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RURAL ELECTRIFICATION ATJONI – ASINDOHOPO / STONHOEKOE

NV ENERGIEBEDRIJVEN SURINAME
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Contents

Abbreviations and Acronyms:

ABS	Algemeen Bureau voor de Statistiek
DPP	Diesel Power Plant
DNA	The National Assembly
EAS	Energy Authority Suriname
EBS	Energie Bedrijven Suriname
EPAR	Electricity network Paramaribo
ENIC	Electricity network Nickerie
EIRR	Economic Internal Rate of Return
ESP	Energy Sector Plan
FIRR	Financial Internal Rate of Return
GDP	Gross Domestic Product
GoS	Government of Suriname
HDI	Human Development Index
HFO	Heavy Fuel Oil
HSE	Health Safety and Environment
ICB	International Competitive Bidding
IDB	InterAmerican Development Bank
IFC	International Finance Corporation
ILO	International Labor Organization
KW	Kilowat
KV	Kilovolt
LNG	Liquid Natural Gas
MNH/NH	Ministry of Natural Resources
MW	Megawat
NGO	Non-governmental Organization
NIMOS	Nationaal Instituut voor Milieu en Ontwikkeling in Suriname
NPV	Net Present Value
PMU	Project Management Unit
PPE	Personal Protective Equipment
R&D	Research & Development
SPCS	Staatsolie Power Company Suriname
SRD	Surinamese Dollar
S/S	Substation
SWOT	Strengths, Weaknesses, Opportunities and Threats
TOR	Terms of Reference
UN	United Nations
UNDP	United Nations Development Programme
USD	United States Dollar
WTO	World Trade Organization
MRO/RO	Ministry of regional Development
SFOB	Stichting Fonds Ontwikkeling Binnenland
MOWT&C	Ministry of Public Works, Transport & Communications
LCOE	Levelized Costs of Electricity
GoS	Government of Suriname

Executive Summary

The electricity supply for the interior under the responsibility of the MNH (DEV) is one whereby in the different villages small generation units are installed. These units are running for approximately 4 - 5 hours daily. The reason for the 4 – 5 hours are the challenges in supplying the villages with enough fuel. The way to supply the villages with fuel is with transportation via boats along the rivers, since there are no roads. The supply of villages with small diesel gensets also results in higher cost for the supply of all the villages.
The GoS has set it as a priority to change the circumstances for the villages in the sense that they are aiming at supplying the village with 24/7 electricity, at lower and reasonable cost. With the 24/7 supply the GoS is aiming at changing the living standards for the people and villages in the interior and for the country as a whole.
Supplying the 24/7 will create the possibility for a great part of the people to gain their independence in sustaining their living conditions and being less dependent on the GoS. It will also create the possibility for improving their living, education and individual development. With this in mind several part of the interior are investigated for the possible way to make the 24/7 electricity supply possible. Those investigations have resulted in the following report whereby the upper Suriname River, from Atjoni to Dangogo and Stonhoekoe are identified as one with the best opportunities.
The project is set up in three phases, starting from Pokigron/Atjoni upstream till Pikienslee as phase 1. Subsequently, the remaining villages will be provided with electricity in phase 2 and 3. The main advantages for this project is the possibility to reach Pokigron/Atjoni by road. Since Atjoni is the most Southern local town accessible through a paved road from the Capital Paramaribo, fuelling the thermal power plant will be easy.

For supplying the 24/7 electricity several generation methods have been investigated such as PV-Solar, Decentralized Thermal, Centralized Thermal and Micro hydro systems. The conclusion is that the most favourable way to realize the 24/7 electricity supply is with a centralized diesel generator station and via a high voltage line connecting the villages. Depending on the local circumstances in several villages and or along the river, additional solar and or hydro installation can be installed as decentralized power generation and connected to the HV line there by keeping pace with the growth and technical challenges related to the HV line.

The main objectives of this project are:

- Increase the quality of electricity service and transfer to 24-hour power supply;
- Improve the living condition of the local population;
- Improve economic and social development in rural areas.

The design for the facilities is done based on civil data, from the register of the Ministry of Internal Affairs i.e the department Central Office for Civil Affairs (CBB) and based on assumptions of best practices from the EPAR and DE networks from the EBS.

The peak power demand for phase 1 is calculated for around the 6 MW. When all households and all other costumers in the area along the upstream of the Suriname River (phase 1+2+3) are connected to the grid the peak demand is estimated to be around 12 MW. The investment for the installation of the generation capacity can be carried out in phases, beginning with an initial installed capacity of 4.5 MW.

This project includes the engineering, procurement, construction, testing and commissioning of the power plant, transmission and distribution line, including training of operators and maintenance personnel. The scope of works will consist (but not limited) of the following:

- Construction of a Power plant at Atjoni;

- Phase 1: construction of a transmission line from Pokigron/Atjoni to Pikienslee;
- phase 2: construction of the transmission up to the village Dangogo;
- phase 3: construction of the transmission line from Djoemoe up to the village Stonhoekoe;
- the installation of HV distribution lines and distribution transformers in the different villages.

The preliminary results of the simulation for the Transmission Line from Atjoni to Asidonhopo shows that a voltage level of 33 kV is sufficient. Taking into consideration the growth based on best practices from the EPAR section it is foreseen that further measures need to be the installation of additional renewable generation capacity to guarantee the supply. High level desktop studies have shown the possibility of several mini hydro possibilities which will result in reducing the generation cost and additionally strengthen the capacity of the transmission facilities.

The 33 kV line can cover the demand growth for 20 years based on a yearly growth rate of 5%. In order to extend this period of 20 years, the renewable energy potential such as micro/mini hydro and solar PV at the upper stream of the Suriname River will be developed and injected to the 33 kV grid to keep the voltage level within the limits. When a road is constructed from Atjoni to Pikienslee, a new thermal power plant can be built in the area of Goejaba and Pikienslee to transmit the power Southwards to Asidonhopo and also Northwards to Atjoni if needed.

Another option is to build a transmission line of 69 kV to cover all the power generated from Atjoni to Dangogo & Stonhoekoe up till a maximum of 20 MW with voltage drop within the limits. However the costs for building the 69 kV line will be higher compared to the 33 kV line.

The GoS with this project aims at contributing significantly to the growth of the national economy. The realization of this project will be a great step on the way to sustainable development of the Southern area of Suriname, for it is the first time that this part of the Surinamese population will be benefited of 24/7 electricity.

During the implementation period local individuals and contactors will have temporary employment. After the implementation, when the project is operational, the quality of socio-economic life in this area will get a huge boost as never before. It will have a huge social and financial economic spin-off in the area which was for decades a subordinated region; due to a lack of structural supply of electrical energy and therefore insufficient water supply, inadequate health care, poor education, no business attraction, etc. The full spin-off of this project is hardly quantifiable and will increase the living standards within the respective and the surrounding area.

1. SURINAME COUNTRY BACKGROUNDS

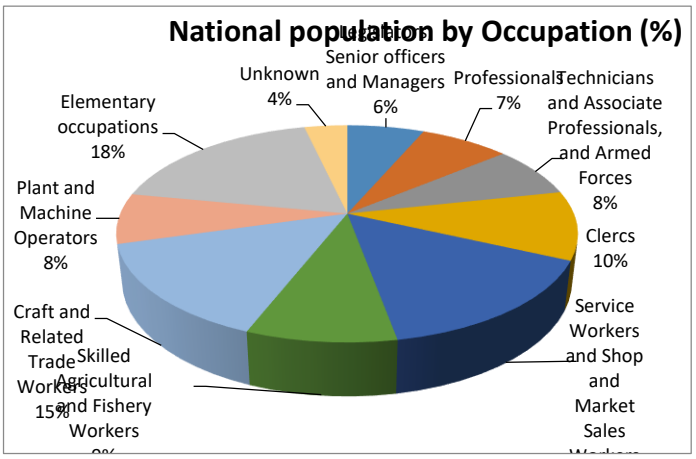
1.1. Introduction

Suriname is the youngest sovereign country in South America that achieved independence in 1975. Being a former Dutch plantation colony, it is one of the most ethnically diverse countries in the world hosting Amerindian tribes, descendants from the slaves brought into the country in the 17th and 18th centuries, descendants from ex-plantation workers from India, Java and China who arrived in the 19th and 20th centuries, and others. Dutch is the official language of the country, although English and Sranang Tongo (a native Creole language) are widely spoken. Suriname is a democratic country with a solid legal system.

With a population of 558.000 persons and with a land area of 164,000 km2 it has one of the lowest population densities in the world (population density of 3.3). About 82% of the population lives in urban and semi-urban areas, the coastal areas with the remaining living in the remote interior. The interior of the country (the “Hinterlands”) and the Amazone Jungle are sparsely populated, predominantly by Amerindians and the “Maroons”. About 50% of the population is under the age of 19 years.

The country is endowed with rich natural resources such as arable land, gold, oil, forests, hydroelectric potential and fisheries.

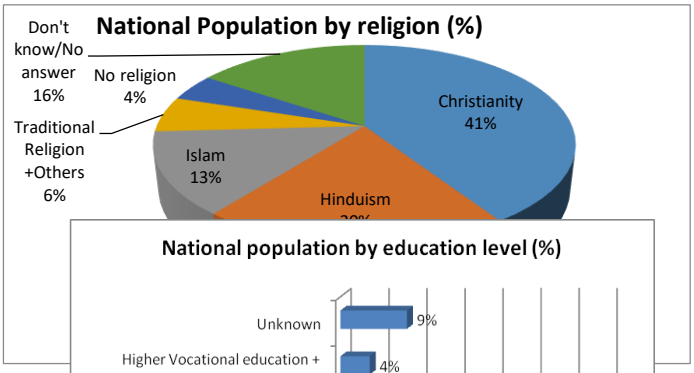
1.2. National Social Indicators



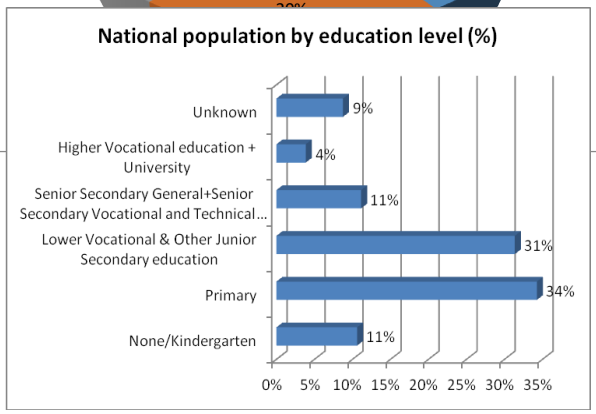
For a country with a huge agricultural potential only 9% of the workers is directly involved in agriculture. However,
Suriname is an upper-middle income country according to the World Bank classification, with per capita income of US$ 8,000 and the economy size of US$ 4.0 billion in 2015. Include the indirect employment in the supporting services and agro-processing, this number can be doubled.

While the ageing of the population is not alarming as yet, this will become more pressing over time. Only 61% of the population is in the productive age group of 15-59 years.

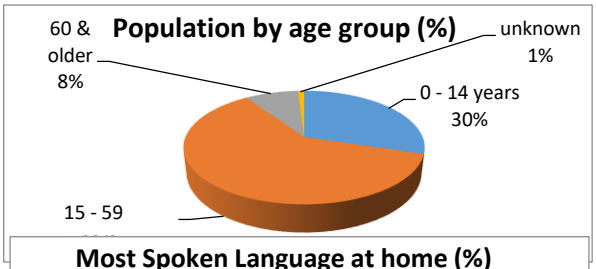
The age group of 0-4 years is smaller than the 5-9 years group and the 10-14 years group. This means that the production labor base will deteriorate over time.



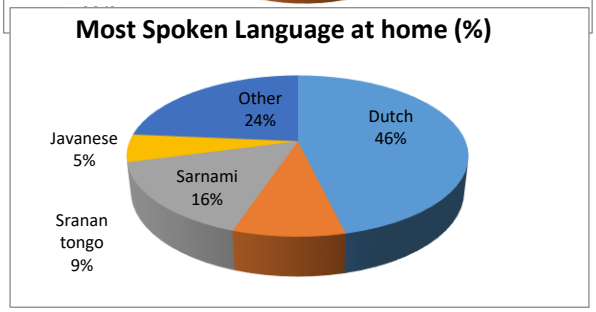
The education level of the country is relatively low. Only 4% has a higher occupational or University level education and 11% has a senior secondary level education. On the other hand in total 76% of the population has only a lower vocational/ junior secondary level education (31%) or lower (45%).



Suriname has a diversified population either by ethnic groups, by religion or by language spoken at home. At national level the most common religion is Christianity (41%) followed by Hinduism (20%) and Islam (13%).



The language spoken at home is predominantly Dutch, the official language of the country (46%). The key local languages are Sranan Tongo (the lingua franca), Sarnami and Javanese.



The Human Development Index (HDI): Health, Education and Income

The HDI is a composite measure for assessing long-term progress in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living.

According to the 2015 Human Development Report Suriname's HDI value for 2014 is 0.714, in the medium human development category, positioning the country at 103 out of 188 countries and territories. Between 2005 and 2014, Suriname's HDI value increased from 0.666 to 0.714.

Table 1: Human Development Index

Human Development Index = 0,714	Rank 103 (2014, of 188 countries)
Health	Life expectancy at birth (years) 71.1
Education	Expected years of schooling 12.7
Income	GNI per capita in PPP terms $ 15,617
Inequality	Inequality-adjusted HDI 0.543
Poverty	Multidimensional poverty index (%) 0.033
	Intensity of deprivation 43.1
	Headcount, multidimensional poverty (%) 7.6
Gender	Gender Inequality Index (GII): 0.463
Demography	Population total 558,000
Environmental Sustainability	Carbon dioxide emissions per capita (tons) 3.6
	Change in forest area, 1990/2010 (%) - 0.1

Inequality

The Gini Index for Suriname in January 1999 (latest available data) was 52.8% under the line of perfect equality. One might expect that also the GIGI Index has been changed favorably in the last 10 years. (Index Mundi, 2012). The Inequality adjusted HDI value is calculated at 0.526.

Health

The life expectancy at birth is 71.1 years. Furthermore the annual Government expenditure on the health sector amounts 3.4% of GDP.

Indicator	Value
Under-five mortality (per 1,000 live births)	31
Health index	0.801

Education

The mean years of schooling of adults are 7.7 years and the expected years of schooling of children is 12.7 years. Furthermore the adult literacy rate of both man and woman of 15 years and above is 94.7%.

Indicator	Value
Primary school dropout rates (%)	9.7
Education index	0.631
Combined gross enrolment in education	69 %

Gender

The adolescent fertility rate is 39.5, which means that 4% of the children born in 2012 had mothers of the age of 15 -19 years. The maternal mortality rate amounts 130 per 100,000 live births, which means that 0.13% of the mothers is not surviving the birth of their child.

Indicator	Value
Labour force participation rate (Ratio female/male)	0.590
GII: Gender Inequality Index, value	0.463
Shares in parliament, female-male ratio	0.133

Innovation and technology

The indicator for the number of mobile telephone subscribers per 100 people amounted 171. This is in line with the popular statement that everybody in the country has more than 1 mobile telephone. Furthermore 40.1 % of the population has an internet connection.

1.3. National Economic Development Indicators

Suriname is an upper middle-income country and was one of the Caribbean's best performing economies over the last decade, largely due to its rich endowment in natural resources. The economy grew by 4.5 percent per year on average between 2004 and 2014, bringing the per capita income to US$ 9,300 (Atlas method).

Suriname's economy is characterized by strong dependence on exports of a few commodities and a large public sector. The economy is dominated by the mining industry, with exports of oil, gold, and alumina[1], accounting for over 80% of exports and 27% of government revenues (reaching around 40 percent in 2011), making the economy highly vulnerable to mineral price volatility. Around 60 percent of total formal-sector workers are employed by the government and state-owned firms dominate a number of industries.

In addition, most of Suriname's population and economic activities are located in low-lying coastal areas that are vulnerable to rising sea levels, heavy rainfall, and strong winds. Worldwide, for the year 2100, an average temperature increase of 1.4 - 5.8º C is expected. The expected sea level rise in this century is estimated at 5 mm/year. This means, for a plan period of 22 years an increase of maximum 22 x 0.5 cm = 11 cm.

The GDP composition (2015 est.) by sector indicates that industry (gold, alumina and oil) contributes 49%, services: 45% and agriculture: 6%. The key agriculture export products are rice, bananas, fish and shrimp; vegetables and forest products.

The phenomenon of continued slowdown in global economic growth due to the global economic crisis did not spare Suriname. This resulted into a downward trend in world prices of gold and a decrease of approximately 31% by the end of 2015 relative to December 2012 [2]. The crude oil price fell by about 76% at year-end 2015 compared to end 2012.

The economy grew by about 1.8% in 2014. Investment in the mining sector for the expansion of the oil refinery of Staatsolie Maatschappij Suriname N.V. and the start of construction of the Merian Gold Mine from Surgold Company have made a significant contribution to this growth. Investments in the mining industry had a spin-off impact on the construction sector, which grew by 23% in that year. Although the oil production level has remained virtually constant, Staatsolie has recorded disappointing results that show a causal link with the falling world prices for petroleum. The consolidated sales have fallen in the first half of 2015 almost 41% to $ 313.2 million compared to $ 531.4 million in the same period of the previous year. All resulted in the fact

[1] Alumina production was abandoned at the end of 2015.

[2] Adopted from the Annual Year Report 2013 IAMGOLD.

that government revenues from these sectors also declined sharply. The planned introduction of a modern Sovereign Wealth Fund, which aims to offset the budget deficit and to minimize the impact of price fluctuations on the world market of oil and gold on Suriname, has so far not happened yet.

Table 1-1: Macro-economic indicators of Suriname in the period 2008 - 2015

	2008	2009	2010	2011	2012	2013	2014	2015
GDP (at market prices, mln SRD)	9698	10638	11993	14452	16434	16932	17194	17922
Annual growth rate (in %)	4.1	3	5.2	5.3	3.1	2.9	1.8	0.2
Balance of Payments (mln US$)								
Current account balance	325	111	651	431	162	-196	-415	-808
Goods balance	337	11	686	968	707	243	133	-375
Exports (FOB)	1744	1402	2084	2649	2700	2416	2145	1652
Imports (FOB)	1407	1391	1398	1679	1993	2174	2012	2028
Service trade balance	-123	1	-18	-362	-425	-374	-550	-470
Income balance	20	5	-104	-262	-192	-131	-69	-27
Net current transfers	91	94	87	87	73	67	71	65
Capital and financial baseline	-116	-73	-616	-307	18	47	265	542
Net foreign Investment	-231	-93	-248	73	173	188	163	276
Other capital movements	115	21	-368	-380	-155	-140	102	265
Overall balance	-208	39	35	124	180	-149	-150	-266
Central Government								
Total Revenue (mln SRD)	2355	2945	2606	3538	4025	3960	3751	3399
of which Tax revenue (in %)	17.4	17.2	15.7	18.5	18.3	17.9	16.1	15.5
Total Expenditures (mln SRD)	2210	2860	2955	3551	4411	4728	4564	5006
Current expenditures (in %)	18.0	21.2	20.0	19.7	22.3	22.7	20.7	26.1
of which Interest	0.6	1.3	0.9	1.0	0.8	1.3	0.9	1.5
Capital expenditure	4.8	5.7	4.6	4.8	4.4	4.3	5.0	2.5
Primary balance	2.1	2.1	-2.0	0.9	-1.5	-1.1	-3.7	-7.7
Overall balance	1.6	-2.1	-2.5	-2.0	-2.7	-5.9	-5.5	-10.0
Gross Internat. reserves (mln US$)	603	657	691	817	1008	779	625	330
Governm. Domestic debt (mln SRD)	640	918	1297	1360	1653	2583	1889	3588
Governm. External Debt (mln US$)	319	269	334	463	567	739	810	876
CPI (%)	9.4	1.3	10.3	15.3	4.4	0.6	3.9	25.2
Exchange rate (SRD/US$)	2.8	2.8	2.8	3.3	3.3	3.3	3.3	4.0

Source: CBvS, ABS, Min. of Fin.

The economy contracted by 3% in 2015 as falling oil and gold prices took their toll on the monetary, budgetary and real sectors of the economy. In addition to the lower commodity prices Suralco closed down the alumina refinery in late 2015 when its parent company Alcoa decided to streamline its business. In November 2015, the government devalued the currency by 23% to SRD 4.04 and had to shift to a floating exchange rate which increased the exchange rate to around SRD 7.50 for the US$ at the end of 2016.

Imports amounted US$ 2.0 billion and exceeded Exports of US$ 1.7 billion resulting in a further decrease of national foreign exchange and gold reserves to US$ 330 million (31 December 2015). Furthermore the national external debt increased to 876 million (31 December 2015).
In the year 2015 Budget expenditures of SRD 5.0 billion exceeded budget revenues of SRD 3.6 billion resulting in an overall deficit of -10% of GDP; (source: Proplan 2016).

Recent Economic Developments

The country's economic downturn has led the Government of Suriname to request for support from the International Monetary Fund (IMF), the World Bank, the Inter-American Development Bank, and the Caribbean Development Bank to provide the financing and technical support needed to place the economy on a sustainable path.

Table 1-2: Suriname's Financial sector indicators

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Financial Sector										
Money supply [M1] (SRDMn)	1,549.5	1,939.0	2,434.1	2,677.9	3,003.8	3,546.5	4,305.3	4,466.5	4,650.4	4,926.4
Broad money [M2] (SRDMn)	2,793.4	3,597.0	4,336.6	4,994.8	5,525.2	6,710.0	8,128.5	9,028.1	9,520.2	10,639.3
Net credit to the government (SRDMn)	330.4	139.1	-73.1	115.7	191.4	-63.5	-9.4	525.5	1,291.5	2,636.9
Credit to the private sector (SRDMn)	1,333.4	1,784.1	2,409.7	2,707.6	3,051.9	3,660.1	4,229.0	4,983.9	5,407.2	6,287.6
Deposit rate (%)	6.6	6.3	6.4	6.2	6.2	6.6	7.0	7.2	7.4	7.7
Lending rate (%)	15.3	12.9	11.7	11.6	11.8	11.7	11.8	12.0	12.5	13.4

rname, and General Bureau of Statistics

In May 2016 the government released the Recovery and Stabilization Plan 2016–18, which laid out a program of fiscal and monetary policy adjustments to stabilize the economy, along with policy and institutional reforms that will facilitate private sector activity. The government is struggling with economic adjustments required to adapt to the decline in foreign reserves of recent years in the aftermath of the commodity boom. While the GoS committed itself to a 2-year IMF Stand-By Agreement programme in May 2016, this has been put on-hold due to some doubts on the social repercussions. This may create risks to the forecasts of renewed growth in 2017.

The external current account balance has deteriorated overtime. Suriname observed current account surplus of 6.5% of GDP per annum during the period 2010-2012, mainly due to the exploitation of its mineral resources, and higher prices of the country's major commodity exports (gold, petroleum, and alumina). The gross international reserves which amounted US$ 1,008 million, representing 4.7 months of imports in 2012, decreased to US$ 330 million (representing 2 months) by end-2015.

