand sector (energy efficiency) and the potential for the use of thermo solar applications.

11. Energy intensity of national economy

It is a challenge to produce numbers regarding this indicator, because the energy consumption and its value added by sector are insufficiently precise mapped in Suriname.

However, the U.S. Energy Information Administration (EIA) does provides some information on energy intensity of Suriname for the years 2007-2010. See table XVI below.

[20] ECLAC, REPORT OF THE MEETING ON ENERGY EFFICIENCY IN THE CARIBBEAN, 2009
[21] NIMOS, Suriname's First National Communication

Energy Intensity- Total Primary Energy Consumption in Quadrillion BTU (Btu per Year 2005 U.S. Dollars (Market Exchange Rates)			
2007	**2008**	**2009**	**2010**
11,825.6659	11,375.3252	11,174.1161	10,536.501

Table XVI: Energy Intensity Suriname for the period 2007-2010. Source: www.eia.gov, retrieved February 17th, 2014

2.3 Renewable Energy vis-á-vis Goal of SE4ALL

12. Overview and Assessment

Currently, the main renewable source of energy in Suriname is hydropower. Almost 15% of the population live in the hinterland far from the centralized power supply systems. The most accessible sources of renewable energy for them are river, solar and bio energy.

In the Paramaribo area, electric power is supplied by means of hydroelectric power through the Afobaka hydro power plant. Most of the energy that is provided by hydro power accounts for over 50% at 130MW at peak for the capital city and the outskirts. This hydro generation is due to the high level of water in the lake but there are implications for low levels of water in the lake that may occur in the future.

Forecasts show that peak load for Suriname as a whole will grow to 500 MW in the year 2022[22].

Due to the growing demand of energy, increasing hydroelectric power is challenging because there is no formal policy to promote further hydro installations[23]. Any additional energy demand is usually covered with diesel generators, which have a lower cost per capacity installed, and a shorter installation time, but a much higher operational cost.

In 2006 Staatsolie made its transition from an oil company to an energy company. Besides exploring, producing and refining crude oil, Staatsolie is now engaged in many renewable energy projects. An ethanol project is currently being implemented. This project will be able to produce between 14 and 15 million litres of ethanol by 2016 and will be able to produce E-15 for the transport sector. The project also will produce 25MW power from bagasse[24]. Staatsolie is also undertaking feasibility studies on the proposed Tapajai hydro power project, that will add 168 MW to the current capacity of the Afobaka dam of 189 MW. This hydro power project is currently on hold due to political issues.

[22] ECLAC, Final draft 'Suriname's National Energy Policy 2013 – 2033'
[23] ECLAC, REPORT OF THE MEETING ON ENERGY EFFICIENCY IN THE CARIBBEAN, 2009
[24] ECLAC, Final draft 'Suriname's National Energy Policy 2013 – 2033'

The Government of Suriname has recently entered a fairly comprehensive Memorandum of Understanding with the Government of Brazil which will promote the production and use of bio-energy in both countries as well as to establish a basis for the two countries to work together in various regional and multilateral forums for the development of an international biofuels market.

The government is also exploring other options like the use of small hydro-power plants in the interior. Also the use of small solar powered units for water distribution in 11 villages.

Anton de Kom University of Suriname (AdeKUS) is conducting extensive research in the use of renewables in the energy supply mix – this research includes waste-to-energy, use of solar, small hydro dams, biodiesel and wind energy. One wind turbine in northeast Galibi is active, which is owned and managed by a lodge owner.

Currently AdeKUS is now engaging in a EU-project. This project focuses on mainstreaming energy efficiency in relationship to sustainable economic development and Climate Change into existing curricula and CPD in Urban and Transportation Planning, Engineering and Architecture of Caribbean Higher Education Institutes (HEIs) and increase inter-institutional networking and regional capacity in energy and the built environment.

Another EU-project in which AdeKUS is engaged is the Edulink 2 project: 'Capacity building in applied renewable energy technologies in Guyana and Suriname'. The goal of this project is to strengthen the universities in the field of applied technologies for renewable energy with a view to the sustainable economic and social development of Guyana and Suriname.

The Kwamalasemutu Project, plus small scale solar applications has demonstrated the technical feasibility of using solar energy for electricity supply in Suriname.Solar systems are envisaged to continue playing a key role in the electrification of Maroons and Amerindian communities.

In the near future IAM Gold (mining company) will start with the construction of a 5MW solar power plant[25].

In places where villages are near waterfalls, the government is exploring the use of micro and mini hydro power.

