GUYSOL

March 2023

Guyana Utility Scale Solar Photovoltaic Program

Project Summary – Prospect

East Canje, Berbice.

The Guyana Power and Light

103 Carmichael Street,

North Cummingsburg,

Georgetown.

Allana Heeralall - Mohan – Environmental Management Specialist

Project Summary - Prospect

1. A detailed description of the proposed project, including:

> ***(i) Physical location and its characteristics along with GPS coordinate/s; where applicable distances from the closest town, settlement, indigenous community, and nearby waterways such as creeks, rivers, closest town, etc; general/predominant land use (residential, tourism, agricultural, commercial, industrial, etc.) of the area; sensitive receptors (day-care facilities, schools, hospitals, etc.) likely to be affected by the proposed project; the relative abundance of natural resources in the area; and the non-disputed nature of the land.***

Prospect - Berbice

The project of Prospect will be executed close to the coastal plain of Guyana which may be designated as both a natural region as well as a physiographic region with a depth ranging from 8 to 65 km. Prospect lie within the coastal biogeographical province of Guyana. NAREI has designated the area as a 'coastal biogeographical province' characterized by the following biotic communities:

a) The Marine ecosystem: includes mudflats, mangrove forests and shell beaches. The mangroves protect the shoreline against erosion.
b) The Estuarine ecosystem: is characterized by wetlands which occurs at the mouths of the rivers.
c) The Riverine ecosystem: is characterized by tidal wetlands which occur along river banks.
d) The Palustrine ecosystem: comprises of marshes and swamps in river flood plains, as well as water savannahs.
e) The Lacustrine ecosystem: consists of natural lakes and the water conservancies. Some flora includes water lilies, razor grass and ite palm and ferns.

The most fertile soils are found on the coastal plain especially between and along the Essequibo to Corentyne River courses. These soils are generally a mix of fluvial deposits, with higher fertility being nearer to the coast. The main limitations are drainage, high salinity and toxicity.

Prospect is a small community located in Region 6 (East Berbice Corentyne) and this Coastal community consists of a small percentage of farmers and sugar workers of Guyana. The area is dominated by agricultural activities, mainly cattle rearing and farming which helps to sustain the livelihood of the people and the neighbouring communities. The Prospect population comprises of approximately 3,266 resident and is supplied with electricity from the Canefield Substation and Power Plant with on a twenty-four (24) hour basis.

Prospect was once used as an area sugarcane cultivation and is currently not being utilised. The Project site is approximately 56.5 acres in area and will support 3MWp. Prospect can be found geographically at Longitude -57.490252° and Latitude 6.252745°. The town of New Amsterdam can be found approximately 1.4 miles from the project site.

The area is predominantly use for housing developments and farming activities.

Map showing the Prospect site and surrounding areas.

(ii) A description of all feasible and reasonable alternatives.

The preliminary selection of sites was done while a representative sample were chosen. The representative samples were selected according to the technical aspect and the socio-environmental aspects. The identification of possible locations for the various projects was

constrained by the availability of land; proximity to existing infrastructure, particularly access roads and GPL substations; and the solar resource potential. Given the resource map shown below in Figure 1. The area of land required was determined based on an estimation of 5 acres per MWp of installed capacity, which would provide adequate space for the solar panels, battery storage, roads, switchgear, proper buffer areas and other required infrastructure. The solar resource potential at each site was estimated for crystalline silicon modules with a fixed system loss of 14%. The European Commission's Photovoltaic Geographical Information System (PVGIS) (http://re.jrc.ec.europa.eu/pvgis.html), which utilizes satellite images to calculate solar radiation data, was used. The PVGIS-SARAH dataset was chosen, since it has hourly time resolution, a spatial resolution of 3 arc-minutes, and covers Guyana for a time-series of 2005-2016.

GPL had requested to acquire this project site from NICIL on 11-Sep2019. An updated request was submitted on 12-Apr-2021. NICIL has since indicated to GPL that it is processing the surveys and valuations required for GPL to acquire the sites. This site is a portion of lands formerly under cane cultivation and was previously surveyed for GPL. GPL continues to work with NICIL to advance these acquisitions and was granted permission to commence de-risking work at the location by NICIL on April 30, 2021.

(iii) Description of any existing baseline information on the physical (landscape, soil, water, air, the use of natural resources), ecological (flora and fauna), and social environment (economic and cultural aspects).

Based on the ESA carried out the following existing baseline information was gathered:

PHYSICAL ENVIRONMENT -

a) SOILS

The coast itself is under sea level by about two meters. The flat narrow strip along the Atlantic coast was built up from centuries of sediment accumulation from the large South American rivers. This action has given rise to the fluvial soil type, which is mostly clay of varying properties along the coast. The plain is composed of a great variety of soils developed from a variety of parent materials such as marine and fluvio-marine deposits with back-swamp organic soils. In general, the soils closer to the shore and along rivers are more fertile but however, today the processes of accretion and erosion are still very active. While the coast along the

ocean is mostly clay, there are sections that are sandy, particularly near the river mouths and along some riverbanks. Prospect is located on Guyana's coastal belt with agriculture being a prevalent economic activity done on a commercial basis throughout the coastal belt due to its extensive organic wetland. Hence, agriculture is an ultimate contributor to employment, foreign exchange and economic growth in Guyana, as the sector accounts for 30% of employment and 40% of export earnings. The project area for example possesses a high level of fertile soils for the production of agricultural activities. Hence, rice is a large-scale agricultural activity. Farming is considered economical in these areas due to the pegasse area and the coastal 'frontland' and 'riverain' clays.

The soils of the coastal plain have been categorized as follows:

1. Low humic gleys of high base status, marine phase "frontland clay" (*Hydraquentswith Sulfaquents, Fluvaquents*): contains relatively fertile, poorly drained clay soils developed on unconsolidated sediments with associated sandy 'reefs' that are old beach ridges. Some saline soils and organic 'pegasse' soils also occur in patches. Despite high levels of fertility, irrigation and drainage is very important prior to agricultural production.
2. Low humic gleys of high and medium base status, fluvio marine phase, riverine soils (*Fluvaquents* with *Endoaquents, Medhemists*): describes poorly drained, deep, silty loam to silty clay over clay textured soils that have developed over alluvial deposits. They occur mainly between the Berbice and Corentyne Rivers, along the Demerara River. The soils have moderate to high fertility which decreases away from the coast. The need for drainage is the main limitation. The soils are extensively cultivated with rice and sugar the main crops but with a natural vegetation similar to 1a where not cultivated.
3. Bog soils, peat and muck phases, deep pegasse (*Medihemists* with *Sulfohemists, Medisaprists*): bog soils or pegasse occur as coastal back-swamps and are most extensive in north-western Guyana. The soils are organic accumulations of peat and other organic matter occasionally inter-layered with clay and can be as deep as 9m. They are very acid and have extremely low fertility. Drainage, fertility and acid sulphate toxicity are the main limitations to agriculture. The land cover is mainly natural vegetation of grassland and swamp forest.
4. Low humic gleys of low base status, including groundwater laterites and planosols (*Endoaquepts* with *Fluavaquents, Sulfaquepts*): these soils are very poorly drained

clays often with a peat topsoil with better drained laterite 'islands' and planosols that show an abrupt silt pan. The soils are very poorly drained, have extremely low fertility and often exhibit acid sulphate and aluminum toxicity. Drainage, fertility and acid sulphate toxicity are the main limitations to agriculture. The land cover is mainly natural vegetation of scrub, waterlogged grassland/marsh and swamp forest.

5. Groundwater laterites (*Humaquepts* with *Endoaquepts, Fluvaquents, Psammaquents*): this mapping unit occurs at the boundary of the coastal plain and the White Sand Plateau and is most extensive between the Berbice and Demerara rivers and south of the Torani Canal in Region 6. The soils are poor to moderately well drained, deep silty clays to clays of low fertility. Drainage is the main limitation in some areas but the low fertility can be enhanced through appropriate land management. The land cover is largely forest with some areas of savanna.

b) WATER

Water is an important source whether used for transport, consumption, industrial or agriculture. However, since Guyana's coastal plain lies below the sea level, it is mandatory to protect the coastal belt from immense floods and other sea hazards, Mangroves play an important role in Guyana's Coastal Plain. Low laying coastal areas depend on mangrove forests which acts as a natural barrier for the coastland. Concern over the sea defences is always on the local agenda. The diminishing mangrove population along the coast, decreases the natural defences of the coastline against wave action, erosion and flooding. Apart from this, mangroves also have ecological benefits for local aquatic life and spin off benefits for local fishery.

There are threats to these mangrove forests however. Local people use them for leather tanning, as the mangrove trees have the desirable tannins, and to a lesser extent for fuel, but this thankfully is not very widespread. Mangrove forests are constantly degraded due to logging and erosion, but the government is mounting a restoration project in concert with the European Union. Mangrove forests are home to manatees, scarlet ibis, spectacled caiman, shrimp, crabs and fish. Sandy beaches are nesting sites for sea turtles. Swamps occur in a line between the coastal plain and the white sandy interior hills. A line of swamps forms a barrier between the white sandy hills of the interior and the coastal plain. These swamps, formed when water was prevented from flowing onto coastal croplands by a series of dams, serve as reservoirs during periods of drought.