The Government's fiscal position has deteriorated overtime. According to the CBvS the fiscal deficit was 2% of GDP in 2011, which deteriorated to 10% of GDP in 2015, mainly due to increased Government spending.

The Government's gross public debt increased from 27% in 2011 to over 60% in 2016. As per Debt Act (2002), in 2011 Surinamese authorities raised the legal limit for domestic debt from 15% to 25% of GDP and lowered the foreign debt ceiling from 45% to 35% of GDP. Furthermore in

2016 the definition of debt in the mentioned Act, which was formulated rather strict, was widened and brought in line with the international definition; (source: Proplan 2016).

1.4. Challenges Facing the Economy

The current recession is expected to continue in 2017. However, recent investments in large oil and gold operations may help GDP growth recover in 2017, once these operations enter full production. The government's reliance on revenue from extractive industries will temper Suriname's economic outlook, especially if gold prices continue their downward trend.
The average real economic growth is to be driven mainly by foreign direct investment (FDI) and domestic private investments particularly in gold and oil production, as well as in infrastructure including utilities, roads, air transport and seaport facilities. Although the medium-term growth prospects appear to be favorable, it will depend on the future prices of mineral products, monetary and fiscal policy stance and dynamism of the private sector (both local and foreign investors).

Due to a narrow economic base (i.e. highly dependent on gold and oil) and weak institutional capacity, the attainment of the ambitious targets, as formulated in the Government Declaration, appear to be challenging.

Another challenge is the need to create at least 5,000 new jobs per year. The historic data show that Suriname has not been able to generate significant additional employment during the last decade. These appear to be ambitious especially since the major economic activities in Suriname are linked to the extractive industry (oil and gold), which are capital intensive and account for about 85% of the country's exports earnings.

The Government has limited fiscal space for non-commercial investment/ infrastructure with weak implementation capacity. The country needs to mobilize huge investment (both public and private) in order to achieve the targets during the next Plan period 2017-2021. For achieving sustainable economic growth, a country needs good physical infrastructure. According to World Economic Forum, Global Competitiveness Report (2014-2015), Suriname has a score of 3.7 (out of 7) and is globally placed at 110 ranking (out of 144 countries). In terms of overall infrastructure the score was 3.4 with a ranking of 86, a drop of 18 positions compared to the 68 position in 2012-2013.

Suriname's economic prospects for the medium term will depend on continued commitment to responsible monetary and fiscal policies and to the introduction of structural reforms to liberalize markets and promote competition; (source: Proplan 2016).

1.5. Legal and regulatory framework Electricity sector

The electricity sector in Suriname faces serious challenges associated to strong growth in energy demand, inadequate financial sustainability of the electricity service supplied and the resulting financial stress of EBS. It has limited resources to keep pace with the technical adjustments required to service the grid areas and the hinterlands. Addressing these challenges involves the revision of:

(i) the legal and regulatory framework;
(ii) sector governance;

(iii) finance and economic performance;
(iv) institutional capacity, including EBS' performance;
(v) know-how of new technological options;
(vi) technical infrastructure and business capabilities;
(vii) monitoring and impact assessment of previous initiatives; environmental and social issues; and
(viii) tracing of a road map to promote the rational use of energy.

In March 2016, the National Assembly of Suriname (DNA) approved the "Electricity Act 2016" and the "Energy Authority Act". The new institutional and regulatory frameworks established in these Acts reflect the main principles and guidelines for the sustainable energy sector reform:

- Creation of an Energy Authority of Suriname (EAS), which will provide technical support and advice to the Ministry of Natural Resources (MNR) and will be in charge of the preparation of an Electricity Sector Plan (ESP) and the regulation of the electricity sector;
- The Electricity Sector Plan (ESP), to be prepared at least every five years, establishes a long-term strategic development plan for the sector and provides guidance for taking investment decisions, defining performance targets, and setting electricity tariffs;
- EBS remains as a monopoly responsible for electricity supply to end users, but it will be unbundled in business units, with separate management and separate cost accounting;
- Establishment of a Single Buyer model, according to which the Electricity Company will be responsible for procuring production capacity to meet projected demand, following the guidelines provided by the generation and transmission expansion plan of the ESP prepared by EAS and approved by the Government.

The ESP is intended to be guiding the sustainable development of the Power sector in Suriname in assuring a reliable supply of electricity. It has a 20-year long-term strategic view, with a medium-term implementation plan for the next 5 years. The ESP must be developed and implemented by the EAS. As the ESP forms the foundation for the future Suriname energy sector, assuring a coherent and effective ESP is crucial. The Electricity Act sets out the different elements which are to be included in the ESP. These elements will be allocated to the following three ESP modules:

- Strategic Plan:
  A 20-year horizon plan, setting out the strategy to assure a sustainable electricity sector for Suriname. The strategy plan will define clear and quantitative targets to achieve and the strategies to be followed in order to assure these targets.
- Technical Plan:
  This includes demand forecasts for 5 years and the generation and network capacity expansion requirements. Based hereupon the financial projections, including cost and investment needs and financing strategy, will be determined.
- Regulatory Plan:
  This includes the identification of the required regulations, in order to enforce the adequate functioning of the sector. The proposed regulations will establish clear rules for all sector

entities and will be enforceable by EAS. The regulatory plan will comprise of technical-, tariff-, and regulation aspects.

The implementation of the ESP is a key element of the transition to the new sector model. In addition to a long-term strategic development plan for the electricity sector the ESP shall also define a five-year action plan, which shall include, among others:

- An optimal Generation Expansion Plan;
- Basic criteria to prepare the tender documents to procure production capacity based on renewable energy sources;
- Quality and reliability standards for the provision of electricity services.
- A Transmission and Distribution Expansion Plan;
- Conditions for developing renewable self-generation and cogeneration facilities.
- Energy efficiency guidelines for consumers;
- A methodology to prepare a tariff adjustment program to focalize electricity subsidies, in order to reduce transfers from the national treasury and to implement efficient tariff structures.

From a broader perspective and to achieve sustainable development of the power sector, the ESP shall address the three pillars of energy sustainability:

- Energy security: the effective management of primary energy supply from domestic and external sources, the reliability of energy infrastructure and the ability of energy suppliers to meet current and future demands;
- Energy equity: accessibility and affordability of energy supply across the entire population;
- Environmental sustainability: supply and demand efficiencies, development of renewable and other low-carbon energy sources.

In general terms, consistent with the three pillars of energy sustainability, the ESP for Suriname should establish policies and strategies to achieve the goals dealing with the main issues of the energy sector as summarized below:

Table 1-3: Diversification of the generation mix.

Issues:	Goals to achieve:
○ The power sector becomes more and more dependent on conventional HFO units to meet demand growth. ○ A coherent policy for promoting the development of generation using renewable energy technologies is missing.	- Promote the development of renewable energy for grid-connected and off-grid applications. - Identify potentially attractive hydroelectric projects and define a policy for their development. - Analysis of viability of introducing imported natural gas and its application as an alternative to liquid fuels.

Table 1-4: Energy security

Issues:	Goals to achieve:
• Strong demand growth. • Weak generation and transmission expansion planning. • Electricity tariffs that cover only a fraction of supply costs. • Budgetary transfers from national treasury subsidizing the supply.	- Establish adequate quality and reliability of service standards. - Strengthen the expansion planning capabilities. Prepare an optimal expansion plan and organize a competitive bid program to procure new generation needed to meet demand. - Implement tariffs that reflect cost recovery- prepare a tariff adjustment program to focalize subsidies and reduce transfers from national treasury. - Identify tariff/subsidy scenarios in order to enable the government to set a target for the maximum amount of subsidy contribution from the government by the 5-year period.

Table 1-5: Energy access and affordability

Issues: (in the hinterlands):	Goals to achieve:
o High energy supply costs from small diesel units. o Inefficient fuel supply arrangements for the diesel engines. o Limited provision of electricity, with most sites receiving a 6 hour per day low quality service in best of the cases. o Unsustainable and inefficient investment, and maintenance scheme fully subsidized. o Lack of a strategy to improve energy access and affordability.	o Improve the institutional framework and the business model for energy supply in the hinterland, in order to reduce energy supply costs and to increase access to reliable energy services. o Define a strategic plan for rural electrification. o Reduce energy supply costs by connecting suitable isolated areas to the grid and using off-grid renewable generation. o Design an efficient tariff and subsidy scheme for rural electrification. o Promote the application of individual sustainable electricity generation (e.g. solar panels).

Table 1-6: Energy efficiency

Issues:	Goals to achieve:
<u>On the demand side:</u> ○ Low and subsidized tariffs do not provide incentives for energy efficiency. ○ There is no energy efficiency program. <u>On the supply side:</u> o Although electricity losses are within reasonable boundaries, the generation resources are not used efficiently: dispatch of generation units is driven by financial and contractual criteria. o Supply costs in some isolated areas and regional systems are high.	o Assess the potential for improving energy efficiency and conservation at the demand side and prepare an energy efficiency improvement program. o Improve the coordination of the operation and dispatch of the generation resources.

Table 1-7: Strengthening the institutional and regulatory framework

Issues:	Goals to achieve:
o The institutional and regulatory framework is weak. o MNR does not have the capability for the planning and implementation of an energy policy. o The regulation of electricity service is practically non-existent and poor. o EBS depends on money transfers from the national treasury and does not operate as a commercial enterprise and there is an important lack of reliable and publicly available data for the energy sector.	o Support the organization, staffing and operation of the Energy Authority. o Improve the transparency of the budgetary transfers from national treasury to EBS, in order to provide incentives for an efficient and commercial operation. o Unbundle EBS in business units with separate management and cost accounting. o Design and develop a consolidated energy database, and establish procedures to generate, maintain and publish relevant sector statistics.

(The Electricity Act 2016 strengthens the institutional and regulatory framework by creating an Energy Authority, establishing a single-buyer scheme, instituting cost-recovering tariffs and focalized subsidies).

2. STAKEHOLDERS

The following main stakeholders were identified to work on this document:

- NV Energiebedrijven Suriname (EBS)
- Telecommunicatie bedrijf Suriname (Telesur)
- Stichting Fonds Ontwikkeling Binnenland (SFOB)
- The Ministry of Regional Development (RO)
- The Ministry of Public Works, Transport & Communications (OW)
- The Ministry of Natural Resources (NH)

From the stakeholders the following representatives were assigned to work on this report:

- NV EBS: A. Aboikoni, S. Bakridi, D. Pinas, C. Resomardono, A. Jeroe, M. van der Kust
- Telesur: W. Weigle, D. Ramlakhan, R. Naipal, S. Raminderpersad
- SFOB: M. Cairo
- RO: W. Finisie, H. Deel, T. Fonkel, J. Petrusie
- OW: M. Samat, A. Dewoe, M. Rampiare
- NH: R. Harris, H. Hoepel-Aroma, R. van de Scheurrijker.

2.1. NV Energiebedrijven Suriname

2.1.1 Historical development

In 1932 the *Nederlands Indische Gas Maatschappij* (NIGM) power plant started the generation of electrical power with a capacity of 1.193 MW in Paramaribo. In 1950 the name NIGM changed to *Overzeesche Gas en Electriciteits Maatschappij* (OGEM). In 1953 the N.V. OGEM started the distribution of bottled propane gas under the name OGANE, derived from OGEM and PROPANE. In 1965 the propane was produced via diesel katalysation. Currently the propane is imported.

After signing of the Brokopondo Agreement in 1957 the US based ALCOA constructed the Afobaka hydro power plant. In total 10% of the energy generated would be ceded to the country. With the abandoning of the aluminum production in 1999, the hydro-energy became almost fully available for the EBS electricity demand.

In 1972 the OGEM transformed the company in N.V. Energie Bedrijven Suriname (EBS) as a joint venture between the Surinamese government and OGEM B.V. in Rotterdam. The Surinamese Government became the biggest stakeholder with 60 percent of the stocks while the other 40 percent of the ordinary shares belonged to OGEM B.V. Both partners each received 50 percent of the priority shares in the limited liability company. In 1975 after the independence of the country the Suriname Government became the sole shareholder.

Since 1973, EBS operates the system under a 50-year countrywide concession covering generating, transmission, and distribution of electricity. EBS receives supply from the Afobaka Hydropower Plant (HPP) under the terms of an agreement between the Government of Suriname (GOS) and Suralco, which owns the facility. EBS owns thermal plants fueled with diesel and fuel-oil and also purchases electricity from the State oil Power Company Suriname (SPCS).

2.1.2 The Organization

The business profile

The N.V. Energie Bedrijven Suriname is the provider of electrical energy and is responsible for its transmission and distribution to customers. Furthermore N.V. EBS has a daughter company, which is N.V. Ogane. This company is responsible for the supply of imported propane gas to customers.

Currently the company is supervised by a supervisory board and managed by an Executive board of directors. The board of directors consists of the Executive Director (CEO), Financial Director (CFO), Technical Director (CTO) and Operations Director (COO) who are responsible for running the company and report to the supervisory board. Each of these directors are responsible for different parts of the organization.

According to the “Electricity Act 2016”, as mentioned in the previous chapter, the organization structure of the N.V. EBS must be transformed into the structure as depicted in Figure 2-1 by January 2018.

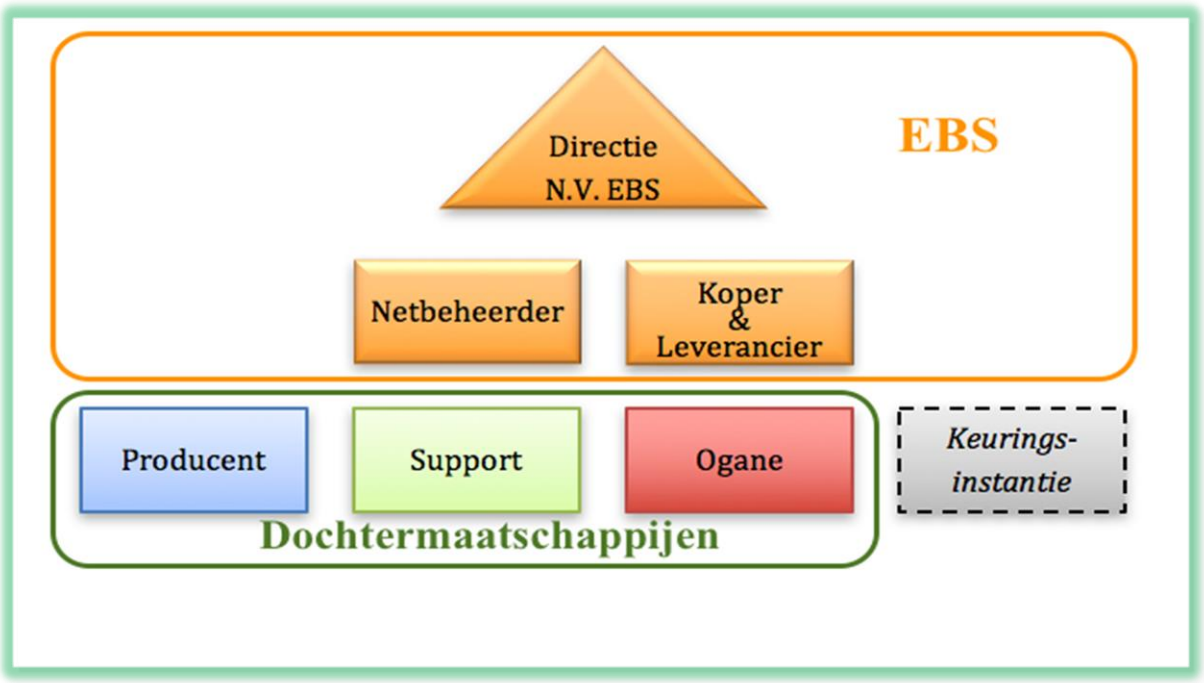


Figure 2-1: The future (from 2018 on) organization structure of N.V. EBS

Community role of the company

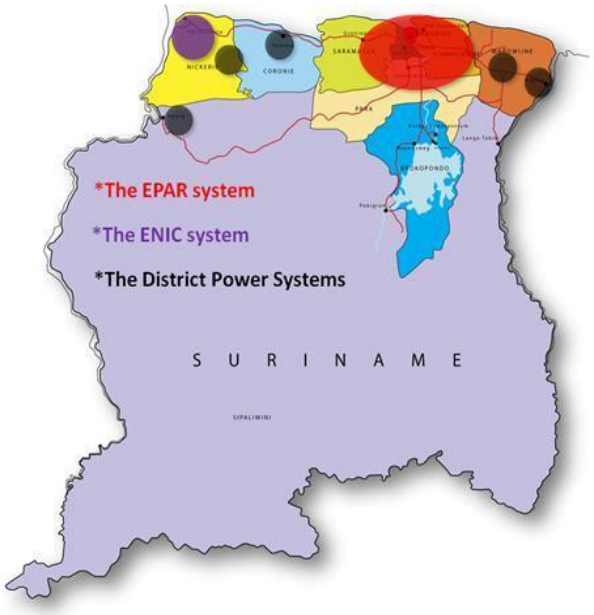
Due to the role of N.V. EBS in the community and the fact that the production of sufficient energy is of big importance for the economic development of the country, the company has 2 main responsibilities to the community which are:

1. To secure the electrical power capacity to meet the energy demand;

2. To maintain efficient electricity cost price.

2.1.3 The energy supply system

Figure 2-2: Location of the EBS power systems



The energy supply system is part of the value chain of the N.V. EBS. The value chain presents the key processes of the company, which are:

1. Generation
2. Transmission
3. Distribution

Suriname´s power sector consists of a number of individual power systems: the EPAR system, covering Paramaribo and the surroundings, the ENIC system, for Nieuw Nickerie in the western part of Suriname are the largest service areas.

The remaining power systems are located at: (i) Albina and Moengo in the Marowijne district (eastern part of SME); (ii) Apoera in the Sipaliwini district (south-west); (iii) Wageningen (western part) in the Nickerie district; and (iv) Totness in the Coronie district. These five power systems have, in combination, an approximate installed capacity of 22.2MW through fossil fuel power plants that supplies electricity to over 5,000 customers, located mainly in the coastal zone of Suriname. Furthermore we have the Brokopondo area, being fed via the Afobaka plant in the mid-south.

Rural Electrification

Electricity supply in the sparsely inhabited interior is under the mandate of *Dienst Electrificatie Voorziening* (DEV), which is an agency of MNH. About 130 villages have diesel generators installed which are owned and operated by DEV. The total installed capacity is approximately 6 MW. About 100 of these villages are provided with diesel fuel by DEV on a monthly basis. Fuel transport to remote villages is done by boat, while communities closer to Paramaribo can usually be reached by road. The electricity service is designed for an average time of 4 hours per day (from 7:00 pm to 11:00 pm).

Rural households are not charged for the service as all the costs are absorbed by the GOS. Fuel supply is constrained due to cost, losses and logistical reasons and in some villages it is unavailable for long periods, which affects services, quality of life and economic activity. In response, in some areas people tend to migrate temporarily or permanently. The GOS considers the availability of reliable electricity as a key factor to stabilize demographic development in the hinterlands and to the development of civic centers.

2.1.4 SWOT Analysis Electricity Supply

The SWOT analysis of the N.V. EBS, which has identified its internal weaknesses and strengths as well as the external opportunities and threats, differ in the coastal area from the Hinterland. In general the SWOT analysis is depicted in Table 2-1.

Table 2-1: SWOT analysis EBS

STRENGHTS: **1**. Competent and experienced technical staff. 2. Pleasant work environment. 3. Existing customer base (152,775 connections)	**WEAKNESSES**: 1. Current tariffs not cost-recovering 2. Insufficient financial means 3. ICT outdated and not integrated. 4. Absence of lower cost fuels and systems. 5. Insufficient project management experience. 6. Insufficient generation capacity 7. Insufficient transmission and distribution system. 8. Frequent black-outs. 9. Long waiting list for new connections 10. Lack of resources in the Hinterland
OPPORTUNITIES: 1.Changing roles in new Electricity Law. 2.Increasing demand for electricity connections. 3.Monopoly in transmission and distribution. 4.Switch from HFO to LNG	**THREATS:** 1. Reduced purchasing power/economic recession. 2. Poor decision making on tariffs. 3. Too much Government involvement. 4. Increasing international and national environmental requirements. 5. Negative public image of EBS

With the implementation of this project, N.V. EBS will help in improving the quality of electricity in the Hinterland to 24/7 basis and consequently improve the social and economic living conditions of the local population.

With the implementation of the new Electricity Act 2016, the N.V. EBS will also be in a better position to reduce the other weaknesses and most of the threats. Furthermore, the project is allowing capturing the opportunity of a future switch from HFO to LNG as primary energy source, which positively contributes to meeting the international environmental requirements as well as reduced generation costs.

2.2. The Ministry of Regional Development

The Ministry of Regional Development aims at the sustainable development of the districts with the objectives of improving the living conditions of the local population. This is expressed in the vision and mission of the Ministry.

VISION STATEMENT

By 2021 we are a professional organization that works to reach sustainable development in the area of decentralization; rural development such as infrastructure and human resources in partnership with citizenship, public and private organizations.

MISSION STATEMENT

We improve the living condition of the Surinamese people, especially the rural communities, through:

1. Decentralization;
2. Capacity building of the locals, village management and local organizations;
3. Legislation on regional institutions; Decentralization and traditional authority;
4. Research and data collection;
5. Participation of the locals and targeted information through PR;
6. Agricultural development in the hinterland;
7. Efficient administrative procedures and processes.

The main focus of the Ministry of Regional Development is to keep the communication between the regional government and the traditional authority. As a result, communities in villages are involved in social and economic development regarding their environment. Attention is given to the following areas:

1. The regional governmental institutions;
2. Relations between regional and central government;
3. Integrated governmental actions with the aim to bring regional development, improving the living conditions in the districts and the sustainable development of the interior;
4. A coherent policy aimed at cooperation between the districts, in order to promote common interests.

FOCUS LOCATIONS

In the *Planwet* the developing of specific local towns for the Hinterland is included for the regional and spatial planning with the main objective to improve the local economies. The Ministry of Regional Development is currently focusing on the following four (4) local towns:

1. Atjoni;
2. Snesiekondre;
3. Stoelmanseiland;
4. Apoera.

The intention is for the abovementioned locations to grow into local towns with all governmental facilities to provide opportunities for surrounding villages to strengthen their socio-economic development. One of the important conditions is the availability of reliable and sustainable electricity. Through partnerships with other stakeholders, reliable and high quality electricity supply will be provided.

Figure 2-3 Map of Suriname indicating the focus areas

2.3. Stichting Fonds Ontwikkeling Binnenland

The semi government agency Stichting Fonds Ontwikkelings Binnenland (SFOB) is a supporting organization of the Ministry of Regional Development. The SFOB was established in 2003 with the goal to contribute to the elimination of the socioeconomic disadvantage of the residential communities which are under traditional leadership in Suriname. The agency functions as an executive body, which has now become a professional development institute for structural and sustainable development in Suriname's interior.

SFOB is a relatively small organization with a high level of expertise in its policy area. The SFOB staff is very skilled and is distributed over the various departments within the bureau, who are very professional in carrying out their work. The organization is constantly working on upgrading the capacity of its staff.