Currently a feasibility study for generating biofuel out of elephant grass on mined out lands will be conducted. This study will be undertaken by a private institution CROP with funding from SIDS DOCK.

[25] www.gov.sr: website Ministry of Natural resources

13. On-grid and off-grid renewable energy

As mentioned before, the Suriname power sector consists of a number of individual power systems. Some of these systems are interconnected while others operate as electrical islands. The Afobaka Hydro Power Plant (HPP) is connected via 161 kiloVolt (kV) of transmission line, owned and operated by SURALCO, with the national grid (EPAR). Currently no other renewable energy source is being generated.

14. Use of renewable energy sources (RES) for thermal applications (cooking/ heating)

In Suriname, thermal power generation for cooking is generated by cooking gas. The number of households that uses electric stoves is likely to be negligible[26]. There is no expectation that renewable energy will be used for thermal power generation for cooking in the near future.

15. Use of RES for productive activities

Besides Suralco and IAMGOLD using hydropower, the use of renewable sources of energy for industry and manufacturing activities can be illustrated by the use of solar collectors within the tourism sector in the interior. For example, some of the big tourism resorts are located in the remote interior and thus can't be connected to the national grid. Supply of energy mostly takes place by a combination of solar collectors and own generators.

16. Consolidated Summary

The main problems for Suriname in achieving SE4ALL goals are as follows:

- Frequent load shedding occurring mostly in the coastal zone where the majority of the population lives. The provision of electricity to the rural areas by DEV is costly and not efficient. The supply is also limited to 4-6 hours per day.
- No energy efficiency framework available, resulting in low energy efficiency of technologies applied at large production enterprises and lack of investments for technology modernization;
- Use of renewable energy sources in both the coastal zone and the interior encounters an important obstacle in the highly subsidized energy. The introduction of user fees to improve the sustainability of energy in the interior is still far from being feasible. The slow development of renewable energy is partly due to a lack of financial mechanism and institutional support.

[26] No actual data available on the number of electric stoves.

2.4 SE4ALL Goals

In the first half year of 2013, the Final draft of National Energy Policy 2013-2033 was released. The following text regarding the vision and goals of the energy sector in Suriname comes from the Final draft of the National Energy Policy 2013-2033, page 3[27], which is more or less in line with the SE4ALL goals:

The development of Suriname's national energy policy will take into consideration goals and strategies that will facilitate access to electricity for all, secure and sustainable energy supply using both renewable energy sources and fossil fuels, as well as exploring options for developing the country's indigenous energy sources.

Its vision is:
A modern, efficient energy sector, providing all citizens and sectors with access to reliable and affordable energy supplies and long-term energy security towards enhancing the quality of life of all Surinamese, advancing international competiveness and environmental sustainability
Vision of Suriname's Energy Sector to 2033

The vision is more or less in line with the SE4ALL Goals. The Strategic Framework, which comprises the goals and strategies underpinning this National Energy Policy, is comprehensive and is expected to be durable to 2033 and beyond, yet flexible and adaptable to meet new challenges and opportunities as they arise. This Strategic Framework addresses both supply and demand energy issues and places priority attention on seven key areas:

1. Providing access to energy for all and ensuring energy security
2. Security of Energy Supply through diversification of fuels
3. Modernizing the country's energy infrastructure
4. Increasing the proportion of renewables potential in the energy mix[28]
5. Energy conservation and efficiency[29] .
6. Development of a comprehensive governance/regulatory framework to effectively support the advancement of the energy sector
7. Eco-efficiency in the mining sector and other productive sectors

[27] ECLAC, Final draft 'Suriname's National Energy Policy 2013 – 2033'
[28] There is yet no target set. This has to be developed by the Government in consultation with the private sector and civil society
[29] There is yet no target set. This has to be developed by the Government in consultation with the private sector and civil society

The National Energy Policy will ensure that by 2033, all citizens will have access to energy and there will be energy security that will contribute to advancing the economy of the country, contributing to international competiveness and marked reductions in poverty. Through the policy, Suriname will set the foundation to enable it to take further advantage of renewable sources of energy. The policy also will provide strategies to ensure effective promotion of conservation and efficiency in the use of energy resources within all sectors of the society, thereby creating a more sustainable Suriname.

17. Goals

- *Energy access*

In the National Energy Policy 2013-2033 (final draft, section 2, page 14) it is stated that *all citizens have access to reliable and affordable energy supplies and Suriname is able to meet its energy demands for households and industry, improving the quality of life of all.* Emphasis will be placed on ensuring access to reliable and affordable energy for all citizens of Suriname by 2033. Suriname has been able to provide almost all its citizens (85%) with access to electricity. This goal will ensure that the remaining 15%, largely in the interior, have access to electricity.