Mangroves occupy the extreme northern edge of the coastal plain, and there are current programmes targeting the conservation and cultivation of the various species of mangroves. There are an array of secondary vegetation including weeds (grasses), shrubs such as Carrion Crow bush (*Senna reticulata*) and black and sweet sage (*Cordia spp*.) and these are routinely removed as part of routine cultural treatments for cultivated crops or as hygienic enhancement of residential areas. Plants deemed 'weeds' that are typical of canals and conservancies areas include *Cabomba acquatica, Eleocharis cellulose*, and *Nymphaea odorata*; however, 'weeds' such as *Utricularia inflata, Utricularia purpurea* and *Mayaca spp*. are considered environmentally friendly weeds.

In Guyana the most important aquifers can be found in the unconsolidated, poorly sorted deltaic sands that underlie the coastal lowlands Ninety (90) percent of Guyana's population residing along the Coastal Plain receives their water supply from coastal aquifers, while the remaining ten (10) percent of the population receive water supply from surface water. A series of three separate but hydro-geologically connected aquifers has been providing water for the coastal inhabitants of the country over the past years.

Large quantities of fresh water are available from Guyana's coastal aquifer system. This system occupies a subsurface area of about 20,000 km2, extending about 250 km along the Atlantic coast and 40 to 150 km inland. Sediments reach a thickness of 1,800 m onshore and become progressively thicker offshore and toward the east. The coastal aquifer system is composed of three connected but hydro-geologically distinct aquifers. The lower two aquifers are confined by overlying layers of clays which protect them from contamination by overlying sources. The three aquifers are named, from upper to lower, the Upper Sands, the A Sand, and the B Sand, with each capable of yielding large amounts of water.

The Upper Sands aquifer is 30 to 60 m deep and ranges in thickness from 15 to 120 m; it is the shallowest of the three aquifers of the coastal aquifer system. In Georgetown in 1831, this was the initial aquifer developed for water supply. However, due to a high iron content (greater than 5 mg/L) and brackish water (total dissolved solids greater than 1,200 mg/L), the aquifer was never fully exploited and withdrawals ceased in 1913. The water from this aquifer becomes more saline toward the coast and the aquifer is composed of quartz grains, which represent former beach dune deposits. Within 15 km of the coast, ground water in this formation is confined by the Demerara Clay, a marine clay. From 15 to 35 km inland to the outcrop of the White Sands Formation, the older Coropina Formation, also a marine clay, acts as the confining

unit. These confining clays have an average thickness of 45 m. Thickness of the Upper Sands unit ranges from about 15 m in the Georgetown area to 90 m near the Corentyne River in the east, this unit crops out and is recharged through the White Sands Formation, 35 km south of Georgetown.

c) AIR

The Particulate Matter (PM) measurements were taken using the Temtop Airing-1000 Air Quality Monitor Real Time Display High Accuracy PM2.5/PM10 Detector. PM2.5 and PM10 measurements recorded in micrograms per cubic meter (µg/m3), were taken at various sample locations after a log interval of 5 minutes. After the log time, the PM2.5 and PM10 concentration in micrograms per cubic meter (µg/m3) were recorded from each sample site. The Total Suspended Particulate (TSP) measurements were taken using the Thermo pDR-1000AN personal DataRAMTM Particulate Monitor. TSP measurements recorded in milligram per cubic meter (mg/m3), were taken at various sample sites after a log interval of 5 minutes (Thermo-Electron-Corporation, 2005). After the 5-minute interval log time, the real time Concentration value, the Maximum Concentration value and the Time Weighted Average (TWA) concentration in milligrams per cubic meter (mg/m3) were recorded from each sample site. The wind direction and temperature at time of monitoring at each site was recorded. Conversions from milligrams per cubic meter (mg/m3) to micrograms per cubic meter (µg/m3) were done by taking the milligrams per cubic meter (mg/m3) measurements x 1000 (Hedges 2004, p.23). Micrograms per cubic meter (µg/m3) results were then compared to the United States Environmental Protection Agency (USEPA) 1971- 2012 National Ambient Air Quality Standards (NAAQS) for Particulate Matter, as a current PM2.5, PM10 and TSP limit permissible utilised. Quality assurance and quality control (QA/QC) was practiced, as well as routine parts of the air quality monitoring during the calibration, operation and maintenance of the monitoring equipment.

PM10 concentration of the monitored area ranged from 9.6 – 111.1 µg/m3 (Figure 13), during the monitoring period. The highest PM10 measurements were recorded at air quality sample 1 AQ1 (111.1 µg/m3), which is below the PM10 USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS) 150 µg/m3 24-hours average along with the other eleven (11) values.

- TSP of the monitored area from time weighted average (TWA) ranged from 0.00 – 0.028 mg/m3 (Figure11), respectively, during the monitoring period. The TSP readings

varied among the twelve (12) sample sites, with the highest TSP concentration recorded at AQ1 (0.028 mg/m3 = 28 µg/m3). In comparison with the TSP USEPA 1971 - 2012 National Ambient Air Quality Standard (NAAQS) 150 µg/m3 24-hours average, all the said values were recorded below the TSP Air Quality Standard.

- Maximum concentration ranged from 0.00 – 0.01 mg/m3. The highest Maximum Concentration was recorded at AQ3 (0.089 mg/m3 = 89 µg/m3). In comparison with the USEPA 1971 – 2012 NAAQS 150 µg/m3 24-hours average, measurements showed that AQ3 was below the USEPA 1971 - 2012 NAAQS - TSP AQS during the time of monitoring while the other eleven sample points were all below the limit.
- The highest average concentration value was also recorded at AQ4 (0.045 mg/m3 = 45 µg/m3), which was followed closely by AQ1 (0.036 mg/m3) and AQ3 (0.028 mg/m3). These values were below the USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS) 150 µg/m3 24-hours average along with the other eleven (11) values.

All the TSP, Average and Maximum concentration readings were below the USEPA 1971 – 2012 TSP National Ambient Air Quality Standards (NAAQS) 150 µg/m3 24-hours.

d) NOISE

The existing sound environs throughout the proposed Prospect Project location was characterized as nothing less than pleasant, mimicking that of a suburban natural environment with the chirping of birds and the rustling of the wind between the fields of cane, with faint vehicular noises on occasions. Noise measurements were taken at various strategic locations within and around the proposed location of the solar PV farm operation. Levels of noise were recorded proposed project location using a sound level meter (ExTech 407730). The Guyana National Bureau of Standards (GNBS) established that the noise decibel levels are not to surpass the established permissible noise level/limits proposed by the given Guideline for noise in specific environment which has been adopted by the Environmental Protection agency (EPA).

The proposed solar PV Farm at Prospect had noise levels ranging from 41.1 dB to 58.8 dB. The sample areas never exceeded 60 decibels (dB) throughout the data collection process. During the time of monitoring, the highest noise level recorded was observed to be 58.8 dB (Figure 10). This was recorded near the public road where vehicles frequently traverse the area. Importantly, all levels recorded was negligible because it falls below the 75 dB Residential

Daytime limits (06:00 h – 18:00 h) of the Guyana National Bureau of standards (GNBS) Guidelines for Measurements and Assessment of Noise in the Environment.

e) BIOLOGICAL RESOURCES

Prospect PV Project site is located in the community of Prospect, which lies within East Berbice and in close proximity to the Canje River. The site which has been identified for the project can be considered as disturbed since much of its primary vegetation and natural habitats have been lost over many years of infrastructure development and expansion of commercial and industrial activities.

The project of Prospect will be executed close to the coastal plain of Guyana which may be designated as both a natural region as well as a physiographic region with a depth ranging from 8 to 65 km. Biographically, Guyana is divided into three major provinces:

a) The coastal biogeographical province
b) The savannah biogeographical province
c) The forest biogeographical province.

Prospect lie within the coastal biogeographical province of Guyana. NAREI has designated the area as a 'coastal biogeographical province' characterized by the following biotic communities:

a. The Marine ecosystem: includes mudflats, mangrove forests and shell beaches. The mangroves protect the shoreline against erosion.
b. The Estuarine ecosystem: is characterized by wetlands which occurs at the mouths of the rivers.
c. The Riverine ecosystem: is characterized by tidal wetlands which occur along riverbanks.
d. The Palustrine ecosystem: comprises of marshes and swamps in river flood plains, as well as water savannahs.
e. The Lacustrine ecosystem: consists of natural lakes and the water conservancies. Some flora includes water lilies, razor grass and ite palm and ferns.