Vision Foundation FOB
The SFOB serves as a success and strategic factor, which supports the hinterland communities in their endeavor of socioeconomic development and independence.

Mission Foundation FOB
The FOB Foundation is a strong, indispensable and reliable factor in the sustainable development of the interior of Suriname.

Projects and programs
Since its establishment, SFOB has known the following phases:
1. The start-up phase SFOB1 from 2002- 2004;
2. SFOB 2 (2004-2007) has been successfully completed with the execution of 16 projects. From the lessons learned, a next phase has been started;
3. The SFOB 3 program has been completed with the implementation of nine (9) water projects in various communities and centers in Suriname.

The foundation has carried out various projects in the interior of Suriname.
Some projects are listed below:
- Electrification Project in indigenous village Matta;
- Multifunctional Community House Bigiston;
- Construction of additional facilities in Atjoni;
- Educational facilities Kwakoegron;
- The construction of eight (8) sustainable water supply systems;
- Formulation of 12 integral development plans of communities;
- Develop and set up a service centers at three (3) locations, i.e. Atjoni, Sneesikondre and Stoelmans Island. Etc.

The foundation has conducted projects with various partners, such as ministries, business organizations, Community Based Organizations, local NGOs as well as international NGOs and international donors, including UNDP, UNICEF, IaDB,Stg. World Water Network.
Focus areas SFOB:
The areas on which SFOB focused are:

1. **Capacity building:** Strengthening of Traditional authorities and essential government departments and institutes aimed at the realization of productive projects through taking into account also the essential role of women in the hinterland regarding food production and education in the field of sustainable poverty reduction. SFOB stands for Community Development in the broadest sense, which means that we will never focus only on key individuals within the communities. The contact and input of the average person is also of great importance because it brings a balance in the collaboration. At each step of the project cycle, community participation is necessary; SFOB is in favor of participatory processes.

2. **Utilities**: the sustainable use of available natural resources through the establishment of sustainable water and electricity supply facilities and the promotion of renewable energy sources in the hinterland. Since the founding of the organization, the SFOB has concentrated on setting up water systems for the community. As is known, the inhabitants are dependent on rivers and creeks. Due to issues such as pollution, communities are forced to switch to other systems such as rainwater catchment. In order to keep these systems running, electricity is a must. In addition, the foundation has a pilot project called the Gran Olo project, which should be an example of generating electricity using hydropower. In addition to the above mentioned, the organization is keen to look at other new methods such as solar energy and wind energy.

3. **Spatial planning**: Improvement of infrastructure and associated facilities including a waste recycling management system. This in relation to the population distribution of the

hinterland communities. The Surinamese government has set up service centers in different areas in the interior in the context of decentralization. In light of global themes such as climate change and sustainable development these centers are set up so that the community can make sustainable use of their services.

4. **Entrepreneurship**: Encouraging small entrepreneurs of the local communities in terms of production promotion, food security and the sustainable use of potentially available resources. Capacity strengthening is associated with the independence of individuals and communities. Entrepreneurship is an opportunity to bring about independence. However, this must be in balance with the local community in order not to disturb existing structures. Effective process guidance is therefore a must.

2.4. The Ministry of Public Works, Transport & Communication

HISTORICAL DEVELOPMENT

The history of the Ministry of Public Works brings us back to the year 1855, where the Governor at that time, Mr. Charles Pierre Schimpf, decided that the Civil and Military Building Departments will be put together on January 1, 1856 under the name of the *Bouwdepartement* (department of construction). From there on the construction department has undergone various name changes over the years. Recently, February 2017, the Ministry of Transport, Tourism and Communications has ceased to exist, and the Transport and Communications departments have been transferred to the Ministry of Public Works, whereby the official name become the Ministry of Public Works, Transport & Communication.

MISSION

The Ministry of Public Works initiates, builds and maintains public properties in order to create a livable, clean and beautiful Suriname.

VISION

The most customer-friendly and professional government organization, which, through the efficient use of the state owned resources, develops and manages sustainable public properties in order to improve the quality of life in Suriname.

ORGANIZATION STRUCTURE

The Ministry of Public Works, Transport and Communications consists of the following four (4) directorates:

1. The Directorate Civil Engineering
2. The Directorate of Architectural Work and Spatial Planning
3. The Directorate for Environmental works
4. The Directorate Transport and Communications

The Civil Engineering Directorate is mainly involved in infrastructure works for mainly the urban areas. This Directorate is involved in the project "Rural Electrification Atjoni-Asidonhopo / Stonhoekoe", because of its expertise in infrastructure works. The infrastructure works for this particular electricity project in the rural area Boven-Suriname will be carried out in collaboration with the Ministry of Regional Development, because of their responsibility for the infrastructure in rural areas.

The Civil Engineering Directorate its main focus is to provide for a good infrastructure in Suriname which includes (but not limited to) roads and bridges.

2.5. The Telecommunication Company Suriname (Telesur)

INTRODUCTION

Rural areas of Suriname were sparsely covered and were not considered as a viable business case by telecommunication operators. Recent growth of tele-density in urban areas, fueled by mobile technology, has meant that the digital gap between rural and urban areas has widened. Rural populations will need to be provided with mobile telephony and wireless broadband access, by connecting remote areas to the broadband core networks. Choosing efficient, cost effective and fast-deployment technologies, whether wired or wireless networks, will improve accessibility. The key challenges for the provision of telecommunication services in rural areas are driven by both technological and economic considerations. Setting up backhaul connectivity remains a high-cost exercise. Erratic power supply or complete lack of energy sources is a major barrier, and photovoltaic power supply is increasingly becoming a viable alternative. The requirement to maintain sufficient backup systems raises operational costs substantially. This program will contribute to the goal of digital inclusion, by providing assistance for the development of connectivity in rural and remote areas using suitable technologies for access, backhaul and sources of power supply.

A HISTORICAL VIEW

Telesur was founded on May 1, 1945 under the name s' Lands Telegraaf Telefoondienst (National Telegraph Operator), LTT, and was formed from the merge of the 'sLands Radiodienst, (country's Radio Service), (established in 1925) and the s Lands Telefoonwezen, (country's Phone Being), (founded in 1907). Twenty-eight years later, the company's name was changed to s' Lands Telegraaf Telefoonbedrijf (National Telegraph and Telephone Company). In 1981 the name was officially changed to Telesur. In 2007 the law Telecommunications Services in Suriname was introduced. In 2008, the Surinamese telecommunications company, Telesur, expanded its operations to the Netherlands. Telesur started in 1996 with the opening up of the interior for Telecommunication services. A Micro wave link was installed on a 508m mountain in the interior to be used as a Hub tot he further located Upper Suriname River (USR) region. An AMPS mobile system was installed on this mountain and mobile services could be provided up to 70km from this site.

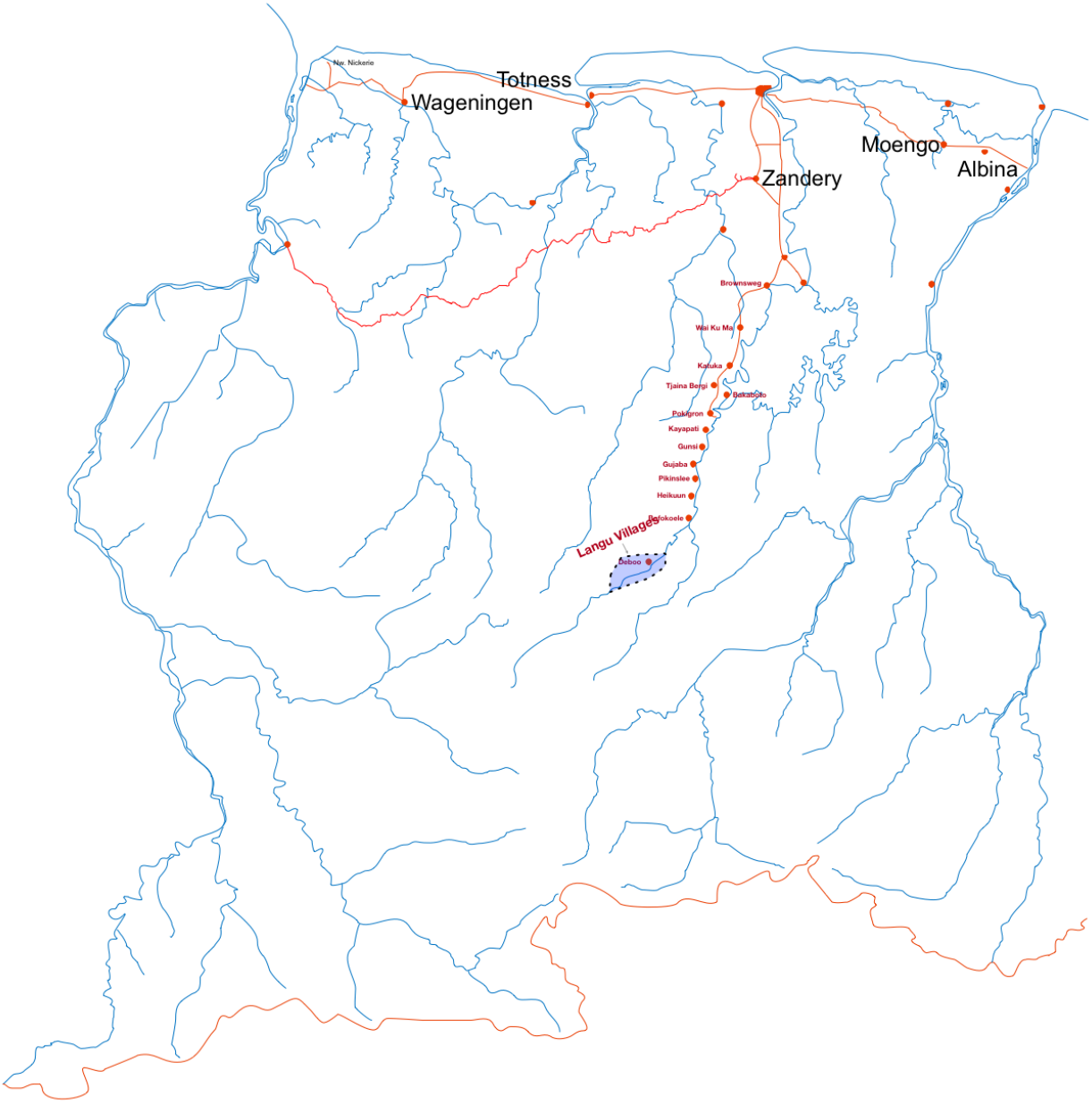


Figure 2-4 Telesur Sites in the Upper Suriname River Area and the Road to Atjoni

In 1998 the AMPS system was replaced by a TDMA system. A Vsat network was implemented in 2002 to provide Telecommunications to the most remote areas of Suriname. One Vsat was installed in the Village Asidonhopo in the Upper Suriname River region. By implementing Telecommunication services for the Langu Villages in 2009, the most remote region of the Upper Suriname River region was opened up. The Langu Villages are located as far as 2 day journey by boat. Between 2009 and 2011 new sites were implemented in different villages along the Suriname River to provide coverage to the Villages in the Upper Suriname River area. In 2010 3 sites were implemented along the road to Atjoni to provide coverage on the road and the Villages along the road. These sites were Wai ku ma, Katuka Bergi and Tjaina Bergi.

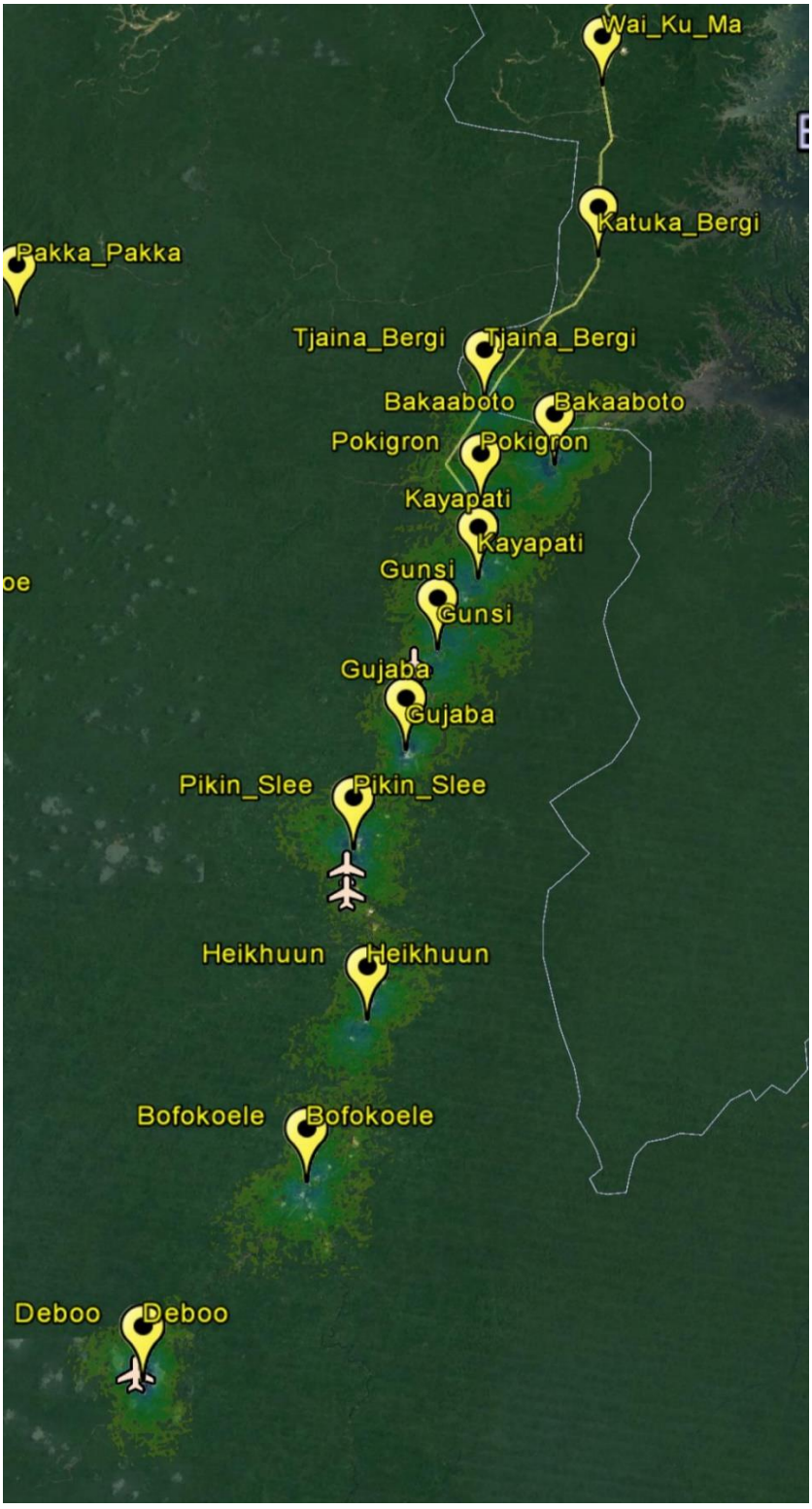


Figure 2-5: 2G & 3G coverage of the Upper Suriname River Area

3. ELECTRIFICATION OF UPPER SURINAME RIVER AREA

3.1. Introduction

The electricity supply in the interior, under the responsibility of MNH (DEV) is one whereby the villages are supplied with small diesel gensets for approximately 4 hour daily. The reason for this being the infrastructure possibilities. The interior of Suriname has been lacking structural electricity for decades. The Government policy is aimed at bringing electricity to areas which have been lacking it on 24/7 basis. Based on the infrastructure opportunities, the Upper Suriname River area is chosen to supply the electricity on 24/7 basis starting from Pokigron/Atjoni upstream till Pikienslee as phase 1. Subsequently, the remaining villages will be provided with electricity in phase 2 and 3 as illustrated in Figure 3-1.

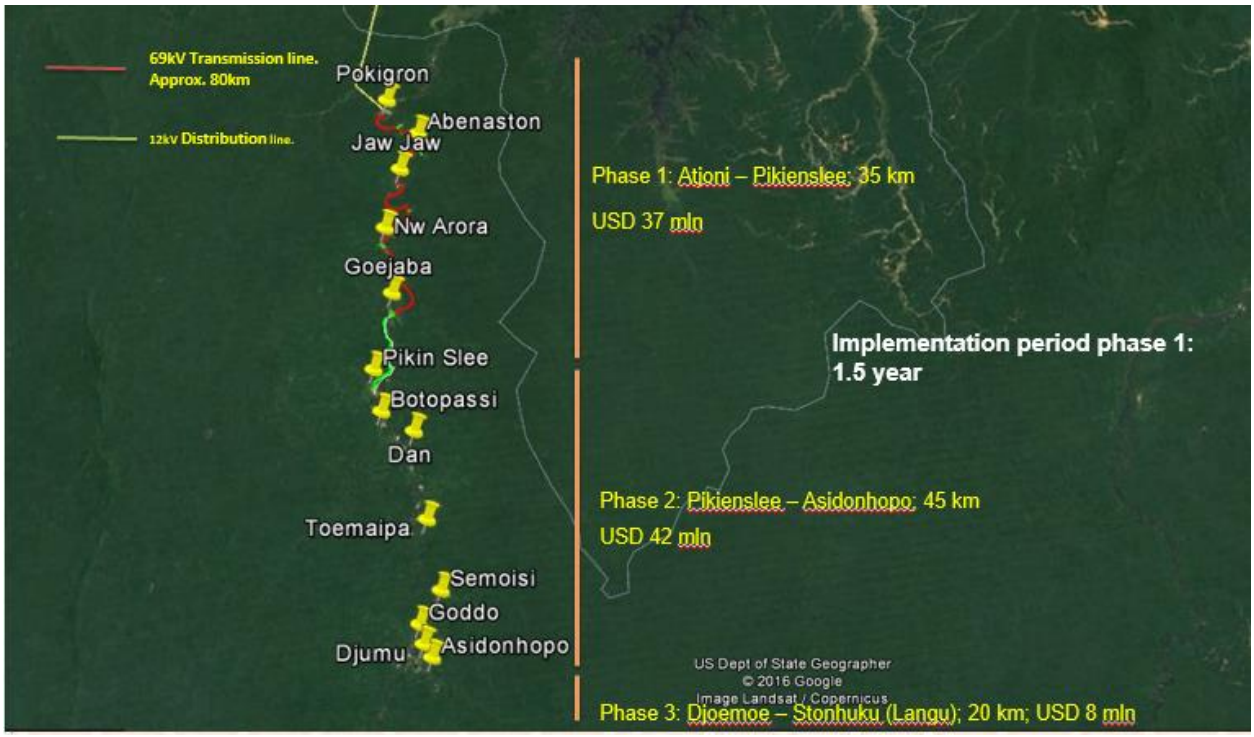


Figure 3-1: Overview of the villages at the upper stream of Suriname River, starting from Atjoni/ Pokigron till Dangogo/Stonhoekoe; (Source: EBS).

The alternatives for power generation in this area are: PV-Solar, Decentralized Thermal, Centralized Thermal and Micro hydro systems. Based on the investment costs and the LCOE, it has been decided to set up a centralized thermal power plant for the supply of firmed power at Atjoni with a new HV grid to Pikienslee as phase 1 and for the near future to connect power from renewable resources on the main grid. The objectives of this project are:

- Increase the quality of electricity service and transfer to 24-hour power supply;
- Improve the living condition of the local population;
- Improve economic and social development in rural areas.

The projected location for the thermal power plant will be located near Atjoni/Pokigron at approximately 195 km from the Capital Paramaribo. Atjoni/Pokigron is a local town adjacent to the village Pokigron and consists of (but not limited to):

- primary school;

- secondary school;
- boarding school;
- local bank;
- Governmental offices;
- market place; and
- primary health care center.

Since Atjoni is the most Southern local town accessible through a paved road from the capital Paramaribo, fuelling the thermal power plant will be easy. The people in the surrounding villages of Atjoni are living mainly of fishing, hunting, eco-tourism and small scale agriculture for own consumption. There are no other economical and industrial activities in the Area.

Market Demand Analysis

Currently electricity is being generated and supplied by thermal power plants, consisting of one gensets at each village or concentration of villages in the interior. The electricity is available from 19:00h to 23:00h.

Electricity is currently used in most of the households for lighting purposes. Some households have some basic appliances as refrigerator and freezer. The biggest consumers in the areas are the small Supermarkets. Table 3-1 shows an overview of the current installed electrical capacity in the area.

Table 3-1 installed capacity in the villages included in phase 1

Name of village	Installed Capacity in kW
Pokigron/Atjoni	700
Gengeston	40
Pamboko	60
Abenaston	68
Amaka Kondre	40
Kajapatie	30
Jaw Jaw	68
Lispansi	30
Adawai	12
Gunzi	30
Nw. Aurora & Tjalikondre	60
Gujaba	140
Grantatai	48
Bendikwai	48
Pikienslee	40
Total	**1414**

Source: IDB-2015

Currently there are no actual electricity consumption data of the area readily available because meters are not installed at the households.

Atjoni/Pokigron is a special situation apart from the other villages. Currently a new 500 kWp solar PV plant is being implemented at Atjoni under a financing program of the Inter-American Development Bank (IDB) which will operate in hybrid mode with the existing 750 kW diesel thermal power plant. This PV-diesel hybrid system will supply Atjoni and the village Pokigron for 24/7 electricity. The distribution system is being upgraded with a 12kV distribution grid. It is the

expectation that in Q3 2017 the local town Atjoni and the village Pokigron will be supplied with electricity on a 24/7 basis. In order to increase the electricity service availability (24 hours) to the nearby villages, the EBS is looking for possibilities to supply the electricity through a thermal power plant or through transmission and distribution line from the nearest substation.

The PV project is a good experience for EBS in order to analyze the other opportunities.

3.2. Peak demand analysis

3.2.1. Peak demand

Currently there are no data available regarding the amount of household per village. Also the current energy consumption of the households and small commercials is not known.

Based on the mentioned lack of data the following assumptions were made, based on best practices in rural areas, in order to determine the peak demand:

- An amount of 4 people per household is used based on World Bank standard for rural areas;
- The average power connection is 3 kVA for household, 50 kVA for small commercials & public facilities and 75 – 150 kVA for health care centers;
- A load factor of 60% is used, which is slightly higher compared to the 53% load factor in other rural service areas under EBS responsibility;
- A reserve capacity of 25% and for street lighting an amount of 5% of the total installed capacity is used.

The design for the facilities is done based on civil data, from the register of the Ministry of Internal Affairs i.e the department *Central* Office for Civil Affairs (CBB) and based on abovementioned assumptions of best practices from the EPAR and DE networks from the EBS. The peak power demand is therefore 6 MW for phase and 12 MW for phase 1, 2 & 3, refer to Annex 1 for details.

3.2.2 Installed capacity and future prognosis

Although the peak demand for phase 1 is 6 MW at year 1, the installed capacity can be carried out in phases, beginning with an initial installed capacity lower than 6 MW and expanding by additional gensets. Since the power plant will be fueled by HFO and taken into account the available HFO gensets in the market, three (3) pieces gensets with a capacity of 1.5 MW each (total of 4.5 MW) will be installed for phase 1.