- *Energy efficiency*

The National Energy Policy 2013-2033 (final draft, section 2, page 15) states its second goal: *Suriname has modern energy infrastructure that enhances energy generation capacity and ensures that energy is transported safely, reliably and affordably to homes and communities throughout the country and the productive sectors on a sustainable basis.* So in 2033 Suriname will have a modernized energy infrastructure consisting of energy-efficient plants and distribution systems. The goal also will facilitate the country to be better able to access and select diversification priorities for the short, medium and long term based on cost, efficiency, access to energy for all, environmental considerations and appropriate technologies.

- *Renewable energy*

Suriname continuously engages in research and development to facilitate the wide-scale development and deployment and use of renewable energy, towards enhancing international competitiveness and energy security supporting long-term economic and social development and environmental sustainability (The National Energy Policy 2013-2033, final draft, section 2, page 17).

This goal focuses on the aggressive development of indigenous renewable energy resources with the goal of increasing the percentage of renewables in the energy mix[30]. For Suriname, the development and diffusion of renewable energy resources and technologies will help realize

[30] The target is yet to be developed by the Government in consultation with the private sector and civil society

important economic, environmental and social objectives. Renewable resources such as wind, solar, waste-to-energy and biomass are indigenous to the country and can effectively contribute to access to energy for all and also to more reliable and affordable energy supplies.

Section 3: Challenges and opportunities for achieving SE4ALL goals

3.1 Institutional and Policy Framework

18. Energy and development

The Energy Sector (both in the Electricity and Oil sectors) in Suriname is characterized by a large participation of the Government of Suriname (GoS). The MNH is primarily responsible for the energy sector including rural electrification. The Department of District Electrification of the Ministry of Natural Resources (DEV) is responsible for the electricity supply to the interior and they have their own energy programmes.

The MNH determines and approves the electricity tariffs as prepared by its Energy Advisory Committee (EAC). The Brokopondo Agreement of 1957, is the mainstay of Suriname's electricity supply and is based on the concession for bauxite mining to Suralco.

The electricity sector in Suriname is based on contractual arrangements between the government and public and private companies. The responsibility for the sector is assigned to the MNH. The most relevant contracts are: (i) between the Suriname State and Suralco regarding the purchase of the electricity produced by the Afobaka dam[31]; (ii) between the Surinam State and EBS regarding the supplying to EBS of the electricity bought by the State from Suralco[32]; (iii) between the State and EBS regarding the concession of supply and distribution of electricity to the public in Surinam[33].

Although the majority of the population in Suriname (85%) is connected to an electricity grid, however in the interior, a significant percentage of households (15%) have no access to the national grid or affordable energy supplies. These households rely on the subsidised limited supply of diesel by the government for the generators that are mostly used between 6pm and 10pm. The government of Suriname is well aware of this situation of limited access to modern energy, which is crucial to human well-being and to its economic development. As there is no poverty reduction strategy in the country the government has recently set up two important

[31] *Brokopondo overeenkomst 27 januari 1958; bijgevoegde energie overeenkomsten tussen de Republiek van Suriname and Suralco van 31 mei 1985, van 25 mei 1990 en van 16 september 1999*.
The Brokopondo Agreement (1958) is the mainstay of Suriname's electricity supply and is based on the concession for bauxite mining to Suralco

[32] *Stroomleverings-overeenkomst tussen de Republiek van Suriname and EBS van 16 december 1972 en overeenkomst voor de levering van additionele energie tussen de Republiek van Suriname and EBS van augustus 1985*
Contracts defining the supply of electricity between EBS and the State (1972 and 1985)

[33] *Concessiekontrakt tussen de Republiek van Suriname and EBS betreffende het leveren van electrische energie aan derden van 22 juni 1973*
The concession of the electricity service by the State of Suriname to EBS (1973)

projects with funding from the IADB, to provide affordable energy to the poor and vulnerable in the interior and to eliminate energy poverty (see Annex I).

19. Thermal energy for households

The department of gas, (OGANE) within the EBS, is responsible for the supply of LPG. They are the sole importer and distributor of cooking gas in Suriname. In Suriname the propane fraction of Liquid Petroleum Gas is used as cooking gas. The use of this cooking gas is by far the most important fuel used for cooking by households in Suriname.The Energy Company of Surianme (EBS) follows two kind of strategies: short term and long term strategies. According to the short term strategies, the EBS plans to improve their plant efficiency, work on quality image and brand and thirdly, increase their storage capacity. On long term the EBS wants to increase the number of filling plants and to modernize the packaging (Composite Gas cylinders are being developed and require less maintenance and have a favorable weight to volume ratio).