The most fertile soils are found on the coastal plain especially between and along the Essequibo to Corentyne River courses (Guyana's Green State Development Strategy: Vision 2040). These soils are generally a mix of fluvial deposits, with higher fertility being nearer to the coast. The main limitations are drainage, high salinity and toxicity.

f) FLORA AND FAUNA

Flora and Fauna diversity within the PV sites is almost non-existent compared to intact, forested areas of other areas beyond because of its level of disturbance and anthropogenic activities. In such areas, the most common species are those considered generalists and those that are not disturbance sensitive. Expanding infrastructure for housing and commercial activities within the area influences flora and fauna diversity within the PV location. The scale and extent of disturbance influences composition and abundance.

Forest in the coastal plain

The forest types in the coastal plain are determined to a large extent by the proximity to the coast or riverbanks. Closer to the sea the sediments are more clayey and flooding duration often increases. Obviously, also salinity, which increases towards the sea, affects the zonation of vegetation types in the coastal area. Below we discuss this zonation from the coastal shore inwards. There are no typical coastal genera among large trees. Genera that have dominant species in this area such as *Virola, Iryanthera*, *Tabebuia, Pterocarpus* and *Macrolobium* also have (often vicariant) species common in the forest on the basement complex, except for the monotypic *Symphonia.*

Natural Forest

Most of the natural forests, except Mangroves, have been removed to make way for the extensive cultivations of rice and sugar cane, fruits and vegetables, ancillary roads and canals, pasture, and housing schemes for coastal residents in the Prospect Project PV Site.

Mangroves occupy the extreme northern edge of the coastal plain, and there is current programmes targeting the conservation and cultivation of the various species of mangroves. There are an array of secondary vegetation including weeds (grasses), shrubs such as Carrion Crow bush (*Senna reticulata*) and black and sweet sage (*Cordia sp*) and these are routinely removed as part of routine cultural treatments for cultivated crops or as hygienic enhancement of residential areas.

Plants deemed ‘weeds’ that are typical of canals and conservancies areas include *Cabomba acquatica, Eleocharis cellulose,* and *Nymphaea odorata*; however, ‘weeds’ such as *Utricularia inflata, Utricularia purpurea* and *Mayaca sp*. are considered environmentally friendly weeds. Weeds in canals restrict water flow as well as use of the canal by barges and other riverine craft

used to transport personnel engaged in the cultural treatment (fertilizer applications, pest control and monitoring) of agricultural crops.

The Prospect PV site flora composition is compound of Veiter grass and the most predominant is Rhodes grass since the site were utilized by agricultural activities. They are remains of sugar cane plantation, type of sugar cane as a part of the current flora from agriculture activities are the type D clones from the Breeding and Selection Unit of the Agricultural Research Department at La Bonne Intention. The DB-clones are produced by the West Indies Central Sugar Cane Breeding Station in Barbados. Since Prospect comprises fragmented parcels of non-productive vegetation, including remnants of cane cultivation. There is a diversity of secondary species including shrubs such as Carrion Crow bush (*Cassia alata*) and black and sweet sage (*Cordia spp*). 'Weeds' that are typical of canals and conservancies areas include *Cabomba acquatica*, *Eleocharis elongate, Eleocharis cellulosa*, and *Nymphaea odorata;* however, 'weeds' such as *Utricularia inflata, Utricularia purpurea* and *Mayaca spp.* are considered environmentally friendly weeds.

Fauna of the project areas

The cultivation of sugar cane on the coastland since the 1630, subsequently followed by rice (*Oryza sativa*) cultivation in 1738, led to massive deforestation of the original vegetation of the coastal plain, the construction of an extensive network of dykes and canals. However, in addition to rice and sugar, the widespread cultivation of fruit trees including mango (*Mangifera indica*), genip (*Melicoccus bijugatus*) Malacca cashew (*Eugenia malaccensis*), guava (*Psidium guajava*), jamun (*Syzygium cumini*), papaya (*Carica papaya*), Wiri-wiri pepper (*Capsicum frutescens*), and bird pepper (*Capsicum annuum 'pequim'*) enhanced the food sources and habitats for local fauna. Similarly, the cultivation of palms grown for food or aesthetic purposes enhanced the variety of local habitats for fauna.

Animals such as fishes, birds, snails and shrimp are the most abundant species. The birds that can be found in the project sites of Prospect are hoatzins, egrets, gulls, herons, ibises, hawks, tanagers, flycatchers, finches, blackbird and orioles.

Most of the non-domestic fauna in the project area forage on agricultural crops, however apart from aggressive tactics employed to combat snakes and rodents, there is very little effort made to combat other fauna save for passive alteration of habits caused by routine crop management practices. The application of pesticides is widespread across the coastal belt generally, but these targets a variety of Arthropods.

Apart from an array of birds, by far the dominant being flycatchers and twelve species of waterfowls Reptiles abundant on the coast land (based on personal observation) include the Tegu or Salipenter (*Salvator meriane*), the Iguana (*Iguana iguana*), the spectacled Caiman (*Caiman crocodilus*) and Labaria (*Bothrops atrox*). For non-domesticated mammals, bats (*Chiroptera*), Mongoose (*Herpestes spp*.), and yawarri (*Didelphis opossum*) are abundant. Fishes in the project area include patwa (*Cichlasoma spp*) and hassar (*Hoplosternum littorale*). The non-domestic fauna on the coastland has never been managed or specifically protected. Further, neither agricultural practices nor competition with domestic fauna appear to alter their diversity and abundance to any extent. It is our opinion that the current project will not significantly alter their ecological status. Some of the land uses that were observed in the area are residential housing, homesteads with agricultural activity, other commercial activities such as sawmilling, welding, etc., this activities may affect the fauna distribution with in the project sites. Fauna typical of the project area include:

a) Mammals: e.g., Bats (Chiroptera), and Yawarri (Didelphis opossum)
b) Amphibians: e.g. (Atelopus spp, Bufo spp, Hyla spp)
c) Arthropods: e.g., Crabs: e.g. (Cardiosoma guanhami) and gastropods: e.g. snails (Gastropoda spp.)

g) SOCIO – ECONOMIC

A social environmental Survey targeting 50 households was designed to obtain information on socio-economic factors and characterization. Information such as: health and education, cost of living, health and sanitation infrastructure (water, sewage, and solid waste), energy, cultural sites, community well-being and gender and social issues were obtained. The data obtained from the survey sites mentioned above are summarized and presented below.

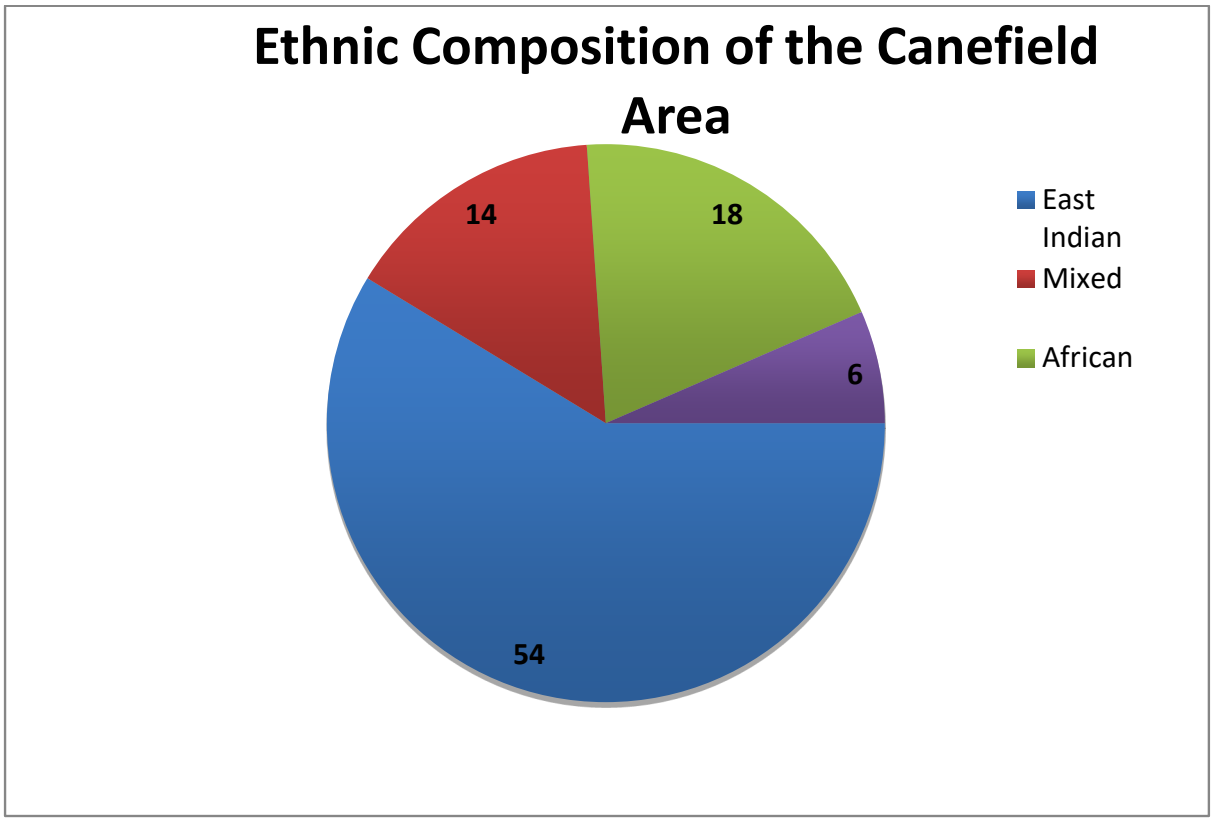
Level of Urbanization

Prospect (Canefield community) is in the region of East Berbice-Corentyne and is located 97 km South-East of Georgetown, Guyana.