In addition to the abovementioned, the 500 kWp solar PV plant which is currently being constructed at Atjoni with battery backup will be interconnected to the new HFO power plant. Also the existing 2 pieces CAT gensets, with a total installed capacity of 700 kW (350 kW each) can be used as emergency gensets for the new power plant. The capacity of the PV plant and the 2 pieces CAT gensets are considered as part of the total installed capacity.

Based on EBS experience in rural areas it is expected that there will be a load jump of approximately 50% in the 2nd year after the implementation of 24/7 electricity supply to a certain service area. The future prognosis for the peak power demand is depicted in Table 3-2.

Table-3-2 Future prognosis for peak power demand

FUTURE PROGNOSIS		
Year	**Growth**	**Installed capacity (MW)**
2020	0%	6.06
2021	50%	9.09
2022	40%	12.72
2023	15%	14.63
2024	10%	16.09
2025	5%	16.90
2026	4%	**17.58**

3.3. Design Analysis

In this chapter, the centralized system of power generations in the area is illustrated. The centralized system that will be illustrated is a hybrid (solar & thermal) Centralized Power Plant at Atjoni. The new 33/69kV transmission line will be constructed from Atjoni up to Pikienslee at phase 1. From this line all the villages in-between Atjoni and Pikienslee will be supplied with electricity on 24/7 basis. The transmission lines will be constructed through a “Jeep-trail” or “passageway” on extra high poles over the secondary forest to minimize the impact on the ecological system.

The preliminary results of the simulation for the Transmission Line from Atjoni to Asidonhopo shows that a voltage level of 33 kV is sufficient. Taking into consideration the growth based on best practices from the EPAR section we foresee that further measures need to be the installation of additional renewable generation capacity to guarantee the supply. High level desktop studies have shown the possibility of several mini hydro possibilities which will result in reducing the generation cost and additionally strengthen the capacity of the transmission facilities.

The 33 kV line can cover the demand growth for 20 years based on a yearly growth rate of 5%. In order to extend this period of 20 years, the renewable energy potential such as micro/mini hydro and solar PV at the upper stream of the Suriname River will be developed and injected to the 33 kV grid to keep the voltage drop within the limits. When a road is constructed from Atjoni to the Villages, a new thermal power plant can be built in the area of Goejaba and Pikienslee to transmit the power southwards to Asidonhopo and also northwards to Atjoni if needed.

Another option is to build a transmission line of 69 kV to cover all the power generated from Atjoni to Dangogo & Stonhoekoe up till a maximum of 20 MW with voltage drop within the limits. However the costs for building the 69 kV will be way higher.

3.3.1. Centralized Thermal power plant

The centralized system is a thermal power plant consisting of (but not limited) the following:

- Three (3) heavy fuel generator sets with a total installed capacity of 4.5MW for phase 1;
- Auxiliary units such as fuel oil, lube oil storage tanks, firefighting system and fuel treatment units;
- Prepaid meters for households;
- Service center for clients;
- 3 new houses for personnel;
- 1 motor cycle for maintenance
- 2 cars for maintenance;
- Surveillance camera system.

3.3.2. Estimated project costs with 69 kV line

The project costs regarding the electricity supply consists of the following major categories:

- Engineering, ESIA & PR works;
- Land clearing;
- Civil works power station;
- Mechanical works power station;
- Electrical works power station;
- Overhead line *12 kV & 69 kV*;
- Transportation works.

The estimated project cost is depicted in Table 3-3.

Table 3-3 Estimated project costs Rural Electrification Atjoni-Asidonhopo/Stonhoekoe with 69 kV transmission line

Cost estimation Rural Electrification Atjoni-Asidonhopo/Stonhoekoe			
Total Cost	**Phase 1**	**Phase 1+2**	**Phase 1+2+3**
Mechanical 3 x 1.5 MW HFO GENSET (+2×2.5MW for phase 2-3)	$ 5,345,000	$ 8,255,000	$ 8,255,000
Civil Work Powerstation	$ 2,958,450	$ 2,958,450	$ 2,958,450
Powerstation Electrical part	$ 2,316,030	$ 2,316,030	$ 2,316,030
OverHead Line 12 kV	$ 2,949,000	$ 7,262,000	$ 10,996,000
Overhead Line 69 kV	$ 13,080,034	$ 31,709,173	$ 31,709,173
Land Clearing	$ 1,000,000	$ 2,000,000	$ 3,000,000
Engineering, ESIA & PR works	$ 1,000,000	$ 2,000,000	$ 3,000,000
Subtotal	*$ 28,648,514*	*$ 56,500,653*	*$ 62,234,653*
Transport (20-30%)	$ 5,729,703	$ 16,950,196	$ 18,670,396
Contingency 10%	$ 2,864,851	$ 5,650,065	$ 6,223,465
Total Cost	**$ 37,243,068**	**$ 79,100,915**	**$ 87,128,515**

The cost estimation is based on desktop studies. Since site surveys are needed in order to determine the correct trace of the transmission and distribution line, the actual costs can vary with ± 40%. In addition the costs of the road (Jeep-trail of passageways) for the transmission line and logistic costs are not included in this cost estimation, since those costs will be covered by the Ministry of Public Works, Transport and Communication together with the Ministry of Regional Development and submitted in separate tender documents.

3.3.3. Estimated project costs with 33 kV line

The project costs regarding the electricity supply consists of the following major categories:

- Engineering, ESIA & PR works;
- Land clearing;
- Civil works power station;
- Mechanical works power station;
- Electrical works power station;
- Overhead line *12 kV & 33 kV;*
- Transportation works.

The estimated project cost is depicted in Table 3-4.

Table 3-4 Estimated project costs Rural Electrification Atjoni-Asidonhopo/Stonhoekoe with 33 kV transmission line

Cost estimation Rural Electrification Atjoni-Asidonhopo/Stonhoekoe			
Total Cost	**Phase 1**	**Phase 1+2**	**Phase 1+2+3**
Mechanical 3 x 1.5 MW HFO GENSET (+2×2.5MW for phase 2-3)	$ 5,345,000	$ 8,255,000	$ 8,255,000
Civil Work Powerstation	$ 2,958,450	$ 3,006,450	$ 3,006,450
Powerstation Electrical part	$ 1,570,520	$ 2,370,520	$ 2,370,520
OverHead Line 12 kV	$ 1,680,600	$ 3,199,200	$ 4,425,280
Overhead Line 33 kV	$ 5,484,094	$ 16,118,680	$ 24,310,500
Land Clearing	$ 1,000,000	$ 2,000,000	$ 2,000,000
Engineering, ESIA & PR works	$ 1,000,000	$ 2,000,000	$ 3,000,000
Subtotal	*$ 19,038,664*	*$ 36,949,850*	*$ 47,367,750*
Transport (20-30%)	$ 3,807,733	$ 10,784,955	$ 13,610,325
Contingency 10%	$ 1,903,866	$ 3,594,985	$ 4,536,775
Total Cost	**$ 24,750,263**	**$ 51,329,790**	**$ 65,514,850**

As mentioned before, the cost estimation is based on desktop studies. Since site surveys are needed in order to determine the correct trace of the transmission and distribution line, the actual costs can vary with ± 40%.

3.3.4. Comparison of 33 kV line versus 69 kV line

As seems from Table 3-3 and Table 3-4, the 69 kV transmission line will increase the project costs for phase 1 with approximately 13 million USD and the total project costs with approximately 22 million USD compared to the costs for the 33 kV transmission line. The 69 kV transmission line will guarantee the capability to meet the growing demand during its lifespan, without voltage drop beyond the limits. To keep the voltage drop within the limits, as mentioned before in this chapter, the 33 kV line will required the following additional measured in the near future:

- Power generation from renewable resources along the upper stream of the Suriname River;
- Building of booster units along the 33 kV transmission line;

- Building of a new thermal power plant in the area of Goejaba and Pikienslee to transmit the power southwards to Asidonhopo and also northwards to Atjoni if needed. The requirement for this option is a road of 80 m wide from Atjoni to Pikienslee.

However there are other pros and cons to be considered besides the voltage drop and the project costs, which are listed in Table 3-5.

Table 3-5 Comparison 33 kV transmission line versus 69 kV transmission line

33 kV Transmission level		**69 kV transmission level**	
Pro's	**Cons**	**Pro's**	**Cons**
Less expensive solution	Maximum **6 MW** capacity without additional measures	Higher capacity up to **20 MW** without additional measures	Higher investment cost USD **(USD 13 MM for phase 1 and USD 22 MM for phase 2)**
Less Right of Way	Addition of distributed generation eminent	Less animal outages (more spacing)	More Right of Way
Lower poles (15 meters)	Use of pole mounted C-banks recommended	Use of special heavy equipment	Longer poles (18 meters)
More animal outages (less spacing)			Groundstations per transformer
Pole mounted transformers available			Limited availability of 69/0.22 kV transformers
Possibility of in line cut-outs			

4. TELECOMMUNICATION SITUATION IN THE AREA: TELESUR VIEW

4.1. Introduction

Rural areas of Suriname were sparsely covered and were not considered as a viable business case by telecommunication operators. Recent growth of teledensity in urban areas, fueled by mobile technology, has meant that the digital gap between rural and urban areas has widened. Rural populations will need to be provided with mobile telephony and wireless broadband access, by connecting remote areas to the broadband core networks. Choosing efficient, cost effective and fast-deployment technologies, whether wired or wireless networks, will improve accessibility. The key challenges for the provision of telecommunication services in rural areas are driven by both technological and economic considerations. Setting up backhaul connectivity remains a high-cost exercise. Erratic power supply or complete lack of energy sources is a major barrier, and photovoltaic power supply is increasingly becoming a viable alternative. The requirement to maintain sufficient backup systems raises operational costs substantially. This program will contribute to the goal of digital inclusion, by providing assistance for the development of connectivity in rural and remote areas using suitable technologies for access, backhaul and sources of power supply.

4.2. Current status

Currently we have 2G and 3G services in this area. The 2G/3G sites are as shown in figure 1. All the sites are powered by solar power.

Telesur has 12 sites to cover the Upper Suriname River area. The coverage is shown in Figure 4-1 Furthermore we have also DTV (Digital Television) coverage in the interior of Suriname. The coverage for the Upper Suriname River area for DTV is shown in fig 3. The Transmitter is located at the Brownsberg site. For this site we have already commercial power available.

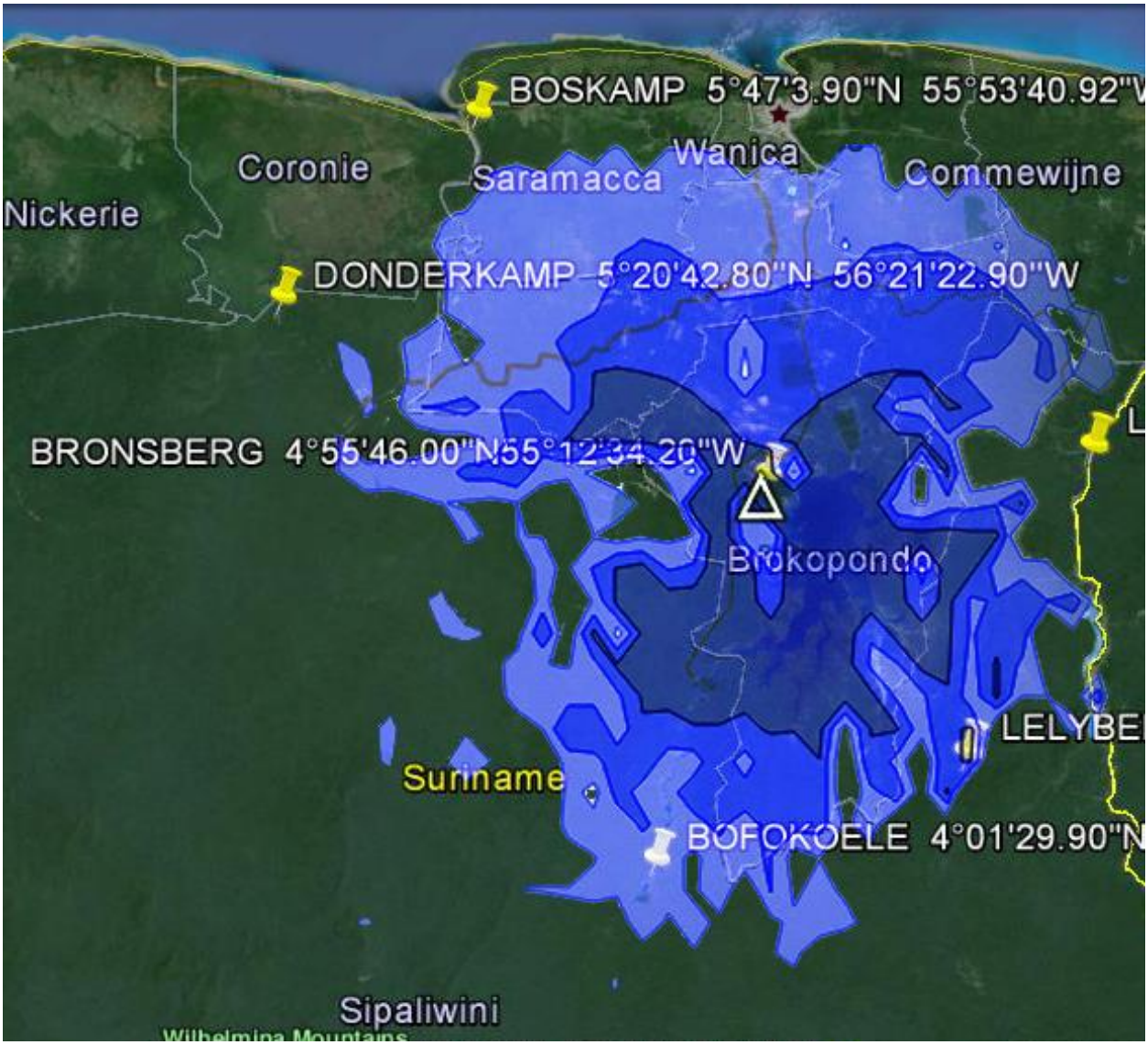


Figure 4-1: DTV coverage of the Upper Suriname River Area

4.3. Challenges

The challenges that Telesur faces to maintain this network are as follows:

• Logistic cost are high;

• Accessibility of the sites;

• Heat. • Humidity;

• Maximize battery life;

• Battery and solar panel theft.

There are also some Commercial challenges:

• Distribution of Prepaid cards;

• Reduce OPEX and generate enough traffic to be cost-effective;

• Marketing reach.

4.4. Collaboration

The Atjoni Electrification Project is an opportunity, for the parties involved, to investigate the possibilities to work together to decrease the OPEX costs for all parties. The new infrastructure will contribute to:

• Reducing Logistic costs;

• Increase Accessibility to the sites.

For Future expansions Telesur Commercial Power will be available, so that Telesur will not need to expand the Solar power system.

4.5. Future

The existing sites in the USR area have already Power and Transmission 1. However, as the area will be more accessible and Commercial power will be available, the Commercial activities will increase. As the Communities will have more earning power, this will result in increase of Traffic. The Telecommunication infrastructure will have to be expanded. The availability of Commercial power will make it easier to implement this expansion. Furthermore we will have to investigate the feasibility to make the provisions for future upgrade of the Telecom Transmission network and power Systems.

4.5.1 TelecomTransmission

To connect the USR Region to the optical network of Telesur, the integration needs to take place in the Telesur site at Brownsweg. This site is the nearest Station that is connected to the Optical network of Telesur. The estimated cost for the Fiber optic connection (excluding equipment) is:

Table 4-1: Telecom transmission costs

	Telecom Transmission costs		
Route	**Installation costs**	**Material costs**	**Total costs (USD)**
Brownsweg - Atjoni	2,494,515.70	523,823.25	3,018,338.95
Atjoni - Stonhoekoe	640,715.41	133,432.19	774,147.60
Pikienslee - Asidonhopo	1,280,587.34	268,625.50	1,549,212.84
Subtotal	***4,415,818.45***	***925,880.94***	**5,341,699.39**

L2 Switches will be used to aggregate the traffic from the remote site. This traffic will be transported via the Telesur site in Brownsweg and the transmission Backbone to Paramaribo. In Paramaribo the traffic will be terminated in the Telesur Data Core. The cost of the equipment and the services to accomplish this will be:

Table 4-2: Network costs

Network costs	
Network	**equipment costs (USD)**
Aggregation/datacore	809,080.00
Backbone	450,000.00
Subtotal	***1,259,080.00***

Furthermore, to connect the existing Telesur sites to the EBS network, some adjustments need to be made at the remote sites. The cost for this is shown in the table below:

Table 4-3: Costs for modification existing networks

Adjustments to existing network	
Type	**Installation costs (USD)**
Power	408,000.00
AC	5,880.00
Miscellaneous	22,933.33
Subtotal	***436,813.33***

A Summary of the cost is shown below:

Table 4-4: Total costs for Telesur facilities

Total costs	
Description	**Total costs (USD)**
Fiber Optical Cable	5,341,699.39
Equipment	1,259,080.00
Power	436,813.33
Grand total	***7,037,592.72***

The total Cost, converted to US$, will be: US$7,037,592.72. The costs are based on an exchange rate of 7.50 SRD for one (1) USD.

5. PRELIMINARY ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

5.1. Introduction

This Preliminary Environmental and Social Impact Assessment (PESIA) for the preparation, construction, operation and decommissioning of the project has been prepared to conform to the Environmental Assessment (EA) guidelines (NIMOS, 2009). Based on these guidelines, the project qualifies as a Category B Project: either an EA will be required or some other form of environmental and social document.

The main purpose for the PESIA is:

1. to identify potential environmental and socio-economic impacts associated with the preparation, construction, operation and closure (decommissioning) of the 4.5 MW HFO Power Plant and the conversion of this Power Plant into a LNG Power Plant in the future;
2. to identify potential environmental and socio-economic impacts associated with the preparation, construction, operation and decommissioning of transmission and distribution lines; and
3. to provide preventive, mitigation and decommissioning measures for these impacts.

Project-study area

The current study has principally been conducted as a desk study, supplemented by limited field reconnaissance and interviews. The reason for the limited amount of field work is related to the amount of proper information already available for the areas which are the villages from along the Upper Suriname River. Pokigron is located at approximately 195 km south of Paramaribo, beneath the Brokopondo Reservo**ir**, officially named Professor Doctor Ingenieur W. J**.** van Blommestein Meer.

Most environmental components of the study areas will be identical to the project area. But certain impacts like noise, soil-, air- and water pollution could extend beyond the boundaries of the project area the project study area is formulated as a radius of 3 km around the projected power plants (Figure 5-1) and 3 km left and right inland from the Upper Suriname River (figure 5-2)

5.2. EHS Regulatory and Policy Framework for the ESIA process

5.2.1 Introduction

The 1987 Constitution of the Republic of Suriname, reformed in 1992, provides the legal basis for the country's environmental policies. Article 6g states that "the social objective of the State is directed towards the creation and stimulation of conditions necessary for the protection of nature and the maintenance of ecological balance".

Suriname does not have an approved national environmental policy and there is no legislation dealing specifically with environmental management. However, environmental legislation is under development and guidelines for environmental assessment have been released. The ESIA process for the proposed project must comply with the guidelines and other relevant existing legislation.

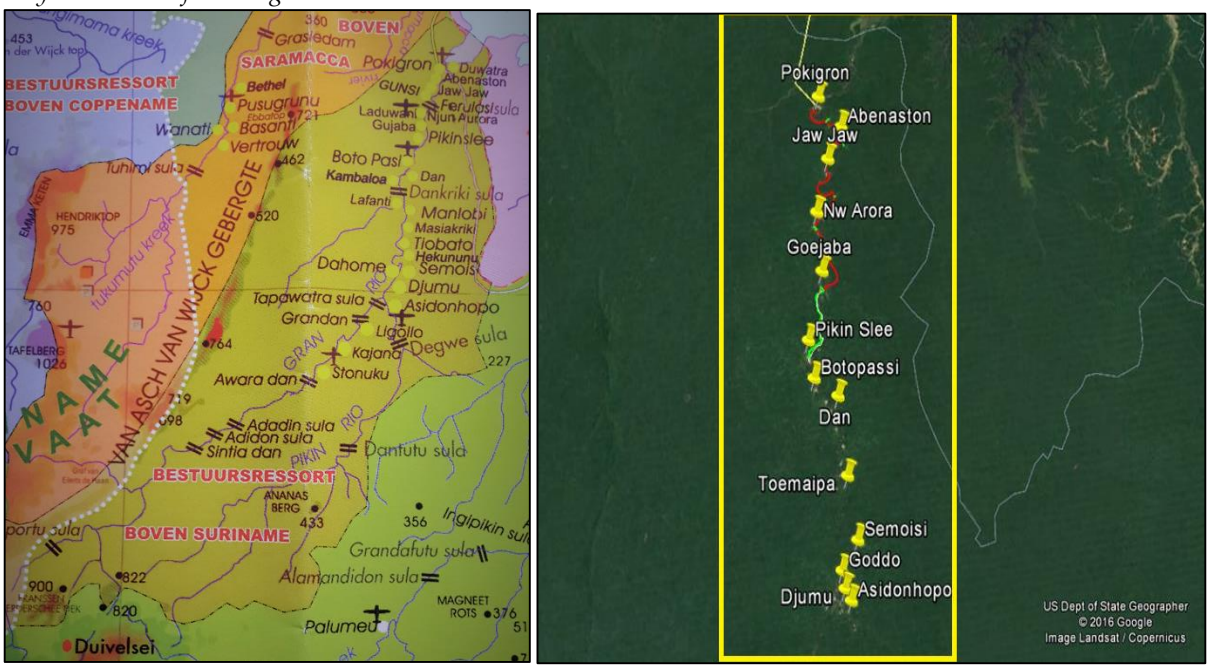
Figure 5-1: Proposed location of 4.5 MW Diesel Power Plant and the project study area with a 3 km radius

The legislative, regulatory and institutional requirements guiding the proposed ESIA process are reviewed in more detail here. The key regulatory requirements pertaining to the proposed project and the environmental assessment thereof include the following:

- Suriname legislation, regulations and guidelines; and
- International best practice standards, such as the guidelines of the World Bank Group.

These are not intended to be definitive or exhaustive, and serves to highlight key environmental legislation and obligations only.

Figure 5-2: Proposed location of transmission and distribution lines along the Upper Suriname River and the project study area 3 km left and right inland



5.2.2. Suriname legal requirements regarding environmental assessments

Other legal instruments governing environmental, health and safety management in Suriname categorized according to the environmental, health and safety issues that they address, are presented in Table 5-1 and international conventions ratified by Suriname in Table 5-2.

Considering health and safety management, Suriname has a long history in developing and execution of occupational health and safety laws. As being a member of the International Labor Organisation (ILO), Suriname strives to be in compliance with ILO standards and guidelines.