20. Power sector

The MNH has very limited resources to effectively undertake regulatory tasks. In addition, the institutional framework of the energy sector in Suriname has a negligible and weak set of legal instruments to regulate the operations of the power sector and the supply of electricity to the public. For example, except the old colonial legislation regarding concession activities[34] and a technical regulation regarding supplying and connecting of electricity[35], the activities of production, transmission and distribution of electricity are not regulated by law.

The other main stakeholders within the energy sector are:

Staatsolie Maatschappij Suriname N.V. (Staatsolie), the State Oil Company of Suriname

Staatsolie is involved in all aspects of exploration, production, refining and marketing of crude oil and refined products. Since 2007 Staatsolie made a transition from an oil company to a gas company. The national oil production is approximately 16,000 barrels per day (bbl/day). Staatsolie's refinery capacity is 7,000 bbl/day and refined oil products, including diesel and gasoline, are imported. Staatsolie owns the SPCS (Staatsolie Power Company Suriname); a 28 MW IPP which is in operation since 2006.

[34] [34] Landsverordening "Concessieverordering" G.B. 1907 n°34

[35] [35] *Algemene voorwarden voor aansluiting en/of levering van elektrische energie door de N.V. Energie Bedrijven Suriname (E.B.S.) anders dan volgens bijzonder kontrakt, vastgesteld bij Besluit van 11 januari 1973 en goedgekeurd bij resolutie d.d. 7 september 1973 n°9277.*
The "General Conditions" defining the electricity service that is not covered by special contracts

Suralco's Afobaka Hydropower Plant (Afobaka)

The HPP with an installed capacity of 189-MegaWatts (MW), is the backbone of Suriname's electricity supply. According to the EBS-SURALCO power purchase contract, the Afobaka hydroelectric power plant supplies 125 MW. The electricity is transported via a 161-kiloVolt (KV) transmission line to Paranam, where Suralco's aluminium smelter is located. EBS buys electricity from Afobaka under an agreement with Suralco. Afobaka enters the system as base capacity, which is complemented by EBS thermal power plant (82-MW) in Paramaribo. Suralco also owns a 78-MW thermal power plant at Paranam for its own operations.

NV Electriciteitsbedrijf Suriname (EBS)

EBS, the national power company, buys electricity from Afobaka under an agreement with Suralco. After 1999, when Suralco closed down the aluminium smelter, EBS' purchases increased substantially (from 50-MW in 1996 to 120-MW in 2007). EBS is a monopoly in transmission and distribution under the concept of the concession contract. Power purchase is ruled by contracts, where this has been sufficient to regulate the activities in the past. However, concession activities do not cover production, transmission and distribution, which today require specific regulations and standards to be effective. Self-generation is permitted but not regulated.

The Rural Electrification Department of the Ministry of Natural Resources and Energy

DEV is responsible for electricity supply to the villages in the hinterland based on diesel generator sets in the capacity range 10 to 60 KW.

In the absence of a specific regulatory framework and specific authority the MNH has the primary responsibility for the sector including rural electrification; with very limited resources to effectively undertake regulatory tasks. The tariff policy and the tariff adjustments are under its responsibility. The Energie Advies Commissie (EAC) is involved in the development of electricity tariffs but it only provides advice for setting electricity tariffs.

In the Hinterland, the government has heavily subsidized energy access to keep electricity and fuels within reach of the poor, inducing inefficiencies, increasing cost per unit of electricity and difficulties to meet demand. In the coastal zone, sufficient hydropower capacity and favourable hydrocarbon prices have hindered the establishment of tariff rates that are sufficient to cover Operation and Maintenance (O&M). In the last decade, this situation has represented a burden to new investments due to low financial capacities of EBS and to the government to cover O&M costs of the service both in the coastal zone and in the Hinterlands.

21. Modern energy for productive sector

All manufacturing enterprises in the districts Paramaribo, Wanica, Commewijne and the communities between Afobakka and Paramaribo and other districts have reliable and quality access to energy supply via the EBS electricity supply systems (the EPAR and ENICK grid). All other districts and communities have to produce electricity with small equipment. This equipment mainly consists of diesel generators,

Other big manufacturing enterprises, such as Suralco, the timber and gold-mining companies in Suriname, produce more or less their own energy. Suralco's HPP provides electricity for the grid as well as its own operations. In addition to that Suralco owns a 78-MW thermal power plant at Paranam and produces 25 MW of thermal energy (Bunker 6 oil) for its own operations.