Demographics and Household Composition

In the Prospect community out of the 50 households that were surveyed, 54% were East Indians, 18% were Africans which account for more nearly three-quarters of the respondents

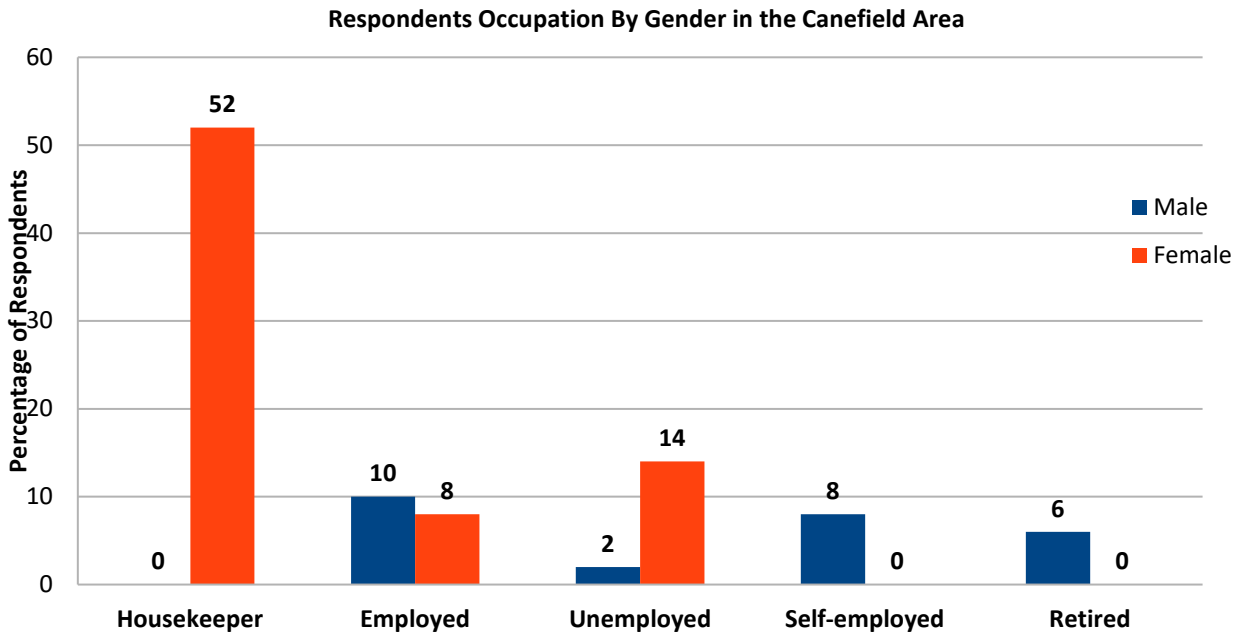
(9). Fourteen percent of the surveyed households comprised of persons with mixed ethnic groupings while 8% and 6% comprised of Portuguese and Amerindians respectively.



Ethnic Composition of the Surveyed Households in Prospect-Prospect

In regards to household composition, households with three and four persons both comprised of 34% each, 20% comprised of five persons, 6% comprised of two persons and also 6% comprised of six or more persons. Twenty-six percent of the respondents were males and 74% were females as such gender is a significant factor of the data collected. Eighteen percent of the respondents were employed (government or private entities) and an additional 8% were self-employed. Six percent were retired while 52% were housekeepers, all of which were females. Eighteen percent of the respondents who were employed (including self-employed) were males as compared to 8% who were females.

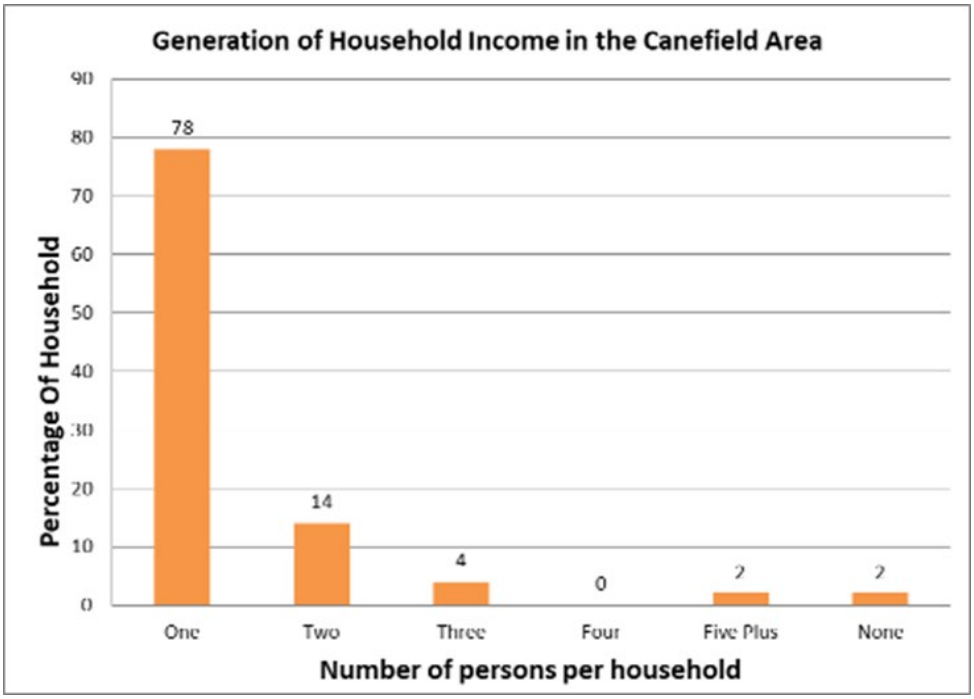
Comparison of Respondents' Occupation by Gender in Prospect Area



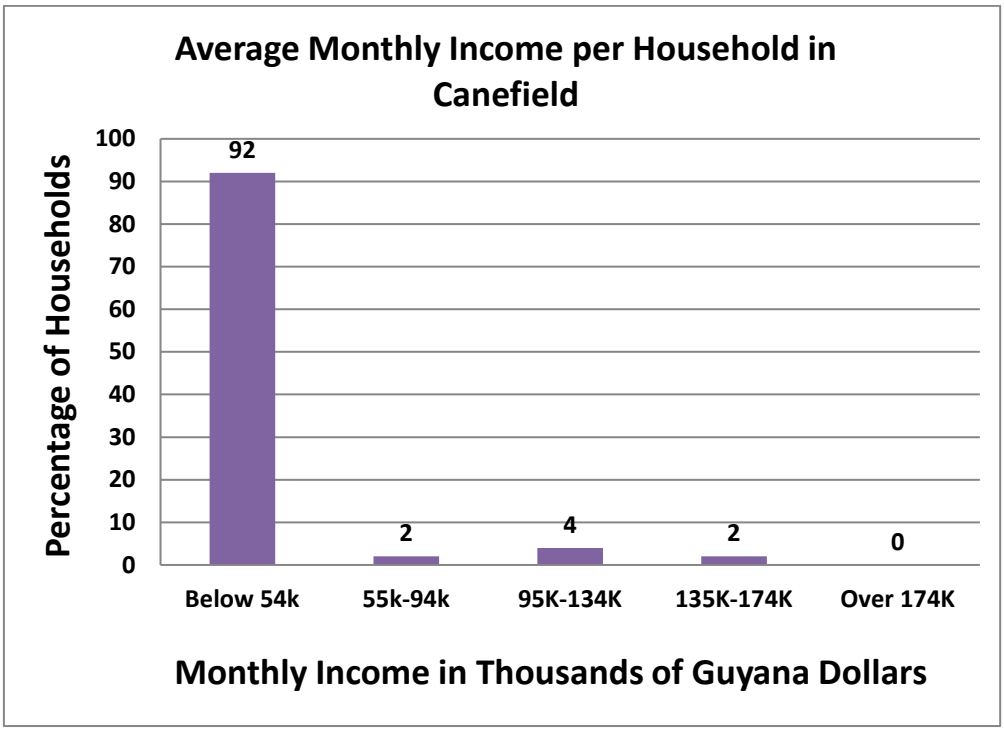
Cost of Living

The overall living standards of the residents of the Prospect-Prospect area were determined in this survey. Of the 50 surveyed households in the Prospect-Prospect area, it was reported that 78% only had one person who was employed. Fourteen percent had two persons employed, while a further 4% had three persons employed. A mere 2% of the surveyed households had five or more persons in employment while an addition 2% of the respondents indicated that no income was generated.