Table 5-1: Relevant national environmental, health and safety management in Suriname

Title	Objective	Implementing agency	Remarks
Environmental management and environmental related			
Constitution S.B. 1987 no.116 last amended by S.B. 1992 no.38.	Article 6g: The state is responsible for creating and promoting conditions necessary for the protection of nature and preservation of the ecological balance.	State of Suriname	-
Electricity law 2016	Foster the availability, affordability, sustainability and environmental hygiene in the electricity supply.	Ministry of Natural Resources	The electricity law is in its implementation phase within the EBS.

Law, Energy Authority Suriname 2016	Regulating and supervise the energy sector.	Ministry of Natural Resources	The Energy Authority is working on promoting the availability, affordability, sustainability and environmental hygiene in the energy supply.
Act on Standards S.B. 2004 no. 121.	Article 3: The Bureau of Standards is authorized to develop and set up or change standards. Article 6: the minister can designate standards for the protection of a. the consumer or user against dangers to public health or safety b. the environment c. national production, fair trade and social activity. Article 11: Inspection of imported goods against set standards.	Ministry of Trade and Industry.	-
Hindrance Act G.B. 1930 no 64 amended by S.B.2001 no. 63.	Article 1: it is prohibited to establish an enterprise which can cause danger, damage or hindrance without a permit from the District Commissioner (DC).	Ministry of Trade and Industry.	-
Penal Code G.B.1911 no1 as amended.	Articles 224, 225: contamination of water resources is penalized.	Ministry of Justice And Police.	-
Construction Law 1956 G.B.1956 no. 30 as amended by S.B. 2002 no. 72.	Provides requirements for the construction of buildings.	Ministry of Public Works.	-
City-Construction Law G.B. 1972 no. 96.	Provisions for urban development.	Ministry of Public Works.	-
Law on Ecological Circumstances in Residential Areas S.B. 1980 no. 68	To improve the ecological circumstances in residential areas	District Commissioners.	-
Police Criminal Law G.B. 1915 no. 77 as amended by S.B. 1990 no. 24	Contains many general environmental provisions with respect to public places, including waste disposal, noise, control of pests, hunting and fishing, water pollution, etc.	Ministry of Justice and Police.	Article 39a penalizes the disposal of waste in public places. Article 51 penalizes the contamination of a water resource.

Harbours Decree 1981 S.B. 1981 no. 86	Provisions for harbour activities.	Maritime Authority Suriname and District Commissioners, assisted by the Prosecutor's office, the Police and the Ministry of Trade and Industry.	Prohibits the discharge of waste, oil, and oil-contaminated water and condemned goods into public waterways and harbours.
Pesticides Law. G.B. 1972 no. 151	The management and use of pesticides. No admission of pesticide if damage occurs to the productive capacity of the soil, plants and so on.	Ministry of Agriculture, Animal Husbandry and Fisheries.	-
State Order on Pesticides S.B. 2005 no.21	Article 16: the minister of Agriculture can prescribe by regulation how to safely	Ministry of Agriculture, Animal Husbandry and	-
(Implementation Regulation of the Pesticide Act).	dispose of pesticide containers. The disposal of used containers and pesticides should carry out in such a manner that water collection areas or surface water is not contaminated.	Fisheries.	
Water Supply Law G.B. 1938 no. 33.	Establishes prohibitions with respect to water wells, etc. that serve as water supply sources.	Ministry of Natural Resources, Ministry of Public Health.	According to this Law the President is responsible for its implementation, but in practice the ministries take on the role.
Forestry Management Law. S.B. 1992 no. 80	Regulations regarding the appointment of protection forest: because of the location, the forest has a significant stabilizing effect on the environment, particularly on the soil and water management.	Physical Planning, Land - and Forestry Management	
Nature Protection Law. G.B. 1954 no. 26, z.l.g. bij S.B. 1992 no. 80.	Regulations for governing the protection and conservation of natural monuments; prohibiting the infliction of damage to the soil from a nature reserve.	Physical Planning, Land - and Forestry Management	
Hunting Act 1954 (G.B. 1954 no. 25, z.l.g. bij S. B. 1997 no. 73)	Protection of fauna and the regulation of hunting	Physical Planning, Land - and Forestry Management	

Occupational health & safety/ labor/ public health			
Occupational Safety Law G.B. 1947 no. 142 as amended.	To advance safety and hygiene in enterprises so that the chance of accidents and occupational diseases can be reduced to a minimum.	Ministry of Labour.	Eight regulations have been issued for the implementation of this Law.
Labor Inspection Law S.B. 1983 no. 42.	Outlines the tasks and responsibilities of the Labor Inspector.	Ministry of Labour.	In cases where the safety of persons is in danger, the Inspector has the authority to close the enterprise in question.
Labor Law G.B. 1963 no. 163.	Establishes agreements on the rights and obligations of the employer and the employee.	Ministry of Labour.	-
Movement of Goods Law S.B. 2003 no. 74.	Provides general rules for international trade.	Ministry of Trade & Industry.	-
Government Decree Resolution Negative List 2003 S.B. no 74 as amended by S.B. 2006 no. 20.	Regulates the international traffic of goods.	Ministry of Trade & Industry.	Import and export of chemical waste, pesticides, animals, mercury, radioactive materials etc. are allowed with the approval of the
Social and cultural			
Monument Law 2001	Regulates the management and provisions on the conservation of monuments, urban and village views.	Ministry of Education and Community Development	

Table 5-2: International conventions ratified by Suriname

Convention	Objective	Responsible Agencies	Remarks
United Nations Framework Convention on Climate Change, UNFCC.	The objective of the treaty is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. This level should be achieved within a time frame long enough to allow ecosystems to adapt to the climate change in a natural way and to ensure that the food supply is not jeopardized and economic development can find progress in a sustainable manner.	Environmental department of the Cabinet of the President.	-
Kyoto Protocol to the United Nations. Framework Convention on Climate Change	The Kyoto Protocol is an extension and elaboration of the UNFCC. It is based on the framework convention and has the same purpose and the same ideas. It is a step closer to joining the harmful effects of greenhouse gas emissions by the parties. The reduction shall be determined by country and within how much time the country has to achieve the reduction.	Environmental department of the Cabinet of the President.	-
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.	The purpose of this Convention is to promote shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals in order to protect against possible danger and to contribute to the environmentally sound use. This can be done by the parties to provide information on the properties of the chemicals.	Ministry of Agriculture, Animal Husbandry and Fisheries.	-

Basel Convention on the Control on the Transboundary Movement of hazardous waste and their disposal.	The Convention aims to protect the environment and human health as well as the minimization of the generation of hazardous waste and other substances. Some of these are: biomedical and medical waste, used oil, used lead acid batteries, PCBs, paint additives, electronic waste (e-waste), mercury and asbestos.	Environmental department of the Cabinet of the President.	-
The Stockholm Convention on Persistent Organic Pollutants (POPs).	This Convention is a global treaty to protect the health of people and the environment against POPs.	Environmental department of the Cabinet of the President.	-
Convention Concerning the Protection of the World Cultural and Natural Heritage	To protect particular World Cultural Heritage	Directorate Culture of the Ministry of Education and Peoples Development	
Convention for the Safeguarding of the Intangible Cultural Heritage	To protect particular intangible Cultural Heritage	Directorate Culture of the Ministry of Education and Peoples Development	This convention is in the process of ratification by the Government of Suriname.

5.2.3. Environment related responsibilities key ministries

In order to facilitate efficient and effective implementation of environmental policy the Government of Suriname created an environmental management structure that is comprised of the following actors:

- The cabinet of the President of Suriname, Environmental Coordination Department is responsible for the coordination and implementation of the environmental policy and the monitoring thereof;
- NIMOS is the governmental institute and responsible for review of ESIA's, pollution control, monitoring and enforcement;
- Ministry of Natural Resources is responsible for the implementation of the Electricity Law;
- The Ministry of Labor is responsible for the implementation, monitoring, control and enforcement of all labor (related) aspects;
- The Ministry of Regional Development is in charge of regional governance, decentralization and the development of the Interior.

5.2.4. Corporate responsibility on environment, health and safety

The main purpose of HSEQ division is the implementation of its HSE policy through the development of HSE management system. EBS has developed a Health, Safety and Environmental (HSE) policy. This policy is the guidance for the EBS to meet national and international HSE standards in its development, execution and exploitation of the company's activities.

The HSE policy is formally proclaimed by the Managing director of EBS in August 2016 by committing to the following:

- The development of management systems to implement activities in compliance with all applicable national laws and regulations, including the Electricity Law, Safety Law, Labor Law, environment related laws and where applicable international standards;
- Awareness of every employee with the policy and active participation in programs, including risk analyses, environmental- and social impact analysis focused on implementing preventive and mitigation measures;
- The protection of humans and the environment by continuous improvement by adjusting company's processes to new technological developments based on national and international environmental, occupational health and safety standards.

Due to many (project) activities implemented for the EBS a set of guidelines have been developed in order to protect the environment and manage health & safety and quality issues. These guidelines are for example HSE guidelines for contractors, waste management guidelines, and safety guidelines.

Relevant Environmental, Health, and Safety (EHS) Guidelines of the International Finance Corporation (IFC) of the World Bank, which are technical reference documents with general and sector-specific examples of good international industry practice, are already used by the EBS. These guidelines contain performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable cost. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. IFC noise, air and waste water discharge standards are presented in Tables 5-3 to 5-5.

Table 5-3: IFC noise level standards

Receptor type	**One hour L –dB (A) Aeq**	
	Day – time (07h00 – 22h00)	Night – time (22h00 – 07h00)
Receptor, institutional, educational	55	45
Industrial, commercial	70	70

Table 5-4: IFC emissions standards

Component	Average period	Guideline value in µg/m^3
Sulphurdioxide (SO_2)	24 hour	125 (interim target 1)
		50 (interim target 2)
		20 (guideline)
	10 minutes	500 (guideline)
Nitrogenoxide (NO_2)	1 year	40 (guideline)
	1 hour	200 (guideline)
Particulate Matter (PM_{10})	1 year	70 (interim target 1)
		50 (interim target 2)
		30 (interim target 3)
		20 (guideline)
Particulate Matter (PM_{10})	24 hour	150 (interim target 1)
		100 (interim target 2)
		75 (interim target 3)
		50 (guideline)
Particulate Matter ($PM_{2.5}$)	1 year	35 (interim target 1)
		25 (interim target 2)
		15 (interim target 3)
		10 (guideline)
Particulate Matter ($PM_{2.5}$)	24-hour	75 (interim target 1)
		50 (interim target 2)
		37.5 (interim target 3)
		25 (guideline)

Table 5-5: IFC waste water discharge standards

Parameter	Unit	Standard
Acidity	pH	6-9
Biochemical Oxygen Demand (BOD)	mg/l	30
Chemical Oxygen Demand	mg/l	125
Total Nitrogen	mg/l	10
Total Phosphorus	mg/l	2
Oil and grease	mg/l	10
Total Suspended Solids (TSS)	mg/l	50
Total coliform bacteria	Most Probable Number / 100	400
Heavy metals		
Iron	Ppm	3.5
Copper	Ppm	0.5
Fenols	Ppm	0.5
Chlorine	Ppm	0.2

Abiding by the standards above it is important for compliance with laws and regulations and to ensure the occupational health and safety of the workers and environmental protection.

5.3. Environmental, Health and Safety Assessment

5.3.1 Environmental Baseline Study

This chapter presents the environmental and social baseline study which is a brief overview of the biophysical and socio-economic environment of the location where the project activities will take place. The baseline study is done to understand the general sensitivity of and pressures on the affected environment. Furthermore, information is obtained to identify potential impacts associated with the planned project. The area of influence was determined during the impact assessment phase based on literature research and interviews with relevant stakeholders. In the following chapters the physical aspects of the environment and socio-economic aspects will be presented.

5.3.2 Climate

Suriname has a typical tropical climate. Most of the Northern part of Suriname has a Tropical Rainforest (Af-climate in Köppen's classification) which is the zone where the solar park will be built. Suriname has four seasons which are:

1. Short rainy season: early December to late January;
2. Short dry season: late January to late April;
3. Long rainy season: late April to mid-August;
4. Long dry season: mid-August to early December.

5.3.3 Precipitation

The average precipitation in Suriname is 2200 mm per year. During the rainy season, the rain removes particles which improve visibility. Dust emissions are further reduced due to the damp soil conditions. Dust emissions increase if the soil becomes desiccated in the dry season.

5.3.4 Ambient temperature

The average temperature at 6.00hrs is between 21^0 and 24^0 Celsius (C).

5.3.5 Wind

The wind direction in Suriname is north to east. The average wind speeds in 2013 was 2.7 Beaufort. Additions to Suriname's weather are the local gales (called sibibusi in Sranang Tongo) which occur at the end of the rainy season with maximum wind speeds of 20 – 30 meters per second.

5.3.6 Air quality

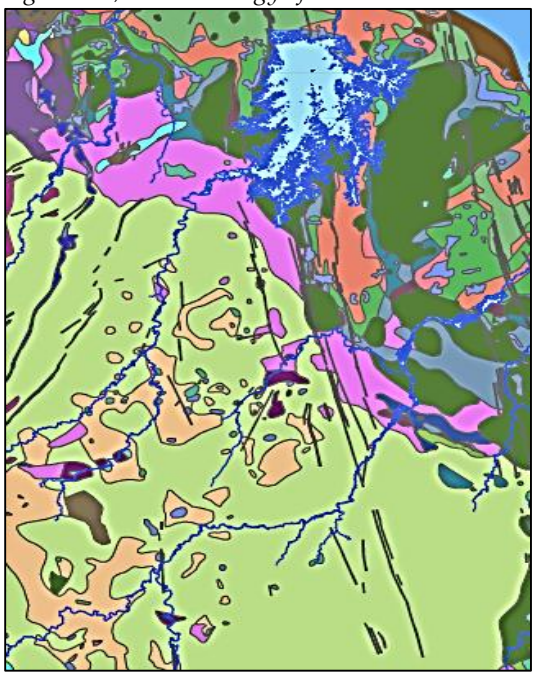
Until now there are no air quality data available in Suriname. Considering the land use of the area, the most significant source of air pollution in the area is likely to be the traffic and slash and burn activities.

5.3.7 Geology, geomorphology

The geology of the area and its surrounding area is presented in Figure 5-3.
The geology of the area consist generally mostly of medium grained biotite granites commonly with megacrysts and locally with hornblende. Also larger spots of hornblende –biotite granites, granodiorites and subordinates tonalities with clinopyroxene and locally with orthopyroxene are present. Smaller spots of migmatatic biotite and muscovite biotite gneisses are present commonly with silimanite and cordierite garnet. The geomorphology varies from plain to hilltops, slope and

depression soils, mostly sandy clay loam and sandy clay, often gravelly as well as locally with ironstone caps.

Figure 5-4; Geology of the area



5.3.8 Flora and Fauna of the Study Area

Hoffman (2009) describes the forest of Stonuku along the Gran Rio as 30 meters high, dominated by Fabaceae (Eperua falcata, E. jenmanii, Dicorynia guianensis) and Lecythidaceae (Lecythis spp., Eschweilera spp.), Moraceae en Lauraceae. Flood forests such as Eperua falcata, Vochysiaceae (Qualea, Vochysia) and Payparola guianensis (Violaceae) are well known. In the rapids many aquatic plants of the family Podostemaceae are found from which most of these plants are under water and only in the dry season abundantly bloom on the rocks. There are 30 different types of Podostemaceae in Suriname from which probably 12 species are endemic to the country (Boggan et al., 1997)

5.3.9 Noise

The land – use type in this area is mix of rural and agricultural. Although detailed noise information is not available it is expected that increased noise levels will be detected due to the traffic along the Upper Suriname River and some economic activities in the afternoon.

5.4. Environmental, Health and Safety Management

5.4.1 Health and Safety Management

Considering health and safety management, Suriname has a long history in developing and execution of occupational health and safety laws. As being a member of the ILO, Suriname strives to be in compliance with ILO standards and guidelines. Besides the national legislation on health and safety the NVEBS has its own Health and safety policy according to the requirements of

OHSAS 18001. This policy provides the framework to protect the health, safety and welfare of all workers at work and of all other people who might be affected by the work.

5.4.2 Risk management

During design development, the designers will assess and document any hazards or risks associated with the design, construction, ongoing operation and maintenance or decommissioning of the various part and components of the substation. A risk management plan will be developed which requires careful review and identification of the likely hazards involved, plus the controls to be used in managing risk during the site activities.

5.4.3 Health and safety management plan

A health and safety management plan will be developed to protect both workers and the general public during all phases of the project. The plan shall be implemented to educate construction workers about the hazards associated with the particular project site and the safety measures that must be taken to prevent injury. The plan shall include standards regarding occupational safety, safe work practices for each task, hazard training requirements for workers, and mechanisms for documentation and reporting. Regarding occupational health and safety, the plan shall identify all applicable federal and state occupational safety standards; establish safe work practices for each task (e.g., requirements for personal protective equipment); establish fire safety evacuation procedures; and define safety performance standards (e.g., electrical system standards and lightning protection standards). The plan shall also include a training program to identify hazard training requirements for workers for each task and establish procedures for providing required training to all workers.

The main health and safety risks are associated with construction activities, and the risks are faced by workers. Clearance of the RoW is an activity in which there is a significant element of danger, particularly to workers, but also to inhabitants of villages. The major issue shall be safety when working on foundation tower or felling of trees to clear the RoW both for workers as well as local community using the area and even during stringing. Working at height should have proper occupational and health safety (OHS) measures. These impacts are not significant as long as they can be mitigated through proper OHS. If the Contractor is made to follow and OHS Plan, these impacts will be removed once the construction phase is completed.

5.4.4 Management of workers

The impacts due to influx of workers will begin from the pre-construction phase and will continue at an expanded scale in the construction phase. This means more workers at each work location, and more frequent movement of construction materials and equipment. Proper planning and experience in the pre-construction phase will set the stage for effective planning and mitigation measures in the construction phase. The main concerns with an influx of workers include:

- Waste and sewage entering the local environment;
- Safety issues at the work sites.

5.4.5 Safety issues at the work sites

Occupational Health and Safety covers all personnel working under the project.

The Occupational Health and Safety program will aim to ensure that the workplace is safe and healthy by: addressing the hazards and risks at the workplace; outlining the procedures and

responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks; identifying the emergency management plans for the workplace or workplaces; and, specifying how consultation, training and information are to be provided to employees at various workplaces.

5.4.6. Nomination of a Health and Safety Focal Person

Within each site the Contractor must nominate a Health and Safety Focal Person who will Function as the focal person/representative for all health and safety matters at the workplace, be responsible for maintaining records of all accidents and all health and safety issues at each site, the number of accidents and its cause, actions taken and remedial measures undertaken in case of safety issues. He/ she will be the link between the contractor and all workers and submit grievances of the workers to the contractor and instructions/directives on proper health care and safety from the contractors back to the workers. He/she will also ensure that all workers are adequately informed on the requirement to use Personal Protective Equipment and its correct use.

5.4.7. Minimizing hazards and risks at the workplace.

To ensure safety at all work sites, the following will be carried out:

- Installation of signboards and symbols in risky and hazardous areas, to inform workers to be careful;
- Ensuring that materials are all stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling, or collapse;
- Removing all scrap and waste material from the immediate work area as the work progresses. All excavated earth must be stockpiled at least 2 feet from the pit to avoid material such as loose rocks from falling back into the excavated area and injuring those working inside excavated sites;
- Where scaffolds are required, ensuring that each scaffold or its components shall be capable of supporting its own weight and at least 4 times the maximum intended load applied or transmitted to it. The platform/scaffold plank shall be at least 15 inches (46cm) wide and 1.5 inches thick. The rope should be capable of supporting at least 6 times the maximum intended load applied or transmitted to that rope. Pole scaffolds over 60 feet (5.6m) in height shall be designed by a registered professional engineer and shall be constructed and loaded in accordance with that design;
- Use only trained staff to construct, install and repair all electrical equipment to prevent risks of electrical shocks and electrocution;
- Install fire extinguishers and/or other fire-fighting equipment at every work site to prepare for any accidental fire hazards.

5.4.8. Waste Management

For the collection, transport and processing of residual or waste materials in order to prevent or minimize environmental pollution. N.V. EBS follow waste management procedures according to local regulations and international standards.

During construction and operation activities at the N.V. EBS, several types of waste will be generated by equipment and crews working within the project area. A distinction is made between non-hazardous and hazardous waste. Hazardous waste is a waste with properties that make it

dangerous or capable of having a harmful effect on human health or the environment[3]. Non-Hazardous wastes include all other wastes that do not fit the definition of hazardous wastes[4]. All potential waste types are listed here:

Table 5-6: Description of the various waste types

Type of waste	Waste description	Method of disposal	Procedure
Non- hazardous wastes			
General waste	Wastes appropriate for landfill disposal, generated by employees and contractors, e.g. household waste, food waste, paper, plastics.	• Public landfill • Re-use: paper • Recycle: plastics	• All recyclable materials shall be collected separately: paper, plastic bottles scrap and metal, demolition waste. • Every EBS employee and contractor is responsible for disposing of non-hazardous waste in appropriate waste containers
Vegetation	Stumps, trunks, leaves, roots, grass plant residues, etc	• Recycle: compost • Re-use: trunks • Special designated place by EBS in collaboration with the ministry of Public Works • Public landfill	The waste must be collected separately every end of day to be disposed of.
Residues of wood	Wood used for foundation	• Wood: re-use • Public landfill	All recyclable wood shall be collected separately every end of the day.
Top soil	Mud, Soil mixed with roots	• Re-use: uncontaminated soil • Special designated place by EBS in collaboration with the ministry of Public Works • Public landfill	The waste must be collected separately every end of day to be disposed of.
Construction waste	Residues of concrete and cement derived from construction of the drive way	• Special designated place by EBS in collaboration with the ministry of Public Works • Public landfill	The waste must be collected separately every end of day to be disposed of.
Other waste or disposal material	Other wastes in which cannot be predicted in	• Special designated place by EBS in collaboration with the	The waste must be collected every end of day to be disposed of.

[3] https://www.epa.gov/hw/learn-basics-hazardous-waste

[4]http://bimpactassessment.net/sites/all/themes/bcorp_impact/pdfs/EM_Monitoring_Recording_Hazardous_Nonhazardous_Waste.pdf

on the proposed area.	advance but are identified on the spot	ministry of Public Works • Public landfill	
Hazardous waste			
Petroleum containing waste	Used oil, fuel, lubricants, greases, oil, filters, and solvents from use and maintenance of heavy equipment.	• Landfarming • Incineration	The waste must be collected separately every end of the day for the final destination
Polluted soil and water	Contaminated soil and water caused by poor waste management	• Oil-water or Soil-water separation. • Landfarming	The waste must be collected separately every end of day for the final destination
Paint waste	Paint residues	• Special designated place by EBS in collaboration with the ministry of Public Works	The waste must be collected separately every end of day for the final destination
Residues of preservatives	Innertol and carbolenium	• Special designated place by EBS in collaboration with the ministry of Public Works	The waste must be collected separately every end of day for the final destination
Packing material	Empty paint drums	• Special designated place by EBS in collaboration with the ministry of Public Works	The waste must be collected separately every end of day for the final destination
Other waste disposal material on the proposed area.	Other wastes in which cannot be predicted in advance but are identified on the spot	• Special designated place by EBS in collaboration with the ministry of Public Works • Public landfill	The waste must be collected every end of day to be disposed of.