HPP also supplies power to Suralco and IAMGOLD trough dedicated transmission lines. The largest companies in the timber, gold and bauxite sector, as well as larger manufacturing companies, run their operations primarily on diesel-power generators.

22. National monitoring framework for SE4ALL

As mentioned before there is no specific regulatory framework for the energy sector.

Table XVII shows the Suriname National Energy Policy goals (in line with the SE4ALL goals as mentioned in paragraph 2.4) and indicators within "Sustainable Energy for All" initiative.

Important remark is that there is a lack of sufficient energy data available in Suriname. To have an effective monitoring framework, sufficient energy data next to capacity and institutional strengthening in the energy sector are of the utmost importance.

The responsibility for maintaining and monitoring energy databases and related activities (including data collection, compilation and analysis) is likely to reside in a number of institutions, such as ABS (the national statistical office), MNH, large manufacturers' organizations (Staatsolie, mining companies, agriculture institutions and others). Also environment and national energy commissions/ institutions should have the responsibility to maintain and monitor energy databases.

Goals National Energy Policy	Proposed indicators
…all citizens have access to reliable and affordable energy supplies…	1) Number of households without access to EPAR/ ENICK grid 2) Population with uninterrupted access to electricity throughout the year 3) Number and length of load shedding
…energy is transported safely, reliably and affordably to homes and communities…	1) The share of technical losses within the grid 2) Adjustment of tariff rates 3) Efficiency of energy conversion and distribution
… facilitate the wide-scale development and deployment and use of renewable energy, towards enhancing international competitiveness and energy security…	1) The ratio of RES in total electricity balance (%) 2) The ratio of indigenous energy sources in energy sector

Table XVII: Proposed national monitoring framework for SE4ALL. Source: ECLAC, Final draft 'Suriname's National Energy Policy 2013 – 2033

3.2 Programs and Financing

23. Thermal energy

No information available on this subject

24. Power sector

The government has acknowledged the need to strengthen the electricity sector. In follow-up to the results drafted for the Government by the company KEMA (report 2008) and the earlier Masterplan (2000), a National Strategy is being devised with support from the Inter-American Development Bank (IDB), to design and establish a Sustainable Energy Framework for Suriname (SEFS). The objective of the SEFS is to increase the efficiency, transparency, sustainability and accountability of the power sector.

Recently, the ECLAC conducted a study for a National Energy Policy for Suriname, This document (final draft) is designed and structured in order to support the Sustainable Energy Framework for Suriname.

Utilization of renewable energy sources in the power industry is facilitated by measures of goals envisaged in the Development Plan of Suriname. Development of renewable is also fostered by funds that provide loans to the companies involved in financing of renewable energy projects. A list of the main projects/ programs and their sources of financing is provided in Annex I. Also a list of the main investments in the electricity sector is provided in Annex II.

25. Modern energy for productive use

The Manufacturing industries in Suriname have access to energy via distribution network and private generators. To improve access to capital and modern production technologies as well as increase of demand-side energy efficiency and utilization of renewable sources, programs are and will be implemented by sustainable energy financing funds. See Annex I for more information on these programs.

3.3 Private Investment and enabling environment

26. Thermal energy for household

Only one private company exist, EBS, that is in charge of supplying households with thermal energy. EBS, through her subsidiary company, Ogane N.V., is the sole importer and distributor of cooking gas in Suriname.

In Suriname the propane fraction of Liquid Petroleum Gas is used as cooking gas, conforming to the Propane HD5 specifications.The distribution chain in the hinterland is not well developed, due to transport problems.

Another barrier is lack of incentives for the customer to return empty cylinders. As the distribution chain depends on the return of the empty gas cylinder, the cost of returning the empty cylinder is mostly the same as the transport cost of a full cylinder. Thus, the total cost of transport exceeds the deposit paid on the cylinder.

Currently gas is sold below market prices, making it extremely difficult to fund strategic investments. Prices are controlled by the government and adjustment decisions are made in a political context.

27. Power sector

The private companies, Suralco and Staatsolie, deliver power to EBS and can as such be considered as independent power producers with whom the Government, as the sole shareholder of EBS, has entered into power purchase agreements.