The average received income of each household ranged from $0 – $174,000 in relation to the income generated per household. A mere two percent received an income between $135,000 and $174,000. Presently, the national minimum wages in Guyana are $70,000 while private minimum wages are $44,200 (Guyana-Chronicle 2018 & 2019) and the income tax threshold is currently $65,000 per month. Based on the survey, 92% of the households were working below a monthly income of $54,000 (Figure 28) thus the respondents would be considered as low income earners.



Number of Persons Generating Household Income in the Prospect Area

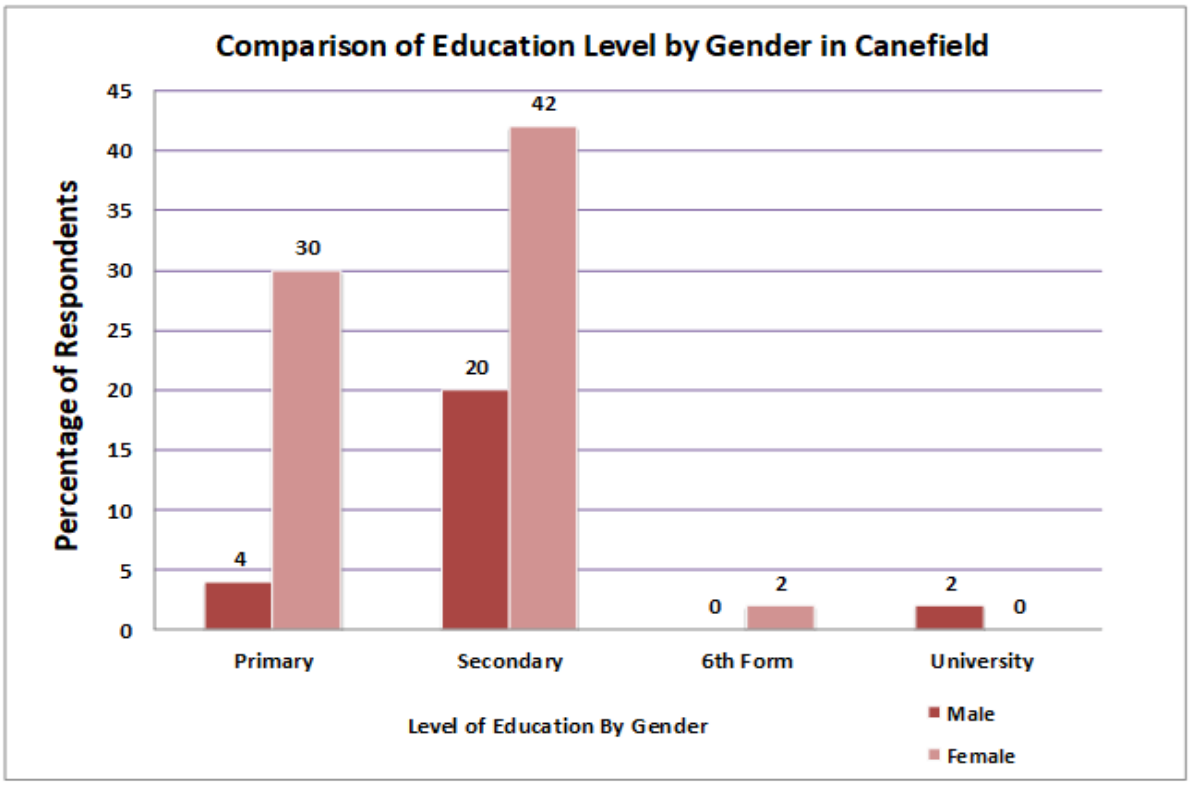


Average Monthly Income by Household in the Prospect Area

Health and Education

The Interamerican Development Bank (IDB) considers health as an important component of long-term socioeconomic development. It is clearly recognized that the improvement of health as a social development activity has a humane value in itself independent of other economic considerations. At the same time, there is definitely a relationship between improved health and economic productivity. Health contributes to the formation and preservation of human capital. Only 6% of the households surveyed in the Prospect-Prospect area indicated that they had health concerns within their respective families. Some of these health concerns were noted to be injuries, respiratory illnesses and blood immune disorders. Education is considered to be the foundation for all aspect of life and provide lifelong learning. Obtaining a quality education is considered to be the foundation to improve people's lives and sustainable development. For similar reasons education has been identified as the fourth sustainable development goal of the United Nations.

In today's society the advancement of women education is considered to play a vital role in societal development. It was reported that out of the 50 households, 30% of female completed Primary as against 4% of males. For the Secondary and 6th form level more females (24%) completed this level while more males (2%) completed University.

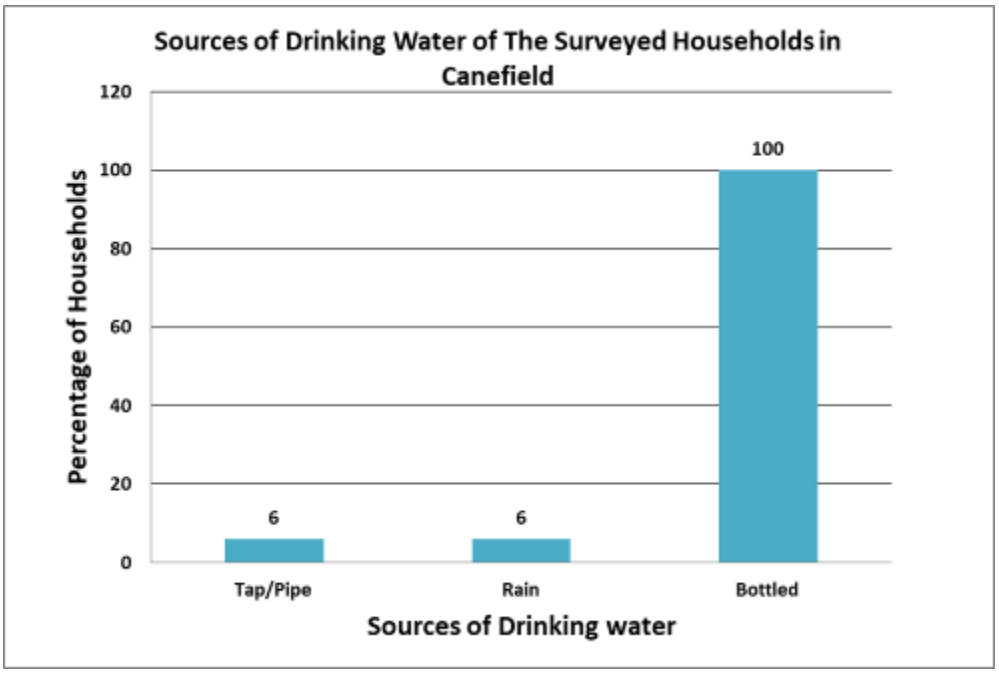


Comparison of Level of Education by Gender in Surveyed Households in the Prospect-Prospect Area

Health and Sanitation Infrastructure

Water is a necessity for all life form and access to safe water and sanitation is essential to not only human health but also to environmental sustainability and economic development. This is in relation to Goal 6 of the United Nations sustainable development which promotes ensuring the availability and sustainable management of water and sanitation.

Guyana Water Incorporated (GWI) are currently providing all the surveyed households in the Prospect area with water. Eighty-eight percent of the respondents indicated that the water provision services to be good or fair, while 12% percent graded the service to be poor.

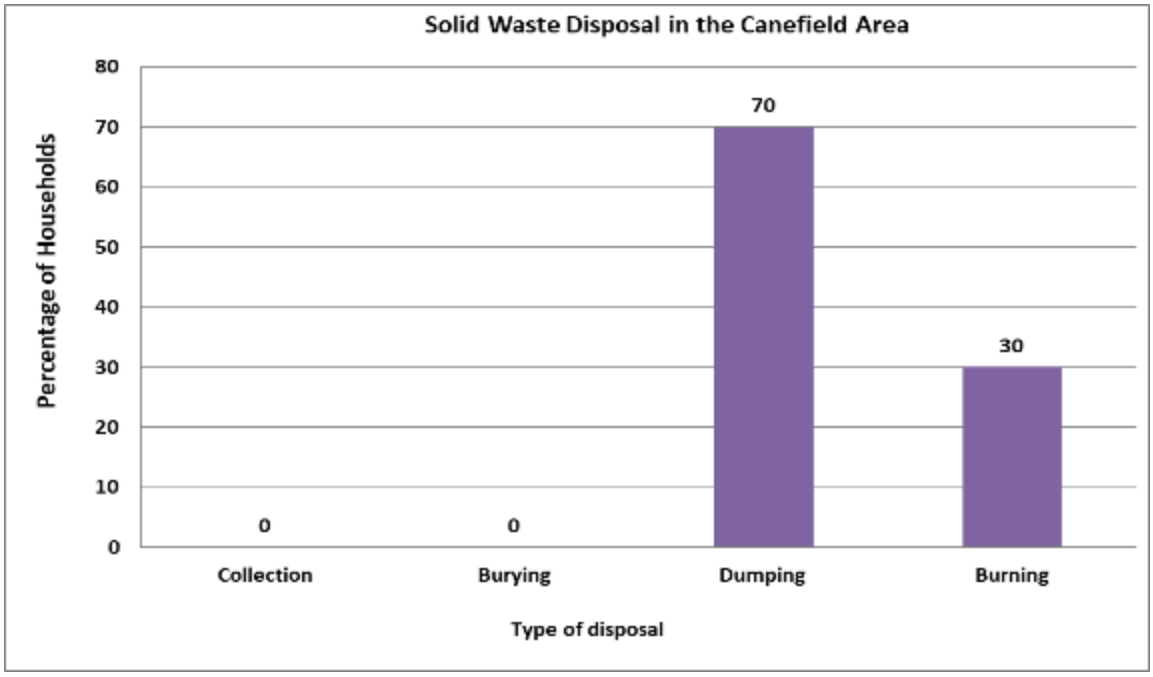


Sources of Drinking Water in Surveyed Households in the Prospect Area

Every surveyed household consumed bottled water (100%). In addition to bottled water being consumed, some respondents consumed rain water (6%) and also tap/ pipe water (6%) provided by the GWI.