The waste management hierarchy -presented below- is a guiding principle for N.V.EBS Waste Management System.

5.4.9 Provision of Personal Protective Equipment

Risks to the health and safety of workers can be prevented by provision of Personal Protective Equipment (PPEs) to all workers. Personal protective equipment like safety gloves, helmet, mufflers etc. will be provided during the construction period and during the maintenance work. This will be included in the construction cost for each Contractor.

Depending on the nature of work and the risks involved, contractors must provide without any cost to the workers, the following protective equipment:

- Helmet shall be provided to all workers, or visitors visiting the site, for protection of the head against impact or penetration of falling or flying objects;
- Safety belt shall be provided to workers working at heights (more than 1.8m) such as stringing and conductor installation;
- Safety boots shall be provided to all workers for protection of feet from impact or penetration of falling objects on feet;
- Ear protecting devices shall be provided to all workers and will be used during the occurrence of extensive noise;
- Eye and face protection equipment shall be provided to all welders to protect against sparks;
- Respiratory protection devices shall be provided to all workers during occurrence of fumes, dusts, or toxic gas/vapor;
- Safety nets shall be provided when workplaces are more than 25 feet (7.5 m) above the ground or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors or safety belts is impractical;
- First aid facilities will be made available with the labor gangs and doctors called in from nearby towns when necessary;

- The safety and emergency procedures manual will be kept. Necessary training regarding the safety aspects of the personnel working at the project site will be provided.

Table 5-7: Specific PPE requirements for each type of work

Type of work	PPE
Elevated work	Safety helmet, safety belt (height greater than 1.8m), footwear for elevated work.
Handling work safety	Helmet, leather safety shoes, work gloves
Welding and cutting work	Eye protectors, shield and helmet, protective gloves
Grinding work	Dust respirator, earplugs, eye protectors
Work involving handling of chemical substances	Dust respirator, gas mask, chemical-proof gloves. Chemical-proof clothing, air-lined mask, eye protectors
Wood working	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator
Concrete and masonry work	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator
Excavation, heavy equipment, motor graders, and bulldozer operation	Hard hat, safety boots, gloves, hearing protection
Quarries	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator

5.4.10 Work zone and traffic safety

A traffic control will be provided for the movement of vehicles in areas where there are also workers conducting other tasks.

Signs

Standard signs for information, speed limits and work zones will assist drivers in identifying, in designated traffic paths, such directives as: REDUCE SPEED, ROAD CLOSED AND OR WORK IN PROGRESS.

Traffic control devices

Standards traffic control devices such as cones, barricades and delineator posts will be used as part of the traffic control plan

Flagging

Flaggers and others providing temporary traffic control should wear high visibility clothing or reflector vests and equipped with high visibility flags.

Lightning and driving

Where lightning is needed there will flares or chemical lightning used in such a way that the glare will be controlled for workers and motorists; seatbelts should be used at all times during driving.

Dust control
Regarding to the environment there will be water used to control dust (if necessary) nearby the traffic roads and the workers areas.

Traffic safety and control during the activity's will take place in collaboration with the local traffic police corps.

Work zones will also be determined in collaboration with the traffic police corps.

5.4.11 Record maintenance and remedial action
The Project Management will maintain a record of all accidents and injuries that occur at the work site. This work will be delegated by the contractor to the site supervisor and regularly reviewed every quarter by project management. Reports prepared by the contractor shall include information on the place, date and time of the incident, name of persons involved, cause of incident, witnesses present and their statements. Based on such reports, the management can jointly identify any unsafe conditions, acts or procedures and recommend for the contractor to undertake certain mitigative actions to change any unsafe or harmful conditions.

5.4.12 Awareness of the Code of Conduct for workers
The Project management will undertake awareness programs through posters, talks, and meetings with the contractors to clarify the rights and responsibilities of the workers regarding interactions with local people (including communicable disease risks, such as HIV/AIDS), work site health and safety, and to make workers aware of procedures to be followed in case of emergencies such as informing the focal health person who in turn will arrange the necessary emergency transportation or treatment. The Contractor will be required to instruct the site supervisor on the code of conduct and ethics for foreign workers (when applicable). As per the Regulations on working conditions of the Department of Labor, all foreign workers are required to respect the values, traditions, culture and law of the country and respect all regulations and rules.

5.4.13. First Aid
First aid kits must be made available at all times throughout the entire construction period. In addition to the first aid kits, the following measures should be in place:

- Provisions of a vehicle on standby from the Project Office/Contractor, or provisions to hire vehicles during emergencies to take the severely injured/sick workers to the nearest medical clinic for immediate medical attention;
- Communication arrangements, such a provision of radios or mobile communication for all work sites, for efficient handling of emergencies, will be made;
- The designated focal health persons' contact number will be posted at the work site for speedy delivery of emergency services. The focal person should know what medical facilities are available at the nearest medical clinic.

Overall, the Occupational Health and Safety program will aim to ensure that the workplace is safe and healthy by: addressing the hazards and risks at the workplace; outlining the procedures and responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks; identifying the emergency management plans for the workplace or workplaces; and, specifying

how consultation, training and information are to be provided to employees at various workplaces. The mitigation measures detailed earlier will be followed to minimize hazards and risks at the workplace and ensure the health and safety of workers. The contractor shall be mandated to abide by the Occupational Health and Safety Rules of the company and national and international standards and regulations. This requirement shall be incorporated in the Tender Document in order to assure safe working environment.

The contractor shall:

- Ensure health and safety of all employees and any person at the workplace;
- Improve working condition that are hazardous to health and safety;
- Provide and maintain PPE in good condition and ensure they are used by the employees;
- Provide to the employee the information, instruction and supervision.

EBS is committed to working in a way which ensures the health and safety of its employees, contractors, customers and members of the public. This will be ensured by the implementation of the health and safety management plan as mentioned above.

5.4.14. Roles and responsibilities

This chapter describes the roles and responsibilities of the design, construction and operations phase. It should be noted that only roles and responsibilities that directly relate to environmental, occupational health and safety as well as social management are described here. The general roles and responsibilities of various parties are outlined in more specific project documents.

Responsibilities of the Chief Executive Officer (CEO):

The CEO has overall accountability for all the activities including HSEQ matters in all phases of the project. The organizational structure is presented in figure 5-3.

5.4.15. Design phase

The key role players during the design phase are: Project Engineering, Health, Safety, Environment and Quality (HSEQ) division and Contractors.

Their roles and responsibilities during the detailed design phase with respect to the implementation of the environmental and social management plan (ESMP) are outlined below.

Project Engineering

- Confirm that all environmental, health and safety, and social (EHS&S) management measures have been incorporated into the project design on completion of the design phase;
- Ensure Contractors are aware of and take into consideration all measures of the ESMP;
- Monitors the implementation of the EHS&S measures.

HSEQ

- Confirms that all EHS&S management plans are implemented and are in compliance with the relevant regulations and standards;

- Monitors the implementation of the EHS&S measures;
- Ensure the review.

Contractor

- Take cognizance of all EHS&S measures presented in this ESMP and ensure the implementation of these measures in all phases of the project.

5.4.16 Construction phase

EBS will implement environmental, occupational health and safety as well as social performance, during the construction phase through the following activities:

- Implementation and management of a programme of inspection, monitoring and reporting;
- Ensuring that all staff undergo awareness training, focusing on the key issues concerning the activities of the projects;
- Implementation of a programme for follow-up and analysis of all near misses, incidents or accidents or pollutions;
- Implementation of a programme for stakeholder engagement.

Responsibilities of Project Engineering

The Project Engineering Division has the overall responsibility for the implementation and overall management of the project. Their responsibility for EHS&S matters is to ensure that all requirements are considered by Contractors such as adding EHS&S requirements in the contracts. Other specific tasks are as follow:

- Review monthly reports on EHS&S performance submitted by the HSEQ manage;
- Review weekly EHS&S compliance checklists submitted by the HSEQ manager;
- Provide direction on strategic matters to Contractors.

Responsibilities of HSEQ

The HSEQ Division has overall responsibility for EHS&S management. They will execute the following:

- Verify that Contractor's activities are conducted in accordance with the requirement of
  - the ESMP;
- Undertake frequent site inspections in collaboration with management teams of
  - Contractors in order to determine compliance with the ESMP;
- Issue Corrective Action Requests to Contractors through the Project Manager;
- Review the following:
  - Weekly environmental compliance checklists / performance reports;
  - Corrective Action Plans submitted by Contractors;
  - Incident, accidents, near misses and pollution reports;
- Complaints reports:
  - Review weekly compliance checklists submitted by relevant division managers;
  - Review monthly reports on the performance of EHS&S management and monitoring of the project;
  - Provide direction on strategic matters;
  - Compile monthly monitoring and performance reports for the CEO.

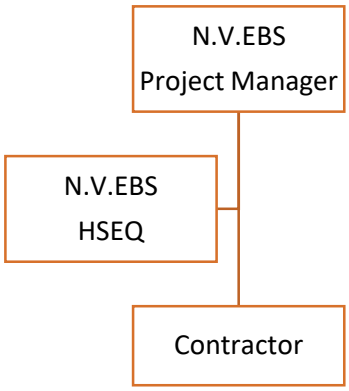


Figure 5- 3: EBS organizational structure for construction activities

EBS will retain responsible for ensuring that all Contractors fully implement the ESMP requirements.

Responsibilities of Contractors

All Contractors have a duty to demonstrate respect and care for the environment and for human factors during their activities. They will also be directly responsible for managing all EHS&S aspects of the construction activities. Their responsibilities are as follow:

- Adhere to legislative and regulatory requirements as well as relevant conventions and standards;
- Adhere to EBS and Contractor's EHS&S management standards and guidelines;
- Adhere to agreed procedures and standards specific for the project;
- Adhere to provisions of the ESMP;
- Notifying the Project Manager and HSEQ Manager of any incident, complaints and non- compliance with project EHS&S requirements or relevant to EHS&S requirements;
- Work closely with the Project Manager and HSEQ Manager to find solutions for problems and ensure implementation of the selected solutions.

EBS will have the overall accountability and responsibility for EHS&S management and monitoring of the projects, to ensure that environmental compliance is achieved.

5.4.17. Operations phase

During the operations phase, EBS will also have the overall accountability and responsibility for EHS&S management and monitoring. The HSEQ manager reports directly to the CEO, ensuring that HSEQ matters continue to receive attention at the highest level. Any Contractor hired during the operations phase will report directly to the relevant operations management personnel.

EBS will enhance EHS&S performance during the operations phase through the following activities:

- Implementation and management of a programme of inspection, monitoring and reporting;

- Implementation of a programme for follow-up and analysis of all near misses, incidents or accidents or pollutions;
- Implementation of a programme for stakeholder engagement.

Figure 5-4: Organizational structure for operational activities

Responsibilities of HSEQ Division

The HSEQ Division will manage all HSEQ matters considering the project activities. They will:

- be responsible for the integration of EHS&S management controls into day-to-day activities in collaboration with the relevant manager of the project;
- ensure that operations comply with the provisions of the management plans;
- manage resources to ensure adequate supervision of environmental, occupational health and safety, and social matters;
- ensure that activities are conducted in accordance with the requirements of the management plan and that standards of EHS&S management are pursued;
- oversee development of awareness and training materials by the training department, and their implementation during training and induction sessions for new workers and at regular periods as appropriate;
- oversee and review EHS&S monitoring and data management and verify that these monitoring results are within specified limits;
- submit quarterly EHS&S monitoring and performance reports to the Chief Executive
- Officer as well as incidents, accidents, near misses and pollutions reports;
- review the monthly EHS&S reports and incident reports submitted by the operations manager.

Responsibilities of the operations manager

The operations manager for operations of the substation is responsible for the day-to-day management of the substation and management of EHS&S requirements associated with the operations. The operations manager will implement the following:

- Implementation of EHS&S requirements;
- Monthly environmental performance reports; and
- Incident reports.

5.4.18 Decommissioning phase

The anticipated lifespan of the power plant is minimal 20 years. While this is a considerable time span, the objective of this section is to provide recommendations for the decommissioning and the rehabilitation of the area in order to achieve sustainable land use conditions and avoid or minimize costs and long term liabilities to EBS. The decommissioning phase monitoring matrix (Annex 5) presents all mitigation measures for the execution of decommissioning activities. The specific roles and responsibilities during the decommissioning phase and the desired post-decommissioning land use will be detailed closer to the time of decommissioning.

5.4.19 Monitoring and Performance Evaluation

During construction activities managed by the Contractor, the HSEQ Manager or his appointed delegate will monitor and review the environmental performance of the Contractor against the commitments of the ESMP. Similarly, during operations**,** the HSEQ Manager or his appointed delegate will monitor the day-to-day performance of EBS staff against the commitments of the ESMP. During both the construction and operations phases the following principal items will be monitored:

- Correct and full implementation of ESMP procedures;
- Compliance with contract commitments, approved Method Statements and with project standards/guidelines.

5.5.20 Monitoring

The implementation of an inspection and monitoring programme is to ensure complete compliance with mitigation measures, approved plans and permit conditions. The monitoring programme also provides transparent assurance to EBS (and external parties) that specified standards are being set so as to reduce (negative) impacts to tolerable levels, to enhance positive impacts and that target performance levels are being met.

The inspection and monitoring programme is designed to measure environmental performance against applicable standards, guidelines and expectations, and to provide early detection of undesirable impacts to the environment. Such information is used to ensure that project standards are being met, and to demonstrate compliance with regulatory requirements. The monitoring programme is amended as and when necessary in order to ensure safe operation and optimal environmental protection.

EBS will be responsible for the collection and monitoring of environmental data e.g. noise quality, as may be stipulated in the ESMP, during both the construction and the operations phases. Monitoring will begin at the commencement of construction activities. Monitoring will continue throughout the construction and operations phases, and the duration and frequency of monitoring may be modified to best characterize any affected environmental aspect.

5.5.21 Data and Information Management

Quantitative environmental monitoring data will be stored in a database, which will allow systematic storage and analysis of data, and will permit rapid retrieval for the purposes of internal and external reporting. The HSEQ Manager or his appointed delegate will administer this database. In order to ensure a consistent and coherent system for documenting the implementation of the ESMP, all written records and other information will be stored in a filing

system that is compatible with the requirements of the existing EBS Environmental Management System. This will comprise standardized forms, documents and reporting procedures.

5.5.22 Reporting

The frequency and nature of reporting of environmental management performance will depend upon the nature of the activity and aspect that is being managed. Reporting may take several forms:

- Reports on critical issues, as required;
- Formal reports and contributions to weekly and monthly project management meetings. Monthly reports on environmental performance and compliance;
- Quarterly performance reports on key indicators; and
- Summary reports to external stakeholders.

Table 5-8: Reports required

Item No	Report during Construction	Frequency	From	To
1	EHS monitoring and performance reports	Monthly	HSEQ Manager	Project Manager (Project Engineering)
2	Environmental checklists/ performance reports	Weekly	HSEQ Manager	Project Manager (Project Engineering)
3	Corrective Action Plans	As required	HSEQ Manager	Contractors (Through Project Manager)
4	Incidents reports	As required	Contractors	Project Manager HSEQ Manager
	Report during Operations			
1	EHS monitoring and performance report	Quarterly	HSEQ Manager	Chief Executive officer
2	EHS performance reports	Monthly	Operations Manager	HSEQ Manager
3	Incident reports	As required	Operations Manager	HSEQ Manager

5.5.23 Feedback

Feedback on performance will be communicated to the appropriate parties, such as the Government, by the HSEQ Manager or his delegate. Any sub-standard performance will trigger a process that notifies the responsible party of the nature of the issue and indicates the actions that are required to rectify the situation. This will be followed up by further monitoring to ensure that the sub-standard performance has been corrected.

5.5.24 Audit and Review

Environmental management performance and the ESMP itself will be subject to a self-assessment audit, against corporate Management Standards. Furthermore an annual, independent external audit of the implementation of the ESMP will be conducted (in Year 1 an interim external audit after 6 months would be beneficial). These reviews will be used to confirm whether environmental performance targets are being achieved and whether the ESMP is functioning efficiently.

During the construction phase, the Contractor will be responsible for managing all impacts caused by the construction activities under the contractor's management. On the completion of contracts, EBS must carry out an audit to ensure that the management and monitoring of all potential long-term/ongoing construction impacts, including those impacts *not anticipated by the ESMP*, are competently transferred from the Contractor to EBS. This monitoring must be incorporated into the EBS operational management plan that will detail the impacts and mitigation measures for the operations phase of the power plant.

5.5.25 Ongoing Review

Environmental performance will be reviewed on an ongoing basis by the HSEQ Manager or his delegate. This will include review of:

- Environmental and social performance data;
- ESMP function and implementation;
- Environmental and social management structures and team.

5.5.26 HSEQ Management System Audit

The Contractor is subject to bi-annual audit, while HSEQ Management Systems are subject to an annual audit, in accordance with corporate requirements. These audits are likely to take the form of an internal self-assessment against the HSEQ Management Standards.

5.5.27 Mitigation Measures and Monitoring Matrices

The general principles in this section apply to all activities for the duration of the design, construction and operations phases of the project.

An environmental impact is defined as any change to the existing environment, either adverse or beneficial, that is directly or indirectly the result of the development of the project and its associated activities. Impacts are generated by certain aspects of those activities. The fundamental approach adopted in the compilation of this ESMP is that management effort should be focused on environmental aspects to prevent negative impacts from occurring and enhance positive impacts, i.e. a pro-active approach. Pro-active measures are then backed up with re-active measures, which serve to minimize the severity or significance of the negative impact, if it cannot be prevented at source.

A series of Mitigation measures has been developed and grouped in Monitoring Matrices to cover activities that give rise to potential impacts during the construction and operations phases. Each Monitoring Matrix of Mitigation measure provides detail on the following:

- The management aspect describing an action and/or activity which interacts with and impacts the environment;
- Description of mitigation measures;
- Identification of the person(s) responsible for implementation of the mitigation measure(s);
- Implementation time frame;
- Monitoring and performance evaluation, including performance indicators;
- Compliance reporting requirements.

These Monitoring Matrices of Mitigation Measures, containing in total 120 measures during all phases of the project, are presented in Annexes 8-11. To facilitate readability, avoid repetition and make the document more "user friendly", similar activities have at times been combined or "rolled up" and mitigation measures have been ascribed to the combined activity.

The summary table below lists the Management Mitigation and Monitoring Matrices for the design, construction, operation and decommissioning phases respectively.

Table 5-9: Summary Table of Monitoring Matrices of Mitigation measures

Matrix	Activity	Phase
Annex 3	Environmental Health and Safety Procedures	Throughout all phases of the project
Annex 4	25 Specific monitoring measures to be implemented during the Design phase	DESIGN
Annex 5	16 Specific monitoring measures to be implemented during Construction activities	CONSTRUCTION
Annex 6	34 Specific monitoring measures to be implemented during Operations	OPERATIONS
Annex 7	45 Specific monitoring measures to be implemented during the decommissioning	DECOMMISIONING

5.6. Social Baseline Study

5.6.1 Population and demographics

Suriname is divided into ten administrative districts, of which Paramaribo is the largest population density district but Sipaliwini the largest district in square meters. All villages within the study area are in district Sipaliwini within the Ressort Upper – Suriname with a surface of 7512 km^2. There are six tribes of Maroons in Suriname from which the Saamakka are the largest maroon tribe. The total population of the Ressort Upper- Suriname is about 18,321 with 8854 men and 9476 women.

5.6.2 Ethnicity and religion

Villages along the Upper Suriname River consist mainly of the Maroon community specifically the Saamakka tribe. Every aspect of the Saamakka life is based on various religious beliefs with strong emphasis on cultural and traditional rituals which is carried out by their ancestors through

time. However, Christianity (Moravian, Roman Catholic, Evangelical Churches) is a religion that is apparently growing in these villages.

5.6.3 History and archaeology

The vast Interior of Suriname is inhabited primarily by four indigenous peoples and Maroon tribes. There are six Maroon tribes, Ndyuka, Saamakka, Aluku, Paramaka, Matawai, and Kwinti, who have lived in the Interior since the 17th century. Together, with the indigenous peoples they represent approximately 20% of the total Surinamese population. It is often mentioned that the archaeology of Maroons provides knowledge about a little known part of African Diaspora history. Little publications of these archaeology findings have been presented. However, it must be noted that many of the religious sites of the Maroons are registered in the past by anthropologists (Herskovits & Herskovits, 1934; Price, 1983; Thoden van Velzen & VIP 1988). These are cemeteries, altars for different (older -) spirits, which are for example lined up behind the villages under a large tree, or locations with a particular history, where the presence of outsiders not appreciated. All these cultural and archeological aspects will be considered during the implementation of the project.

5.6.4 Economic activities, employment and income

The main economic activities are various within the villages. The activities are the following:

- Fishing;
- Hunting;
- Logging;
- Agriculture, for example dry land rice, cassava, taro, okra, maize, plantains, bananas, sugarcane, and peanuts;
- Tourism;
- Design and produce crafts and *pangi's;*
- Small scale production of (hand)soap made from self-extracted maripa and coconut oil;
- Harvest of wild forest products, such as palm nuts;
- Brick production;
- Wooden boats production;
- Small transport by boat companies or one-man business;
- Bakery;
- Supermarkets.

With these listing it is apparent that economic activities are executed in the villages. One of the increasing economic activities is the tourism sector with a growing number of vacation lodges in the area. With regards to the agriculture sector it must be noted that there are no markets within the villages, and family groups are largely self-sufficient. Some women work for extra cash by sewing clothes, baking bread, working on other women's farms, or making crafts for tourists. The median cash income of maroon women in Suriname is just $40 for the year (Heemskerk et al. 2004). Overall, a certain percentage of the community is working for the government.

5.6.5 Education, healthcare and utilities

The education level is quite low in comparison to the coastal areas; the majority of local people is illiterate. Many of them speaks their native Saamakka language; however Dutch is taught in

schools and is widely spoken as well as Sranan Tongo. There are about 22 primary schools dispersed in the Ressort and there is one secondary school based in Pokigron-Atjoni.

Basic healthcare is provided by the Medical Mission Suriname positioned in 12 villages. For serious injuries or illnesses, the people must travel to the capital.

The households in the villages do not have access to 24/7 electricity and potable water. Electricity is guaranteed by a diesel generator that runs from 19.00 till 23.00 hours – however, it must be noted that 75 % of the year there is a lack of diesel oil and no electricity can be generated - and sometimes by small solar panels, and the latter by collecting rain and river water in barrels. Several years ago, yard taps had been installed to acquire water from the river through a pipeline.

Furthermore, the telecommunication network is established in these villages. Internet connection is available, television and radio are therefore made available. However, these services are poorly used because electricity is needed to improve its services.

5.6.6 Politics and local organizations

The Saamakka have like all other Maroon tribes in Suriname their own authority and governance system. The authority in the form of a *Gaama* mentioned in the Peace Treaty of 1762 imposed by the colonial government, recognized the *Gaama* only as a responsible contact person.