Suriname faces several obstacles in establishing a sustainable investment climate and improving the attractiveness of the country, and its ability to sustain long-term, economic growth. Barriers such as uncertainty surrounding policy legislation and poorly developed mechanisms to ensure accountability and transparency prevent large and long-term investments.

There is no regulation in place to stimulate the adequate development of Independent Power Producer (IPP). Self generation is permitted but not regulated. The Afobaka hydropower plant supplies about a half of the national electricity demand under the self-generation regime in the framework of a mining concession.

Concerning renewable power systems, there is no experience with business models such as Independent Power Producers (IPP), for grid-connected wind energy, hydro, PV, community-based operation (for hydro and PV in the interior), sustainable operation schemes under the responsibility of DEV; or net metering (retail users feeding PV or wind power into the grid).

Despite the great potential/capacity of renewable energy sources, their use remains limited due to low electricity prices and the lack of funding for new technology.

28. Modern energy for productive sectors

New demand for energy is commonly covered by fossil fuel generation and there is no policy in place to support the development of hydro resources, impacting the economic and environmental sustainability of the power sector. The government of Suriname is therefore in the process to develop a new energy framework that supports the use of Renewable energy and Energy Efficiency needs (see Annex I).

There are several particular initiatives to meet with the demand for energy, such as the ethanol project of Staatsolie. Staatsolie currently is implementing a sugar cane to ethanol project[36]. Consisting of an agricultural component and an ethanol-producing component, the project will be able to produce between 14 and 15 million litres of ethanol per day by 2016 and will be able to produce E-15 for the transportation sector. The project also will produce 25MW of power

[36] ECLAC, Final draft 'Suriname's National Energy Policy 2013 – 2033'

from bagasse. Additionally, the project will produce 40,000 tonnes of sugar per year to cover the domestic and export markets.

Suralco is currently in the process of undertaking feasibility studies for the generation of energy from LPG, biofuels (from waste), coal and wood for its own manufacturing purposes.

Funded by SIDS DOCK the process of a feasibility study for the generation of biofuel from elephant grass is being undertaken by a private institution CROP.

3.4 Gaps and Barriers

29. Thermal energy for households

We can identify one main problem within this sector, namely the unaffordability and availability of thermal energy (LPG) and modern gas equipment for 16% of the households (see table VIII) because of low income level and high poverty rate. This issue is especially topical in the interior due to the above mentioned reasons.

30. Power sector

EBS is owned by the government and monitored through MNH. The Department for Rural Energy (DEV), in charge of rural electrification also depends on this Ministry. The lack of autonomy of both sector agents has limited modernizing the sector and to recover the cost of the electricity service.

The concessional structure and contracts do not cover the production, transmission and distribution of electricity and do not provide a solid basis to develop the electricity sector, improve the quality of the service delivered, and stimulate cost-effectiveness.

Tariffs in the Electricity Supply Paramaribo and Surroundings (EPAR) area are in the order of US$0. 07/kilowatt hour (kWh), at an estimated average generating cost of US$0.20/kWh[37]. A crucial gap is the lack of a sector framework. This hinders the implementation of tariff regulations. In the hinterland, the GoS subsidizes access to energy, inducing inefficiencies, high costs and difficulties to meet demand. In the coastal zone, tariffs do not cover operational and maintenance costs. There are no clear strategies to cope with increasing demand and integrate with neighbouring economies to seek economies of scale.

[37] IDB report, SU-G1001, 'Development of Renewable Energy, Energy Efficiency and Electrification of Suriname', March 2011.

Renewable Energy (RE) technologies have been considered a major option for Suriname since the 1980's, but RE technologies are still largely unknown in Suriname, as EBS and DEV rely almost exclusively on thermal power plants (operating on diesel or heavy fuel oil). There is limited knowledge on system design, resource assessment, project risks and O&M aspects in the RE sector. Further, the existing grid systems are not ready to absorb a substantial volume of decentralized RE generating capacity. Despite the great potential/capacity of renewable energy sources, their use remains limited due to low electricity prices and the lack of funding for new technology.

31. Modern energy for productive sectors

The manufacturers and industrial enterprises of Suriname have access to energy supply through the electricity supply networks EPAR and ENICK.

The major objective in this sector is the reduction of energy intensity via introduction of modern energy efficient technologies. Promoting mechanisms are provision of state subsidies and privileges, state support in receiving "soft" grants, interest of enterprises in reduction energy intensity.

Power sector planning is scarce and the allocation of responsibilities is not always clear. The dominance of hydroelectricity generation in the past, and the potential of hydroelectric generation in the future have hindered planning, while the system progressively became more dependent on expensive thermal power for its short-term to medium-term expansion. Lack of system planning is particularly problematic given the dependency on hydrological cycles[38].