Solid Waste Disposal

In terms of sanitation, the entire surveyed household had septic tank systems for their sewage disposal. The majority of households within the Prospect project area (70%) engage in dumping while 30% engage in burning of their solid wastes.



Solid Waste Disposal in Surveyed Households in the Prospect Area

Prospect's major public health concerns identified by the respondents during the survey included the prevalence of mosquitoes (96%) and dumping of solid wastes (4%).

The cleaning of government reserves in front of private property is tasked as the responsibility of the Mayor and City Council. In the area of interest, 52% of the respondents were aware that cleaning works were administered at the front portion of their property while 34% indicated that no works were completed. The remaining 14% of respondents were unaware of any cleaning being done.

Energy

Goal 7 of the sustainable development goals speaks to the supply of clean and affordable energy. Energy is considered to be crucial for achieving almost all of the Sustainable Development Goals. This includes its role in the eradication of poverty through improvements in health, education, water supply and industrialization, and in climate change adaptation. Within the Prospect-Prospect area, majority (98%) of the surveyed households had access to power provided by GPL and utilized the service for lighting purposes. While 2% of the households utilized kerosene lamps/candles, of all the households surveyed, 98% considered the quality of the service to be either excellent or good, while 2% considered it to be fair.

For cooking purposes however, the household use of liquefied petroleum gas (LPG) has been identified as one of several pathways to meet the goal of universal access to clean cooking and

heating. In the Prospect-Prospect area, it was found that 98% of the respondents mostly utilized LPG for cooking, while 8% and 2% also utilized kerosene and wood, respectively.

In terms of perception of renewable energy, 86% of the respondents within the Prospect-Prospect project area indicated that they are aware of the term while 14% have never heard of renewable energy. Of the respondents that heard of renewable energy, 2% reported having knowledge or some knowledge of it, while 98% did not have any knowledge of renewable energy. Two percent of the respondents believed that renewable energy uses petroleum to generate power, while 96% were unsure of petroleum use in power generation. Further, 92% of the respondents were unsure of renewable energy being harmful to the environment as compared to 8% who believed that it did not have any adverse environmental effects. Fourteen percent of the respondents indicated that solar energy was a form of renewable energy while 86% were unsure. As it relates to the need for renewable energy in Guyana, 4% of the respondents strongly agreed with this statement, while a further 4% indicated their agreement. Ninety- two percent were unsure that renewable energy was not necessary for Guyana. Eight percent of the respondents were in favour of focusing on renewable energy sources while 92% were unsure of whether Guyana should pursue the development of renewable energy.

As it relates to investment in renewable energy, 6% of the respondents believed that it will bring benefits to consumers, while 94% were unsure that consumers would benefit from this investment. Ninety-four percent of the respondents were willing to support renewable energy development in Guyana, while 6% were unsure of supporting renewable energy development. In terms of increasing knowledge on renewable energy, 98% of the respondents were willing to learn more about the subject, while 2% of the respondents were unsure whether or not they are interested in learning more about renewable energy.

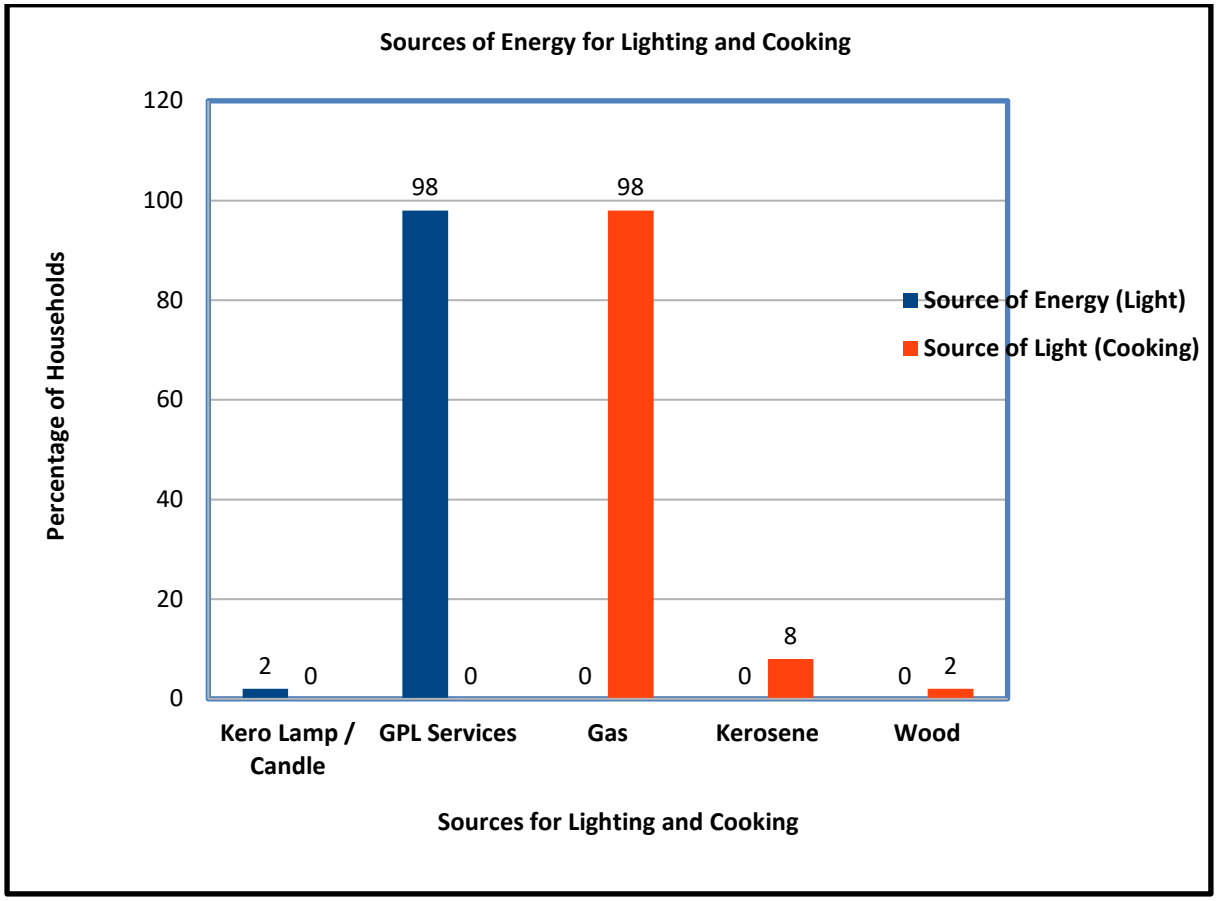
Community Well-being

In the community it was identified by all of the respondents (100%) that lack of employment was a major social issue while domestic violence were perceived as a minor issue (4%). There were no indications by the respondents of any issues with discrimination, crime, poverty, gender equality or sexual abuse.

Children are the future of any community, as such issues that affect them will in turn affect the community's development. Neglect is the most popular form of child abuse and would cause other issues to form if not treated with great concern. These other issues include physical,

emotional and physiological problems. The residents of Prospect stated there were no incidents of neglect or abuse but some cases of physical abuse (2%) occurring in the area.