Traditionally each lo had a *Kabiten (Fii Paw Kabiten*) which they have obtained from peace. *Fii Paw* means peace staff. With the increase in population as well as the number of villages, the number of *Kabiten* also increased. On *Lo* and village level the authority is exercised by the *Kabiten.* He is assisted by the *Basia*. Since 1924 the governance regime recognize the *Gaama;* also *Hedi Kabiteni* pronounced in English as head captains, who has the authority over a particular area on behalf of the *Gaama.*

Within the Saamaka society, there is consensus that the important public functions are assigned to men. Since the end of the 19th century, there are also female *Basia's.* As a result of the developments in the field of gender also women are being appointed to kabiten. Each village has its own board that is formed by the *Kabiten/Hedi Kabiten, Basia* and council of elders. Suriname has no legislation for administrative organization of tribal living in groups and therefore their functions and powers are not regulated by law.

In overcoming social problems within the community or with outsiders these officers regularly keep meetings (*Kuútu's*) at the members of the community. In the past there was no standardized procedure for example, participation or participation in decision making. However, this is changed by the fact that in March 2016 a community engagement strategy was developed with Free Prior and Informed Consent (FPIC) as fundamental basis and should be considered when the project is carried out in the villages.

5.7. Social Impact Assessment

In the following table a general social impact assessment matrix is presented with focus on 2 components which are the design and construction as well as the operation and closure of the power plant and transmission lines. With this overview of impacts, mitigation measures can be

considered throughout the preparation of the project considering participation of all relevant stakeholders.

It is noted through literature research that there are many challenges for the development of the Saamaka. After the peace treaties of the colonial government with the Saamaka , challenges and problems have been stagnated the development of the Saamakka. Some of the challenges and problems was the signing of the Memorandum of Understanding in 1957 between the Government of Suriname and the ALCOA resulted into the construction of the hydro dam. Therefore , the people that have lived in the area had to be moved, as a large part of their territory would go under water. According to Landveld, Michels and other researchers 5000 Maroons and 25-26 villages needed to be removed. Scholtens indicates that 6000 Maroons were distributed to 34 villages. This situation had led to the transmigration of the Saamaka people in 1964 from which until today the effects are visible and identifiable.

Table 5-10: Assessment and mitigation matrix

Aspect	Economic and Social Impact	Negative (-) Positive (+) impact	Mitigation
Design and construction of the power plant and transmission lines			
	1. Employment	+	Participation and ownership in the project phases; capacity building of local employees; increase willingness of teachers to stay in the villages.
	2. Stakeholders and community engagement	+	Participation and engagement in the project phases; increase of collaboration with external stakeholders; implement communication engagement strategies according to FPIC; capacity building of local employees; strategic plan to prevent the loss of land (village land, community land, forest-community concessions.
	3. Road development, increase education and health centers.	+	Implement vision, mission and strategies for development; institutional strengthening; capacity building of local employees; increase of various services such as education and health centers.
	4. Skills and knowledge development of communities	+	Participation in the project phases; capacity building of local employees.
	5. Accessibilities to the villages	-	Increase safety and security; increase local regulation and enforcement.
	6. Noise, dust and oil spills	-	Implement environmental best practices and comply with IFC World Bank standards, EEC and NEN standards.
	7. Climate change	-	Climate resilient mitigation: use of climate resilient equipment, climate monitoring and land use management.
	8. Gender equality	+	Increased employment, job creation and income. Increased empowerment; increased economic participation.
Operations and closure of the power plant and transmission lines			
	– Employment	+	Increase of livelihood benefits; increase awareness on labor, occupational health and safety; capacity building of local employees in the energy, (tele) communication, health, education, security and safety sector etc.; job creations; increase opportunities in other transportation services (other than boat transport).
	– Economic activities: increase of production; increase of e-trade; tourism sector, health sector and agricultural sector.	+	Increase livelihood benefits, implement environmental management best practices; increase regulations and enforcement.
	– Increased opportunities in education; increase of e-learning	+	Increase livelihood benefits; promote implementation of new economic sectors in villages; implement environmental management best practices.

–	Increased telecommunication	+	Increased access to communications, e-education, e-commerce, e-health etc.; implementation of regulation and enforcement regarding telecommunication theft, unethical practices and improper use of (new) telecommunication technology; opportunities for internet banking, remote CBB and e-governance.
–	Noise, dust and oil spills	+	Implement environmental best practices and comply with IFC World Bank standards, EEC and NEN standards.
–	Increased public health	+	Increased e-health; increased shelf-life of medical products; better medical facilities.
–	Security and safety	-	Increased facilitation of Corps Police Suriname and other governmental facilities for safety and security.
–	Culture and archeology	-	Implement strategic plan for cultural conservation, management, education and land use management.
–	Transmigration	-	Increased awareness; increased strategic plan for transmigration aspects.
–	Gender equality	+	Increased employment, job creation and income. Increased empowerment; increased economic participation.

5.8. Social Management Plan

5.8.1 Introduction

This social management plan (SMP) aims to support the management of the social impacts of the project and to consider and develop proper measures and controls to decrease the potential for environmental and social degradation during all phases of the project. The SMP is based on the impact assessment which is generally executed and the results presented in the previous chapter.

5.8.2 Objective of the social management plan

The overall objectives of the following Social Management Plan is to provide the means for the project implementers and to work together with the local communities to:

- Understand community needs;
- Clarify community expectations;
- Communicate development plans;
- Identify mutually beneficial business opportunities;
- Identify potential independent business opportunities.

The following Social Management Plan was developed to address the avoidance of, minimization of, and/or compensation for negative socio-economic effects and the enhancement of positive benefits that could result from the project.

5.8.3 Roles and responsibilities

The Ministry of RO and its relevant stakeholders shall remain in control of community engagement activities and social management activities throughout the project. Though NV EBS will identify/allocate appropriate staff and expertise to support engagement activities in the construction, operations and decommissioning (closure) phase focusing on the technical and environmental, health and safety aspects.

Overall responsibility for the implementation of this management plan shall rest with the Ministry of RO in collaboration with the environmental and social specialist of the NV EBS who shall report on progress to the CEO of the NV EBS. Ministry of RO shall be responsible for designing and implementing engagement activities with local communities and local/regional government.
Others with responsibility for the implementation of this management plan shall include the contractors. The contractors shall be responsible for the integration of procedures mentioned in the social management plans and its requirements into their operating procedures and plans;
NV EBS shall ensure that these procedures and requirements are implemented for all operations.

5.8.4 Important aspects of the social management plan

Community Engagement Plan (CEP)

The Community Engagement Plan (CEP) is designed to ensure effective engagement with local communities, government and key relevant stakeholders during the construction, operation and closure (decommissioning) of the project. The plan contains the methods and recommendations for ongoing engagement with local communities, government authorities and particularly those

responsible for permitting the project, as well as other stakeholders that may be affected by or interested in the project. The CEP will be implemented considering the Community Engagement Strategies of the Government of Suriname with as fundamental the FPIC principals.
Table 5-11 gives an overview of key engagement activities to be implemented during the three phases of the project.

Table 5-11 Overview of key engagement activities

Description	Key engagement activities
Planning and scoping the ESIA	
Conceptual design and scoping consultations stakeholder identification and limited information disclosure about exploration.	Stakeholder identification Community and household surveys Focus group discussions Consultation with governmental agencies Round tables with government officials
Project assessment stage	
Preparing all studies including the ESIA Engagement during land clearing exercises and planning for full construction activities	Consultation and negotiations during land acquisition activities ESIA preparation and consultation with relevant stakeholders Submission of ESIA documents and review Information on project design and progress Maintaining community liaison officers and information centers
Construction, operations and closure	
Construction: Building community awareness of construction impacts and preparing local communities for operations.	Regular construction updates for local villages and community-driven engagement, e.g. community newsletter Disclosure of printed materials (various topics) Awareness raising for communities to help them deal with mine impacts Addressing community complaints
Operations and Closure: Ongoing engagement and community relations, throughout operations and into closure.	Maintaining proven methods of engagement Early engagement on rehabilitation/reclamation Sustainable local development planning

Human resource and employment management plan

Another aspect considered highly after the SIA is the human resource and employment management plan; this component aims to ensure that local employment, one of the main benefits of the project, is maximized and enhanced through effective procedures for employment and training of (new) personnel during the construction, operations and closure phases of the project in a fair and transparent manner. Opportunities for employment (both direct and indirect) will occur in all phases of the project. Benefits are expected to be greatest during operations, when positions will be longer term and will be predominantly filled by nationals and where an increase of new opportunities will be possible. Employment and associated skills training and development is likely to be one of the most significant benefits and outcomes of the project. The potential positive effect is increased wage employment for skilled and semi-skilled of local community throughout the various sectors such as the tourism sector, transport sector, trade sector, education and health sector as well as the energy sector. Therefore, this plan contains the methods and recommendations for ongoing engagement with local communities, government authorities and particularly those responsible for increased human resources and employment in the various sectors and new employment opportunities.

Community Assistance Plan (CAP)

The implementation of the project leads to the increase of socio-economic activities. Therefore, a Community Assistance Plan (CAP) is a first step into the guidance of improving the economic conditions of the villages through diversifying income opportunities, enhancing people's ability to take advantage of diversified opportunities, and building local government capacity to carry out its development responsibilities. In short, strategies need to be developed in order to help the local communities enjoy greater control over their livelihoods and quality of life, thus facilitating their direct participation in the larger economic and social development process. Therefore, the Ministry of RO will play a very important role to establish procedures for identifying community needs, working with the community and other partners, planning and implementing community projects and managing financial arrangements. The CAP can also be part or complementary to the human resource and employment management plan. The approach to the CAP includes the following guiding principles:

- Work closely with various government agencies and ministries to coordinate local development priorities with regional/national programs in order to create a coherent development process. It must be noted that, any external implementing partners that may be required will be introduced to the government and the community prior to any visits to the area.
- Community development initiatives should benefit the community as a whole or a large portion of the community (rather than individual households)
- Initiatives that promote the health and well-being of communities are a priority for future funding or finance, and vulnerable and disadvantaged groups will also be targeted such as women and children.

Land Use Management Plan

The Land Use Management Plan is designed to ensure that NV EBS mitigates for impacts to land and land use that will occur as a result of the project. The plan will be a flexible document that shall be reviewed on a periodic basis. The approach to land use management are as follow:

- Conducted baseline studies, including three field surveys and preliminary census of affected land and assets in the local study area, including current and historical land use and ownership claims
- Mitigation measures, including any compensation for project-affected persons, will be carried out in compliance with national legislation and only with the approval of the government.

These activities and the development and implementation of the land use management plan will be coordinated by the Ministry of RO considering the community engagement plan.

Cultural Heritage Management Plan

The Cultural Heritage Management Plan aims to ensure that the project has minimal impact on the cultural resources of the project area, through the implementation of effective mitigation and monitoring measures through construction, operation and closure. The plan contains the methods to map, document and excavate known cultural resources. Cultural heritage encompasses a wide range of resources, including archaeological deposits and remains, historical monuments, sites and buildings, historical and culturally-significant landscapes, places of worship, cemeteries and graveyards, places associated with local folklore, mythology and traditions and the location of historical and cultural festivals, events and rituals. Cultural heritage impacts could occur predominantly in the construction phase, because land clearance and other intrusive activities are required to prepare the site and build project facilities.

Overall responsibility for the implementation of this management plan shall rest with the Ministry of RO in collaboration with the NV EBS and include the integration of procedures and requirements into their operating procedures and plans and monitoring activities at locations deemed to require special attention in terms of cultural heritage/archaeological management.

Training

All employees of NV EBS and Contractors to NV EBS shall be provided with basic training on social management such as appropriate interaction with local communities and procedures developed for implementation of abovementioned management plans. If needed, additional specialist training by the Ministry of RO shall be provided to NV EBS staff involved in engagement activities.

Monitoring & Reporting

It is important to monitor community engagement to ensure that consultation and disclosure efforts are effective, and in particular that primary stakeholders such as local communities are meaningfully incorporated into the process. Each engagement monitoring procedure from each management plan shall be as follows:

- A monthly monitoring report will be developed by the NV EBS in collaboration with the Ministry of RO regarding the progress of the community engagement activities. In this report the following can be stated:
    a. The level of participation by different stakeholder groups (e.g. women) shall be recorded;
    b. Engagement conducted with government and affected communities;
    c. Comments from, and feedback provided to, stakeholders shall be recorded;
    d. Commitments made to local communities by the project;
    e. Disclosure materials disseminated: types, frequency, and location;
    f. Community attitudes and perceptions; complaints and their resolution; and relations staff, their duties/activities and staff changes;
    g. Committees, groups and partnership activities related to engagement; and
    h. Conduct routine inspections of site activities in consultation with the construction coordinator to assess the potential for chance finds at work sites and any other cultural heritage issues that may arise;
    i. Grievances and actions taken;
    j. Records of community assistance activities/meetings/events;
    k. Training, skills development and capacity building provided;
    l. Traffic management;
- NV EBS shall regularly participate in engagement activities and disperse the following information if needed:
    a. Information dissemination regarding employment, including vacancy announcements;
    b. Information dissemination regarding the project results per project phase.

6. FINANCIAL-ECONOMIC FEASIBILITY FOR 33 kV LINE

6.1. Investments

The total investment for this project is depicted in Table 3-3 and Table 3-4 of chapter 3 for both options, 33 kV line and 69 kV line. The financial-economic feasibility is carried out for phase 1 of both options. The project investments for phase 1 is depicted in Table 6-1 and Table 6-2.

Table 6-1: Project investment phase 1, 33 kV transmission line option: Atjoni – Pikienslee *(in US$)*

Total Cost	Phase 1
Mechanical 3 x 1.5 MW HFO GENSET (+2×2.5MW for phase 2-3)	$5,345,000
Civil Work Powerstation	$2,958,450
Powerstation Electrical part	$1,570,520
OverHead Line 12 kV	$1,680,600
Overhead Line 33 kV	$5,484,094
Land Clearing	$1,000,000
Engineering, ESIA & PR works	$1,000,000
Subtotal	*$19,038,664*
Transport (20-30%)	$3,807,733
Contingency 10%	$1,903,866
Total Cost	**$24,750,263**

Table 6-2: Project investment phase 1, 69 kV transmission line option Atjoni – Pikienslee (in US$)

Total Costs	Phase 1
Mechanical 3 x 1.5 MW HFO GENSET (+2×2.5MW for phase 2-3)	$5,345,000
Civil Work Powerstation	$2,958,450
Powerstation Electrical part	$2,316,030
OverHead Line 12 kV	$2,949,000
Overhead Line 69 kV	$13,080,034
Land Clearing	$1,000,000
Engineering, ESIA & PR works	$1,000,000
Subtotal	*$28,648,514*
Transport (20-30%)	$5,729,703
Contingency 10%	$2,864,851
Total Cost	**$37,243,068**

The implementation will start with Phase I and will gradually go to Phase II and III. The aim is to

implement phase 1 of the project by the end of 2019. However the entire project can be implemented within 2 years, if the finance is available.

The cost estimation is based on desktop studies. Since site surveys are needed in order to determine the correct trace of the transmission and distribution line. In addition the costs of the road for the transmission line and logistic costs are not included in this cost estimation, since those costs will be covered by the Ministry of Public Works, Transport and Communication together with the Ministry of Regional Development and submitted in separate tender documents.

Table 6-3: Total investment phase 1 with 33 kV transmission line in implementation year 1 + 2 in US$

Year	1	2	Total
Mechanical 3 x 1.5 MW HFO GENSET (+2×2.5MW for phase 2-3)	2,138,000	3,207,000	5,345,000
Civil Work Powerstation	1,183,380	1,775,070	2,958,450
Powerstation Electrical part	628,208	942,312	1,570,520
OverHead Line 12 kV	672,240	1,008,360	1,680,600
Overhead Line 33 kV	2,193,638	3,290,456	5,484,094
Land Clearing	400,000	600,000	1,000,000
Engineering, ESIA & PR works	400,000	600,000	1,000,000
Subtotal	7,615,466	11,423,198	*19,038,664*
Transport (20-30%)	1,523,093	2,284,640	3,807,733
Contingency 10%	761,546	1,142,320	1,903,866
Total Cost	**9,900,105.20**	**14,850,157.80**	**24,750,263.00**

The total investments connected with the implementation of the phase 1 of the 33 kV option during 2 years, including 10% contingency, amounts US$ 24,750,263.00.

Table 6-4: Total investment phase 1 with 69 kV transmission line in implementation year 1 + 2 in US$

Year	1	2	Total
Mechanical 3 x 1.5 MW HFO GENSET (+2×2.5MW for phase 2-3)	2,138,000	3,207,000	5,345,000
Civil Work Powerstation	1,183,380	1,775,070	2,958,450
Powerstation Electrical part	926,412	1,389,618	2,316,030
OverHead Line 12 kV	1,179,600	1,769,400	2,949,000
Overhead Line 69 kV	5,232,014	7,848,020	13,080,034
Land Clearing	400,000	600,000	1,000,000
Engineering, ESIA & PR works	400,000	600,000	1,000,000
Subtotal	11,459,406	17,189,108	28,648,514
Transport (20-30%)	2,291,881	3,437,822	5,729,703
Contingency 10%	1,145,940	1,718,911	2,864,851
Total Cost	**14,897,227**	**22,345,841**	**37,243,068**

The total investments connected with the implementation of the phase 1 of the 69 kV option during 2 years, including 10% contingency, amounts US$ 37,243,068.

6.2. Projected Operational Costs and Benefits

The average annual operational costs, during the lifetime of the project are estimated in Table 6-5. The total annual operational costs from year 3 on, up to year 9 are differed from each other because the power plan at Atjoni will not produce the full capacity immediately from the start of the power plant. Production is expected to increase gradually and only stabilize in year 10, so that costs will be variable until year 9. The total annual operational costs are presented in table 6-5, from year 3 on.

The feasibility analysis of the project is done on a constant price assumption. Past experience has learned that the development of inflation is very difficult to forecast. Domestic inflation has shown a tremendous volatility over the past 40 years, with periods of high inflation followed by periods of modest inflation. It is therefore extremely difficult to make projections for the coming 20 years. By calculating in constant price terms, the assumption is made that the inflation of both costs and benefits will be more or less the same.

Table 6-5: Total annual operational costs Atjoni power plant (in US$)

Year	3	4	5	6	7	8	9	10 - 20
HFO- consumption	428,468	642,702	899,783	1,034,751	1,138,226	1,195,137	1,242,942	16,558,228
Diesel- consumption	89,165	133,747	187,246	215,333	236,866	248,709	258,658	3,445,785
Subtotal	***517,633***	***776,449***	***1,087,029***	***1,250,083***	***1,375,092***	***1,443,846***	***1,501,600***	***20,004,014***
Spare parts per kWh	50,633	75,949	106,329	122,278	134,506	141,231	146,881	1,956,714
Direct cost	***568,266***	***852,398***	***1,193,358***	***1,372,361***	***1,509,598***	***1,585,077***	***1,648,481***	***21,960,727***
Labour	317,898	317,898	317,898	317,898	317,898	317,898	317,898	3,496,873
Housing expenses yearly	50,000	50,000	50,000	50,000	50,000	50,000	50,000	550,000
General expenses	70,000	70,000	70,000	70,000	70,000	70,000	70,000	770,000
Total operational costs	***1,006,163***	***1,290,296***	***1,631,255***	***1,810,259***	***1,947,495***	***2,022,975***	***2,086,378***	***26,777,600***
Interest 10% 0f Oper. costs	100,616	129,030	163,126	181,026	194,750	202,297	208,638	26,777,600
Total operational costs+interest	**1,106,779**	**1,419,326**	**1,794,381**	**1,991,285**	**2,142,245**	**2,225,272**	**2,295,016**	**53,555,200**

The financial benefits of this project are calculated based on the following assumptions:

- The additional production of generated kWh are estimated at an average 6 MW for the Atjoni Power plant from year 3 on;
- The electricity tariffs in Suriname are determined by the Government. Subsequent Governments practiced monopoly pricing whereby they have developed a differential system of subsidized tariffs. The average tariff per kWh applied by EBS is now SRD 0.51, which corresponds with US$ 0.073;

- The transmission capacity developed under this project has lower transmission losses of in total 4%, which are delivered to the consumer at the current average tariffs of US$ 0.073.

Considering the current kWh tariff of 0.073 $/kWh with the annual generated energy, the total financial benefits are estimated at US$ 17,496,438 from year 3 on, in a period of 20 years of the project as presented in the next Table 6-6.

Tabel 6-6: Projected financial Benefits Atjoni power plant (in US$)

Year	1	2	3	4	5	6	7	8	9	10 - 20	Total
Financial Benefits	0	0	370,126	555,189	777,264	893,854	983,239	1,032,401	1,073,697	11,810,668	17,496,438

6.3. Projected Financial Cash Flow and Sensitivity Analysis

Since no official institute in Suriname is calculating macro-economic parameters there are no precise up to date figures available. The only estimations, made by Dr. Zenon Garcia in his "National Parameters of Suriname", dates from 1989. In the Garcia report the opportunity cost[5] of capital was estimated at 5.7%. Due to developments on the capital market, this figure seems rather low. However, discussions with monetary experts indicated that an assumption of 6% is reasonable and compared with industrial countries this figure seems to be a good approximation.

Table 6-7: Financial Cash Flow Analysis phase 1, 33 kV transmission line, including 10% interest (in US$)

Year	1	2	3	4	5	6	7	8	9	10 - 20
Investment	9,900,105	14,850,158	0	0	0	0	0	0	0	500,000
Operational Costs	0	0	1,006,163	1,290,296	1,631,255	1,810,259	1,947,495	2,022,975	2,086,378	26,777,600
Financial Benefits	0	0	370,126	555,189	777,264	893,854	983,239	1,032,401	1,073,697	11,810,668
Net Fin. Cash-flow (in US$)	-9,900,105	-14,850,158	-636,037	-735,107	-853,991	-916,405	-964,256	-990,574	-1,012,681	-15,466,932

Due to the low average tariffs, the Net Financial Cash Flow of the project is negative for the life time of the project. As a result the Financial Internal Rate of Return (FIRR) of the project is negative. The Net Present Value (NPV), at an assumed external cost of capital of 6%, amounts US$ -32,560,418 (negative).

Table 6-8: Financial Cash Flow Analysis (in US$) for phase 1 with 69 kV transmission line including 10% interest

Year	1	2	3	4	5	6	7	8	9	10 - 20
Investment	14,897,227	22,345,841	0	0	0	0	0	0	0	2,500,000
Operational Costs	0	0	1,106,779	1,419,326	1,794,381	1,991,285	2,142,245	2,225,272	2,295,016	29,455,360
Financial Benefits	0	0	370,126	555,189	777,264	893,854	983,239	1,032,401	1,073,697	11,810,668
Net Fin. Cash-flow (in US$)	-14,897,227	-22,345,841	-736,654	-864,137	-1,017,117	-1,097,431	-1,159,005	-1,192,871	-1,221,319	-20,144,692

Due to the low average tariffs, the Net Financial Cash Flow of the project is negative for the life time of the project. As a result the Financial Internal Rate of Return (FIRR) of the project is negative. The Net Present Value (NPV), at an assumed external cost of capital of 6%, amounts US$ - 46,971,976 (negative).