32. Summary

The goals mentioned in the Final draft National Energy Policy of Suriname meets SE4ALL goals to a major extent. However, there are gaps and barriers to achievement of these national goals in Suriname. The most important are mentioned as follows:

- Lack of data for proper analysis and planning of the energy sector
- Low/limited affordability of thermal energy for households (mainly in the interior) because of lack of adequate infrastructure in the interior and low income level
- Due to a lack of awareness, regulations, laws, stimulating mechanism and managerial structures, improving energy efficiency wll be difficult to realize.
- Tariffs that does not incentivise EE initiatives.

[38] IADB Project Profile SU-L1022: Support to the Institutional and Operational Strengthening of the Energy Sector

- State monopoly (EBS) on electricity supply and distribution.
- No dedicated energy regulator exists in the country.
- Fragmented institutional coordination with regard to RE and EE.
- Overall lack of stimulating mechanism and institutional support for RE and EE.

Annex I: Main projects/ programs and their sources of financing

Project Title	Lead agency	Financier	Relevant SE4ALL Goal(s) (Access/Efficiency/Renewable Energy)	Brief description	Status and time frame	Total cost (US$)
Introduction of Sustainable Business Models in Suriname Rural Electrification SU-M1019	MNH	IADB	Access/ Renewable energy	The objective of this project is to increase access to clean and reliable energy in the interior of suriname, through the efficient use of renewable energy technologies in rural and indigenous communities. The purpose of the project is to develop and test sustainable business models for rural renewable energy technologies in the interior of the country.	Implementation	5,083,689 USD
Development of Renewable Energy, Energy Efficiency and Electrification (SU-G1001)	MNH	IADB	Energy efficiency/ Renewable energy	This project will promote the use and development of renewable energy (re) and energy efficiency (ee) In Suriname. Re is a major part of suriname's strategy towards 2020, as it is recognized that the country has vast potential for the exploitation of renewable resources, including solar, hydro and bioenergy. This project will assist with reducing energy consumption in Suriname, and demonstrate energy efficiency practices in Suriname mainly by using efficient lighting and solar water heaters. The project will produce proposals for the update/amendment of the legal, institutional and regulatory framework of the energy sector affecting the development of renewable energy and energy efficiency initiatives.	Implementation 66 months	9,392,889 USD
Support for the Preparation of the Sustainable Energy Framework (SU-T1055)	MNH	IADB		This operational input will support studies to achieve the fulfillment of the conditions as proposed in the project profile of the Su-l1022	Implementation	875,000 USD
Support to Improve Sustainability of the Electricity Service (SU-L1009)	MNH	IADB	Access/ Energy efficiency	The Program will contribute to the sustainability of the power sector by strengthening EBS' operational procedures and corporate performance and by improving the sustainability of rural electricity supply. The specific objectives are to support the implementation of information technologies in business support tools for EBS, to provide financial support for upgrading critical infrastructure, and to contribute to expand electricity coverage by grid extension and renewable energy systems in the Hinterlands. The main components of the Program are: (i) Improvement of EBS' Operations; (ii) Sustainable Rural Electrification; and (iii) Critical Infrastructure.	Implementation	30,000,000 USD
Mainstreaming Energy Efficiency and Climate Change in Built Environment Training and Research in the Caribbean (CarEnTrain)	University of Suriname (AdeKUS)	ACP EDULINK II	Energy efficiency	This project focuses on mainstreaming energy efficiency in relationship to sustainable economic development and Climate Change into existing curricula and CPD in Urban and Transportation Planning, Engineering and Architecture of Caribbean Higher Education Institutes (HEIs) and increase inter-institutional networking and regional capacity in energy and the built environment.	Implementation 42 months	487,143.50 Euros
Capacity bulding in applied renewable energy technologies in Guyana and Suriname	University of Suriname (AdeKUS), University of Guyana and the Catholic University of Leuven (Belgium)	ACP EDULINK II	Renewable energy	This project focusses on capacity building in applied renewable energy technologies in Guyana and Suriname. The goal of this project is to strengthen the universities in the field of applied technologies for renewable energy with a view to the sustainable economic and social development of Guyana and Suriname.	Implementation 42 months	613,640 Euro's
Feasibility study of the commercial production of biofuels from dedicated biomass crops on mined out bauxite lands in Suriname	MNH	SIDS DOCK	Renewable energy	To establish the agronomic and techno-economic viability of Arundo donax plantations within the mined-out areas of the Moengo region, as well as to assess the socio-economic and environmental impact that commercial-scale implementation of the project will have on the region. The Arundo donax will be converted through thermochemical conversion processes intoprocesses into solid and liquid biofuels.	Implementation 18 months	700,000 USD