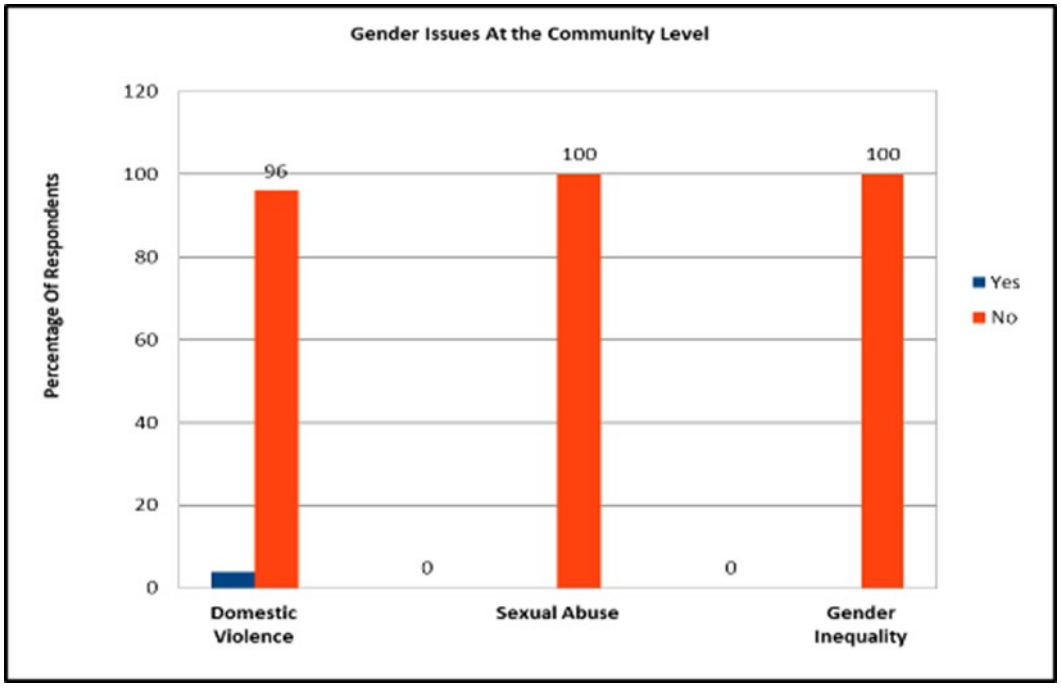
With respect to the level of social cohesion, 92% of the respondents indicated that the Prospect area had an average cohesion, while 4% indicated good cohesion. Another 2% indicated that social cohesion was poor while another 2% stated that they don't know. Twenty percent (20%) stated that there were no opportunities for local employment while a further 14% were unsure or unaware of any employment opportunities. For the respondents (66%) that thought that there were job opportunities, these were identified as mechanics and shop keepers.



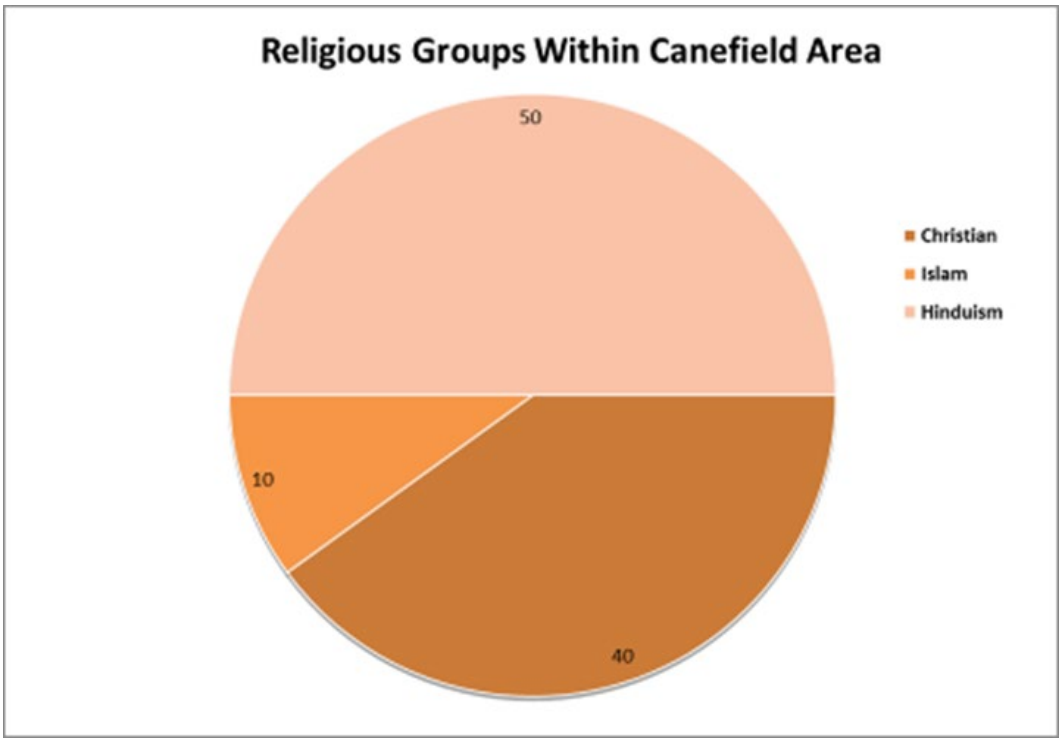
Sources of Energy for Lighting and Cooking within the Prospect Area

Cultural Sites

For cultural features Prospect's respondents, their religious beliefs were either of the three main religious groups (Hinduism, Christianity and Islam). As such several of these places of worship (Churches, mosques and temples) were found in the area. Half of the respondents (50%) religious beliefs accounted for Hinduism.



Gender Issues – Domestic Violence, Sexual Abuse and Equality - at the Prospect Community Level



Religious Groups within the Prospect Area

Physical Assets and Social Services

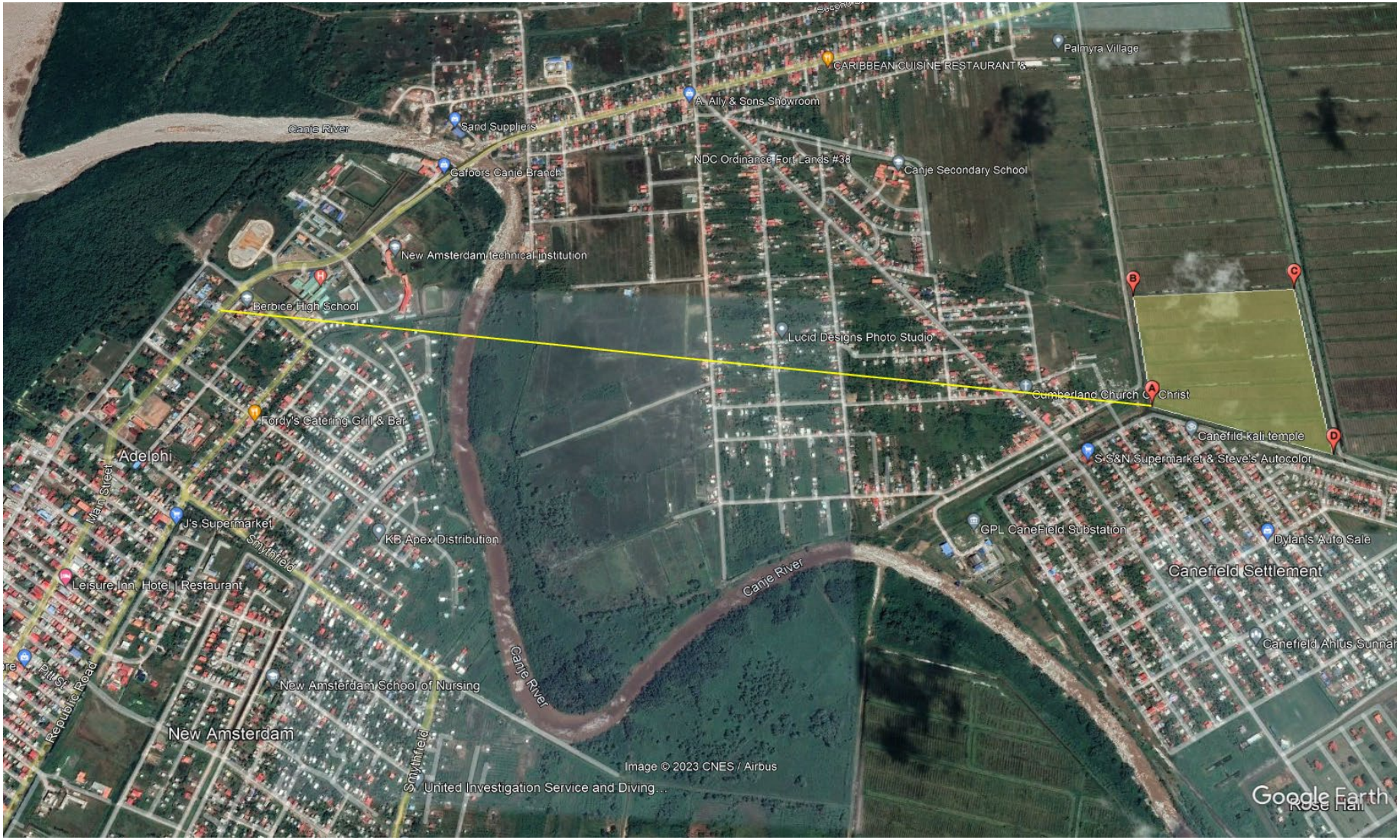
The Prospect area currently have no government or private schools; no government and private health clinics/outposts/hospitals; no private financial institutions; markets; privately-owned shops and stores; places of worship; public spaces; no police station/outpost; no fire service

station; no government post office in the Prospect area. Moreover, Prospect have paved roads and fair telephone services provided. As such the well- being of the community is greatly affected due to the limited number of physical and economical assets, and social services.