[5] Opportunity Cost = Return of most lucrative option - Return of chosen option.

6.4. *Projected Economic Benefits and Sensitivity Analysis with 33 kV line*

Considering the current economic kWh tariff of 0.15 $/kWh with the annual generated energy, the total Economic benefits are estimated at US$ 35,902,403 from year 3 on, in a period of 20 years of the project as presented in the next Table 6-9.

Table 6-9: Net Economic Cash Flow Analysis (in US$) for phase 1 with 33 kV transmission line including 10% interest

Year	1	2	3	4	5	6	7	8	9	10 - 20	Total
Investment	9,900,105	14,850,158	0	0	0	0	0	0	0	2,500,000	27,250,263
Operational Costs (+ interest)	0	0	1,006,163	1,290,296	1,631,255	1,810,259	1,947,495	2,022,975	2,086,378	26,777,600	38,572,421
National Economic Benefits	0	0	759,492	1,139,238	1,594,933	1,834,173	2,017,590	2,118,470	2,203,209	24,235,297	35,902,403
Net Econ. Cash-flow (in US$)	-9,900,105	-14,850,158	-246,671	-151,058	-36,322	23,914	70,095	95,495	116,831	-5,042,303	-29,920,281

In order to identify the critical factors, which are contributing to the financial results a sensitivity analysis is made. Hereby an assessment is made on the impact in case of the occurrence of less favourable situations. Based on the economic benefit of the project the IRR is – 21.2 % while the NPV is – 22,540,590 meaning that the project is financially still not feasible, but the spin-off will remain the same: as great as not quantifiable!

Table 6-10: Financial Sensitivity Analysis Phase 1, with 33 kV transmission line option

#	Assumption	IRR (%)	NPV (i=6%, US$
1	Fin. Benefits are 50% higher	negative	-27,953,970
2	Fin. Benefits are 75% higher	negative	-25,572,795
3	Fin. Benefits are 150% higher, while investment costs are 10% lower	negative	-20,736,577
4	Fin. Benefits are 50% higher while investment costs are 15% lower	negative	-24,349,357
5	Fin. Benefits are 135% higher and also investment costs are 5% higher	negative	-20,851,644

However, the results are sensitive for changes in the tariffs.

6.4.1 Economic costs Sensitivity Analysis with 33 kV line option

Table 6-11: Economic Sensitivity Analysis with 33 kV transmission line option

#	Assumption	IRR (%)	NPV (i=6%, US$)
1	Investment costs 10% higher	negative	-24,839,731
2	Investment costs 10% lower	negative	-20,241,499
3	National Economic Benefits 10% higher.	negative	-18,286,996
4	National Economic Benefits 10% lower	negative	-24,495,043
5	Operational costs 10% lower	negative	-22,585,672

With the economic rate there is clear change in cash flows, so here too the results are sensitive to changes in the economic rate; only a 10% rate change appears to have huge consequences for cash flows.

6.5. Projected Economic Benefits and Sensitivity Analysis with 69 kV line

Considering the current economic kWh tariff of 0.15 $/kWh with the annual generated energy, the total Economic benefits are estimated at US$ 35,902,403 from year 3 on, in a period of 20 years of the project as presented in the next Table 6-12.

Table 6-12: Net Economic Cash Flow Analysis (in US$) for phase 1 with 69 kV transmission line including 10% interest

Year	1	2	3	4	5	6	7	8	9	10 - 20	Total
Investment	14,897,227	22,345,841	0	0	0	0	0	0	0	2,500,000	39,743,068
Operational Costs (+ interest)	0	0	1,006,163	1,290,296	1,631,255	1,810,259	1,947,495	2,022,975	2,086,378	26,777,600	38,572,421
National Economic Benefits	0	0	759,492	1,139,238	1,594,933	1,834,173	2,017,590	2,118,470	2,203,209	24,235,297	35,902,403
Net Econ. Cash-flow (in US$)	-14,897,227	-22,345,841	-246,671	-151,058	-36,322	23,914	70,095	95,495	116,831	-5,042,303	-42,413,086

In order to identify the critical factors, which are contributing to the financial results a sensitivity analysis is made. Hereby an assessment is made on the impact in case of the occurrence of less favourable situations. Based on the economic tariff of produced KWh of the project, both IRR and NPV are negative (NPV = – 36,666,386). IRR is such a large negative percentage that the computational model in fact does not know how to handle it (#NUM!); meaning that the project is financially not feasible at all due to the current tariff. But because of the social-economic spin-off in the area (see section 6.5), it is still recommended.

Table 6-13: Financial Sensitivity Analysis Phase 1 with 69 kV line option

#	Assumption	IRR (%)	NPV (i=6%, US$
1	Fin. Benefits are 50% higher	negative	-42,209,626
2	Fin. Benefits are 75% higher	negative	-39,828,451
3	Fin. Benefits are 150% higher, while investment costs are 10% lower	negative	-37,447,276
4	Fin. Benefits are 50% higher while investment costs are 15% lower	negative	-37,415,654
5	Fin. Benefits are 135% higher and also investment costs are 5% higher	negative	-36,543,100

The results show that the project is sensitive for changes in the tariffs.

6.5.1 Economic costs Sensitivity Analysis with 69 kV line option

Table 6-14: Economic Sensitivity Analysis with 69 kV line option

#	Assumption	IRR (%)	NPV (i=6%, US$)
1	Investment costs 10% higher	negative	-39,233,025
2	Investment costs 10% lower	negative	-33,964,037
3	National Economic Benefits 10% higher.	negative	-32,009,584
4	National Economic Benefits 10% lower	negative	-39,530,210
5	Operational costs 10% lower	negative	-36,871,436

With the economic rate there is clear change in cash flows, so here too the results are sensitive for changes in the economic rate; only a 10% rate change appears to have huge consequences for cash flows.

6.6. The Social-economic spin-off

After implementation, when the project is in operation, the quality of social economic life in this area will get a huge boost as never before. It will have a huge social- and financial-economic spin-off in the area which was for decades a subordinated region; due to a lack of structural electrical energy and therefore insufficient water supply, inadequate health care, poor education, no business attraction, etc. The area does not attract investors (an exception is the Godo Bank at Atjoni and Nieuw Aurora, a cooperative bank that has settled an affiliate for a few years now).

The project involves, providing the villages from Atjoni/Pokigron up to Asidonhopo/Dangogo and the Langu-Area with electrical energy. Some of the spin-off as result of this project, will be:

1. ***Paying electricity;*** currently there is 4 hours a day electricity available in the villages, when there is enough fuel. For the remaining hours the local population need to purchase petroleum for lamps, batteries for flashlights and candles for lighting purposes. With the 24/7 electricity from this project, the money currently spent by the local population for limited lighting can be used to pay their electricity bills based on 24/7 level.
2. ***Telecommunication;*** The Telecommunication Company of Suriname, Telesur, is also involved, who is simultaneously busy bringing the telecom section to a higher level in the area, because of the availability of electric energy;
3. ***Health care;*** using of medical equipment or shelf life of Medicine of the Health Care Authority of the entire interior, *Medische Zending*, is currently limited due to the lack of cooling facilities due to lack of 24-h electricity. This will be history after implementation of this project, for there will be enough electric power for cooling facilities;
4. ***Education;*** teachers for basic education are not motivated to go in that area in order to provide education for, according to them, the general development is lagging behind comparing to teachers in Paramaribo. With implementation of this project, that argument will no longer be valid because as said before the Telecommunication Company of Suriname (Telesur) is also involved to provide internet connection of high standard. Even now there is internet connection in the area, but very poor due to the lack of electricity. So with the implementation of this Atjoni power plant, there will be full internet facilities. It will be like bringing the world into the interior, with the possibility of distant learning and many other forms of education in our interior. Studying and extra-lessons to pupils in the afternoon and eve will also increase, with as a result, increased positive study results in the area;
5. ***Tourism development;*** the development of tourism in the area will also get a push due to this project. The main handicap to bring the lodges to the proper level is the lack of electricity needed for 24/7 cooling facility for food storage, 24/7 air conditioning, internet in order for the tourist to be connected with the rest of the world;
6. ***Government agencies services;*** will also be improved to the level as they are in Paramaribo due to this project: electronic family statements, nationality statements, etc;
7. ***Small businesses in the area;*** the women in the area are usually very active in women's movements. They plant and catch fish and the men hunt wild for sale and therefore need cooling facilities for storage, but due to the lack of electricity supply, their business does not prosper. The women also have small machines like small rice-mills, cassava razors, etc that work with electricity.

Many more social benefits (spin-off) of this project are described in de the ESIA, therefore see chapter 5 of this document.

6.7. Savings Atjoni power plant versus DEV

The department for rural electrification under the Ministry of Natural Resources responsible for energy supply in the interior has been active for many years in this area regarding energy purveyance. A comparison between the annual operational expenses of DEV in the area and the operational costs of the Atjoni power plant under construction shows the following results.

Table 6-15: Operational costs Atjoni power plant

Year			1	2	3	4	5	6	7
HFO- consumption	90%		518,906	778,359	1,089,703	1,253,158	1,378,474	1,447,398	1,505,293
Diesel- consumption	10%		107,985	161,977	226,768	260,784	286,862	301,205	313,253
Subtotal			***626,891***	***940,336***	***1,316,471***	***1,513,942***	***1,665,336***	***1,748,603***	***1,818,547***
Spare parts per kWh			61,320	91,980	128,772	148,088	162,897	171,041	177,883
Direct cost			688,211	1,032,316	1,445,243	1,662,029	1,828,232	1,919,644	1,996,430
Labour			317,898	317,898	317,898	317,898	317,898	317,898	317,898
Housing expenses yearly			50,000	50,000	50,000	50,000	50,000	50,000	50,000
General expenses			70,000	70,000	70,000	70,000	70,000	70,000	70,000
Total operational costs			***1,126,108***	***1,470,214***	***1,883,140***	***2,099,927***	***2,266,130***	***2,357,541***	***2,434,327***
Interest 10% of total operational cost			112,611	147,021	188,314	209,993	226,613	235,754	243,433
Total Operational costs + interest			***1,238,719***	***1,617,235***	***2,071,455***	***2,309,920***	***2,492,743***	***2,593,296***	***2,677,760***

DEV (Min. N.H) annual operational expenses extrapolated on 24/7 basis (in US$) are presented in Table 6-16. It is worth mentioned that the data received from the Ministry of Natural Resources are based on 4 operation hours per day in the villages. Based on those data Table 6-16 is prepared by extrapolation.

Table 6-16: Operational costs DEV diesel generators

Year			1	2	3	4	5	6	7
Fuel comsumption			1,472,246	1,104,185	1,656,277	2,318,788	2,666,606	2,933,266	3,079,930
Load growth correction factor			0	552,092	662,511	347,818	266,661	146,663	123,197
Fuel comsumption after adjustment			0	1,656,277	2,318,788	2,666,606	2,933,266	3,079,930	3,203,127
Housing expenses yearly			50,000	50,000	50,000	50,000	50,000	50,000	50,000
General expenses			70,000	70,000	70,000	70,000	70,000	70,000	70,000
Labor cost			0	0	0	0	0	0	0
Total Cash Cost			***1,592,246***	***3,432,554***	***4,757,575***	***5,453,211***	***5,986,532***	***6,279,859***	***6,526,253***
Cash Annual Surplus			***353,527***	***1,815,318***	***2,686,120***	***3,143,292***	***3,493,790***	***3,686,563***	***3,848,493***

From data received from DEV itself, it should be noted that the DEV operational costs will be much more than the operational costs as will be made to keep Atjoni power plant operational. Therefore, from the financial point of view and also from the point of view of sustainability, it is much wiser to choose to build the Atjoni power plant rather than the continuation of the DEV operation. Based on 24/7 operation of the DEV diesel generators in the villages, the savings compared to the operation of the Atjoni thermal power plant are depicted in Table 6-16 as surplus.

Taking into account the above mentioned surplus, the financial benefits from the generated electricity, the operation costs and the total investment there will be a positive value at the end as depicted in Table 6-17 and Table 6-18.

Table 6-17: Financial status over project life cycle with 33 kV transmission line option

Year	1	2	3	4	5	6	7	8	9	10 - 20	Total
Investment	9,900,105	14,850,158	0	0	0	0	0	0	0	2,500,000	27,250,263
Operational Costs (+ interest)	0	0	1,006,163	1,290,296	1,631,255	1,810,259	1,947,495	2,022,975	2,086,378	26,777,600	38,572,421
National Economic Benefits	0	0	759,492	1,139,238	1,594,933	1,834,173	2,017,590	2,118,470	2,203,209	24,235,297	35,902,403
Surplus Atjoni plant vs DEV			485,467	2,013,228	2,963,194	3,461,926	3,844,288	4,054,587	4,231,237	46,543,612	67,597,540
(Nat.Econ. Ben+surplus DEV) - (Operat. Costs+Investm)											37,677,258

Table 6-18: Financial status over project life cycle with 69 kV transmission line option

Year	1	2	3	4	5	6	7	8	9	10 - 20	Total
Investment	14,897,227	22,345,841	0	0	0	0	0	0	0	2,500,000	39,743,068
Operational Costs (+ interest)	0	0	1,006,163	1,290,296	1,631,255	1,810,259	1,947,495	2,022,975	2,086,378	26,777,600	38,572,421
National Economic Benefits	0	0	759,492	1,139,238	1,594,933	1,834,173	2,017,590	2,118,470	2,203,209	24,235,297	35,902,403
Surplus Atjoni plant vs DEV			485,467	2,013,228	2,963,194	3,461,926	3,844,288	4,054,587	4,231,237	46,543,612	67,597,540
(Nat.Econ. Ben+surplus DEV) - (Operat. Costs+Investm)											25,184,453

7. PROJECT ORGANIZATION

7.1. Project management

The Executing Agency of the project will be EBS assisted by project team consists of representatives from the Stakeholders Telesur, the Ministry of natural Resources, the Ministry of Public Works & Transportation, the Ministry of Regional Development and *Stichting Fonds Ontwikkeling Binnenland* (SFOB). The company has significant experience in similar/related projects. Based on the experience with previous constructions of power plants and transmission facilities in Suriname the execution of the project is expected to take 1.5 years in total.

Project Management Unit (PMU)
The implementation of the project will be the responsibility of the PMU which includes a selection of local subject matter specialists, within and outside the company and the stakeholders, and international specialists.

The PMU will supervise the project implementation. In order to better fulfill its role in the execution of the tasks assigned to it. The PMU is headed by a Project Manager (PM), who is accountable to achieve the following results in the execution of the mission assigned to him:

(i) the technical, administrative and financial supervision of the project;
(ii) the supervision of project implementation;
(iii) quarterly reporting the situation of the project implementation to the CEO of the executing agency;
(iv) Any other task assigned by the CEO of the executing agency.

The PMU is based in Paramaribo with a continuous presence in Atjoni and Pikienslee for phase 1 of the project. It and will be staffed by the following expertise:

1. Project manager;
2. Construction Engineer;
3. Civil Engineer;
4. Electrical Engineer;
5. Mechanical engineer;
6. Procurement specialist;
7. Financial management specialist;
8. Environmental & Social specialists.

These professionals can be current staff members of EBS, the stakeholders and/or external specialists who will be recruited as external individual consultants. Most of these positions are not on a full-time basis. The estimated costs of the PMU is part of the Project budget.

The project will bear all expenses related to the daily management of its implementation. Some of those expenses are related to per diems, salaries, operating cost, transportation facilities, field trips, training and seminars, etc. During the Investment phase the project may need incidental additional assistance in specific fields of expertise.

From the beginning of the first three (3) months, the PMU will focus on the recruitment of the supervising consultant and the launching of the bidding documents for the Contractor, drafting procedures manual and executing the preliminary project activities for the project implementation. The PMU is responsible for the coordination of the preparation of:

1. Tender documents;
2. The public bidding process;
3. The implementation of the project activities; and
4. Reporting to the Government and CEO of the executing agency on the project progress.

Refer to social management plan preliminary ESIA

7.2. Contractor

The works will be executed by one or more contractors through international competitive bidding.

7.3. Auditing

A reputable local or international locally affiliated firm will audit the project accounts on regular basis during the implementation period. The PMU will formulate a TOR and the procedures for the selection of the firm.

The periodicity shall be every year. The audit will take place from the beginning of the civil works. In total 2 audits are expected in the course of the implementation of the project.

7.4. Procurement Procedures

Since the project to be executed as turn-key model, the procurement procedures will be as follows:

- open International Competitive Bidding (ICB) for the award of the contracts related to the Atjoni Power Plant, transmission and distribution line because of the complexity of works to be implemented;
- short list of national and international consultants (firms), subsequent to a widespread “expression of interest” advertisement according to international applicable guidelines, for the selection of the firm of the consultancy services component;
- short list of local firms for the selection of the audit firm as per international applicable guidelines.

Table 7-1: Procurement Activity matrix

#	Output	Procurement type	Procurement mode	Start
1	Formulate ToR/ formalize establishment PMU and contract staff	Services	Price comparison	July 2017
2	Tender and contract supervising Consultant	Services	Public Bidding	July 2017
3	Tender and contract Construction firm Atjoni Power Plant	Works	Public Bidding	Oct 2017
4	Formulate ToR and contract Auditing firm	Services	Price Comparison	July 2017

7.5. Start-up workshop

For the project awareness and ownership, a workshop will be organized at the start of the project. This workshop is aimed at informing the executing agency, the contractors, the consultants, the beneficiaries, the traditional authority and all other stakeholders about the project activities and the applicable rules and procedures. From PMU side, this will be an opportunity to listen and better understand the partners concerns regarding the project implementation and operating phases.

8. FINANCIAL PROPOSAL

8.1. Total project costs

The major project costs includes (but not limited to) the followings:

- ESIA study, PR works and Engineering;
- Atjoni HFO based power plant;
- Transmission (33 kV) and distribution lines;
- Route for transmission line;
- Upgrade and expansion of Telecom facilities.

To costs of the road for the transmission line will be covered by the Ministry of Regional Development together with the Ministry of Public Works, Transport & Communication. The requirement for the road and its total costs will be submitted in a separate document.

The total costs for the electricity supply and the telecom facilities for the entire project (phase 1+2+3) based on 33 kV transmission line are depicted in Table 8-1.

Table 8-1: Project costs for electricity & Telecom facilities

Total project costs for Electricity & Telecom facilities	
Description	**Total costs (USD)**
Power plant, Transmission & Distribution	***65,514,850.00***
Telecom facilities	**7,037,592.72**
Grandtotal	***72,552,442.72***

Based on the spin-offs described in chapter 6, the social benefits in the area upstream the Suriname River, the project can be financed by the contributions of the stakeholders towards the total project costs. In general the road for the transmission line will be financed and carried out by the Ministry of Regional Development together with the Ministry of Public Works, Transport & Communications. The transmission line will be financed by EBS together with Telesur. Because of its experience with the Hinterland community, the Ministry of Regional Development will be in charge for the implementation of the ESIA and the communications with the traditional authority.

9. CONCLUSIONS AND RECOMMENDATIONS

The interior of Suriname has been lacking structural electricity for decades. The Government policy is aimed at bringing electricity to areas which have been lacking it 24/7. Based on the infrastructure opportunities, the Upper Suriname River area is chosen to supply the electricity on 24/7 basis starting from Pokigron/Atjoni upstream till Pikienslee as phase 1. Subsequently, the remaining villages will be provided with electricity in phase 2 and 3.

The main advantages for this project is the possibility to reach Pokigron/Atjonby road. Since Atjoni is the most Southern local town accessible through a paved road from the Capital Paramaribo, fuelling the thermal power plant will be easy.

For supplying the 24/7 electricity several generation methods have been investigated such as PV-Solar, Decentralized Thermal, Centralized Thermal and Micro hydro systems. The conclusion is that the most favourable way to realize the 24/7 electricity supply is with a centralized diesel generator station and via a high voltage line connecting the villages. Depending on the local circumstances in several villages and or along the river, additional solar and or hydro installation can be installed as decentralized power generation and connected to the HV line there by keeping pace with the growth and technical challenges related to the HV line.

Based on civil data, from the register of the Ministry of Internal Affairs and based on assumptions of best practices from the EPAR and DE networks from the EBS, the peak power demand for phase 1 is calculated for around the 6 MW. When all households and all other costumers in the area along the upstream of the Suriname River (phase 1+2+3) are connected to the grid, the peak demand is estimated to be around 12 MW. The investment for the installation of the generation capacity can be carried out in phases, beginning with an initial installed capacity of 4.5 MW for phase 1. Also the 500 kWp solar PV plant under construction at Atjoni and the 2 pieces of CAT gensets will be included in the total installed capacity.

The preliminary results of the simulation for the Transmission Line from Atjoni to Asidonhopo shows that a voltage level of 33 kV is sufficient. Taking into consideration the growth based on best practices from the EPAR section it is foreseen that further measures need to be the installation of additional renewable generation capacity to guarantee the supply.

The 33 kV line can cover the demand growth for 20 years based on a yearly growth rate of 5%. In order to extend this period of 20 years, the renewable energy potential such as micro/mini hydro and solar PV at the upper stream of the Suriname River will be developed and injected to the 33 kV grid to keep the voltage level within the limits. When a road is constructed from Atjoni to Pikienslee, a new thermal power plant can be built in the area of Goejaba and Pikienslee to transmit the power southwards to Asidonhopo and also northwards to Atjoni if needed.

Another option is to build a transmission line of 69 kV to cover all the power generated from Atjoni to Dangogo & Stonhoekoe up till a maximum of 20 MW with voltage drop within the limits. However the costs for building the 69 kV will be way higher.

The project will contribute significantly to the national economy, for it is the first time that this part of the Surinamese population will be benefited of 24/7 electricity. During the implementation period local individuals and contactors will have temporary employment. After the implementation, when the project is operational, the quality of social economic life in this area will get a huge boost as never before. It will have a huge social and financial economic spin-off in the area which was

for decades a subordinated region; due to a lack of structural supply of electrical energy and therefore insufficient water supply, inadequate health care, poor education, no business attraction, etc. The full spin-off of this project is hardly quantifiable and will increase the living standards within the respective and the surrounding area.

With a good preparation and project schedule the implementation period of the project will be 1.5 year, the investment to be made for phase 1, will be 37 million USD and 87 million USD for the entire project based on 69 kV transmission line. However the costs for phase 1 will be 24 million USD and 65 million USD for the entire project based on 33 kV transmission line**.**

ANNEXES:

I. Power Demand Analysis

II. EHS Management Procedures

III. Monitoring Matrix of Mitigation Measures Design Phase.

IV. Monitoring Matrix of Mitigation Measures Construction Phase.

V. Monitoring Matrix of Mitigation Measures Operations Phase.

VI. Monitoring Matrix of Mitigation Measures Decommissioning Phase.

VII. Financial & economic sensitivity for 33 kV transmission line

VIII. Financial & economic sensitivity for 69 kV transmission line