Annex II: Main investments in the electricity sector

ID #	Description (Revision date: 09 Jun 2013)	OME [USD x 1 M]
	Short Term (0 - 1 year)	
37-2011	**Upgrade EBS Electrical Infrastructure due to Power Plant BEM**	
37-2011A	System Stability Study	0.50
37-2011B	New 33kV GIS Switchgear at BEM.	3.00
37-2011C	Upgrade and reinforcement of OSJ	4.00
37-2011E	33kV cable connection between OSA and OSJ (1.5km, 3x3x1x 161kV)	1.00
37-2011F	33kV cable connection between OSJ and OSD (4.5km, 2x3x1x 33kV)	1.60
37-2011G	33kV cable connection between OSR and OSZH (5.5km, 1x3x1x 33kV)	1.20
37-2011H	33kV cable connection between OSJ and OST (2km, 2x3x1x 33kV)	1.00
37-2011I	33kV cable connection between OSLT and OSD (3.5km, 1x3x1x 33kV)	0.50
37-2011J	33kV cable connection between OSZH and OSLT (4.5km, 1x3x1x 33kV)	1.10
37-2011K	Upgrade and reinforcement of OSC	4.00
37-2011L	New Substation Ringweg including 33kV cable to OSJ and OSQ (2x3x1x 33kV)	6.00
100-2012	**Upgrade EBS Electrical Infrastructure due to SPCS Expansion**	
100-2012A	Upgrade Substation I	10.00
100-2012B	Expansion Substation R (Menckendam) (161kV)	5.00
100-2012C	161 kV Cable Connection between Substation I and R	10.00
100-2012D	Upgrade Substation D	11.00
100-2012E	161 kV Overheadline between Substation R and D	8.00
Project 13	**SCADA Dispatch Center**	6.00
36-2011	**Upgrade Generating Capacity Region North-West and Upgrade Electrical Infrastructure**	
36-2011B	33 kV OHL between SS Nw. Nickerie and SS Henar	6.00
36-2011C	Substation Soekramsingstraat	4.50
36-2011D	Upgrade Power Plant Clara	4.50
	Total	**$88.90**

Mid Term (1 - 3 year)		
Project 3:	**New Substations**	
Project 3A	Substation Richellieu	6.21
Project 3G	Substation Powaka	4.00
Project 3J	Substation Industrial Park	5.00
Project 6:	**Upgrade Substation P including P1 – P2**	6.00
Project 7:	**Upgrade Electrical Infrastructure Brokopondo**	25.00
Project 8:	**Replacement of 33 kV OHL by UG Cable between SSI – SSB**	1.00
Project 9:	**Relocation 33 kV Transmission line between SSD – SSE**	1.40
Project 11:	**Adjustment Electrical Infrastructure due to New Build Highway**	4.00
	Total	**$52.61**

Long Term (> 3 year)		
Project 3:	**New Substations**	
Project 3B	Substation Leiding	13.50
Project 3C	Substation AZ	6.00
Project 3D	Substation Rijsdijk	10.50
Project 3E	Substation Torarica	6.00
Project 3F	Substation MLK	6.00
Project 3H	Substation Waterland	6.00
Project 3I	Upgrade Substation F	4.00
01-2011	**Upgrade EBS Electrical Infrastructure**	
01-2011F	Substation Boma	14.50
01-2011H	161 kV Cable Substation D - Substation Boma	10.00
36-2011	**Upgrade Generating Capacity Region North-West and Upgrade Electrical Infrastructure**	
36-2011A	161 kV OHL between SS Henar and Power Plant Wageningen	20.00
36-2011F	Transmission OHL between Wageningen - Coronie	42.00
36-2011G	Substation Coronie	6.00
36-2011H	Transmission OHL between Coronie - Saramacca	85.00
36-2011I	Substation Saramacca	6.00
Project 10:	**New Cable Laying ROC**	0.25
Project 12:	**Upgrade Generating Capacity Region North-East and Upgrade Electrical Infrastructure**	
Project 12A	Substation Albina	6.00
Project 12B	Substation Moengo	6.00
Project 12C	Transmission OHL between Albina - Moengo	36.00
Project 12E	Transmission OHL between Moengo - Tamanredjo	60.00
	Total	**$343.75**

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