(iv) Layout of the project, presented on a map with a scale relevant to the size of the development with the following details:

a) an accurate indication of the proposed site position, as well as, the positions of alternative site/s, if any;

b. The closest town is New Amsterdam, which is approximately 1.76 miles from the project site.



b) names of major and minor access road/s to the site;

KEY

Canje Road
Cumberland School Street
Steve Street

c) identification of receiving waterbodies;

3. A description of the design of the proposed which shall include:

(i) Design\construction drawings, specification of any structures, volume of expected pollutants, etc.

The construction drawings are currently being developed and as soon as they are accepted and approved, they will be submitted to the agency.

(ii) The project size, e.g. capital investment, number of employees projected for each stage of the project, rates of production, transportation route etc;

The Capital investment for the entire GUYSOL project is 83.3 million united states dollars. The number of employees is yet to be determined. It is estimated that this project site will have an output of 3MWp.

(iii) Activities associated with all development stages from construction to closure:

a) operation and production processes and alternative design/s considered;

To be determined.

b) a guide for all stages of the project from raw material to the finished product; and

To be determined.

c) technical description of the proposed project's process/activity accompanied by a Process Flow Diagram/s;

To be determined.

(iv) Use of Natural Resources: approximate quantities of raw materials required at each stage of the project and their possible sources;

To be determined.

(v) Source of utility services such as water supply and treatment options, energy/electricity and communication facilities;

Water will be suppled from GWI, while transmission lines will be established from the nearest transmission lines to the site to facilitate the flow of the power produced from the solar farm back in to the grid.

(vi) Waste production: types of waste, the monthly quantity/volume of waste managed (generated, stored, transported), the volume of effluent to be discharged along with a chemical analysis indicating the effluent's composition and methods of waste disposal/treatment. Potential locations for recovery/disposal sites shall be identified with justifications for the site selection;

The waste produce will only be domestic waste. Which will be disposed of by a hired service provider.

(vii) The duration of the project for each phase; and

To be determined

(viii) Decommissioning plan (where applicable).

To be determined

4. Potential Impacts and their Significance

An assessment of the potential impacts of the proposed development and its significance in relation to:

(i) the extent of the impact or the area of influence: the geographical area that may be affected by the proposed activity and the manner in which the various aspects of the environment: physical (landscape, soil, water, air, the use of natural resources), ecological (flora and fauna), and social (economic and cultural aspects) may be impacted

	Construction Phase	**Operation**	**Decommissioning**
	Air Quality		
Prospect	Dust generation: expected to be brief, frequent, and localized due to preparation of the site and use of heavy machinery (clearing, levelling, excavation, grading). Dust generation from road proximity to the site may generated dust from heavy duty traffic based, on physical inspection, the road that lead to the sites and where households are located are completed paved in all three sites.	<u>Reduction of carbon emission</u> (+): There is an expected long-term reduction of greenhouse gases emissions compared to the baseline. Based on the current annual energy production in Prospect (35,818,000 kWh in 2019), it is expected that the operation of the PV system will bring a reduction on CO_2 emissions of 8954500 tons of CO_2 every year ([1]). The generation of energy through the PV system will approach a	Dust generation: expected to be brief, frequent, and localized due to preparation of the site and use of heavy machinery (clearing, levelling, excavation, grading). Effects can be minimized with adequate mitigation measures. The impact is considered minor. Nitrogen and Carbon oxides emission: expected to be brief and localized due to the operation of heavy machinery, transportation trucks, generators, compressors

	Effects can be minimized with adequate mitigation measures. The impact is considered minor. Nitrogen and Carbon oxides emission: expected to be brief and localized due to the operation of heavy machinery, transportation trucks, generators, compressors and other construction equipment. The impact is considered minor.	greener power generation, since the energy produced by the PV plant will feed first the local load need at the substation and then any excess will go into the 69kV System The impact is considered major.	and other construction equipment. The impact is considered minor.
	Noise		
Prospect	Elevated noise levels: Due to the nature of the land designated to the PV Plant, the surroundings are cane fields and a public drain for irrigation purposes, concluding that the site have low noise levels as expected.	Low noise levels: localized low levels of noise due to operation of electrical components of the PV plant, maintenance activities, and vehicular traffic. The impact is considered minor.	Elevated noise levels: Brief, frequent and localized elevated noise levels due to dismantling of facilities, increased vehicular traffic, and movement of equipment. The impact is considered minor.
	Soil		

Prospect	Loss of top soil: Long-term and localized loss of top soil during site clearing and preparation activities. Sugarcane cultivation does not require chemical inputs higher than average – in fact, the use of insecticides and fungicides is below the average for comparable cash crops. Nevertheless, traces of agrochemical may be present on top soil, protection equipment will be needed during construction (Markku Lehtonen and François-Régis Goebel, 2019). The impact is considered minor. Soil compaction: Long-term and localized soil compaction which may cause soil erosion and	No impacts expected.	Soil contamination: Brief and localized soil contamination due to oil spills during dismantling activities. Effects can be avoided with adequate mitigation measures. The impact is considered minor.

	surface water runoff and riverbed silting. Effects can be minimized with adequate mitigation measures. The impact is considered minor. Soil contamination: Brief and localized soil contamination due to oil spills or other substances. Effects can be avoided with adequate mitigation measures. The impact is considered minor.		
	Land Use		
Prospect	Land use: The site comprises 15 acres of State-owned land. The current land use of the land can be considered as commercial/industrial. The installation of the PV systems will not significantly impact the	Land use: The site will be used for energy generation for the lifetime of the facility. There is no significant change in the land use of the site. The installation of the PV systems will not significantly impact the economic	Land use: The site will be dismantled, and the facilities removed. The future site use shall be in line with the land use of the area or be restored to its initial stage. The impact is considered minor.

	economic activities of the Prospect Community and the surroundings area. The impact is considered minor. Current land use of the ROW is road reserves commonly used for installation of infrastructure networks such as the one for the proposed project. The new transmission lines for interconnection of PV Farm to the grid and substations will be done within the existing right of way (ROW). Therefore, there is no expected modification of the Land use of the proposed transmission lines. The impact is considered insignificant.	activities of the area. The impact is considered minor.	.
	Landscape and Visual Impact		
Prospect	Visual landscape: The installation of the PV system will alter the	Visual impact: The PV systems will reflect sunlight and may	Visual landscape: The decommissioning of the system

	visual landscape of the project site. The components of the PV system will become a dominant feature of the environment. The effects can be minimized with adequate mitigation measures. The impact is considered moderate.	become a distraction for motorists and aircrafts. The effects can be minimized with adequate mitigation measures. The impact is considered moderate.	will reverse the visual impacts at the proposed site. The impact is considered minor.
	Solid Waste		
Prospect	<u>Solid waste generation Increased</u>: Waste generation will be significant during the construction phase. Important volume of green waste is expected to be generated due to the clearance of the cane fields. Construction waste and domestic waste generation is expected to be temporary and localized but significant in volume. As an indirect impact, it is highly	<u>Solid waste generation Increased:</u> Domestic waste generation may be expected during maintenance activities on site. Although the generation will be long-term and localized, the volume generated can be considered low. The effects can be minimized with adequate mitigation measures. The impact is considered minor.	<u>Solid waste generation Increased:</u> Solid waste generated is expected to increase in the decommissioning stage. Solid waste generated is expected to be localized, temporary and significant volume of domestic, scrap metal, construction waste, and hazardous waste. The effects can be minimized with adequate mitigation

	probable that temporal food supply business will increase nearby the project site. These businesses will also be a source of increased generation of solid waste that will need to be considered in the project. Poor solid waste management on site may lead to improper disposal, burning, and pollution of water resources. The effects can be minimized with adequate mitigation measures. The impact is considered moderate.		measures. The impact is considered moderate.
	Surface Water		
Prospect	Surface water pollution: Construction activities may result in pollution of nearby surface water due to runoff (increased	Surface water pollution: During operation, wastewater will be generated from security/maintenance staff offices	Surface water pollution: Activities may result in pollution of public irrigation canal due to runoff (increased turbidity,

	turbidity, organic load). This is expected to be temporary and controlled with adequate drainage and wastewater management at the site. Potential spills of oil could cause contamination of the nearby surface water through run-off. This aspect is temporary and easily avoidable. Wastewater generation from construction crew living quarters may also cause increased organic load to nearby water bodies if not adequately managed. The impact is considered moderate.	and cleaning of the PV cells. The effect is expected to be long term and can be mitigated with adequate collection and management practices. The removal of soil cover might generate minor impacts due to erosions during operation also. Potential spills of oil could cause contamination of the nearby public irrigation canals. This aspect is very localized, temporary and easily avoidable. The impact is considered minor.	organic load). This is expected to be temporary and controlled with adequate drainage at the site. Potential spills of oil could cause contamination of the nearby public irrigation canals. This aspect is very localized, temporary and easily avoidable. The impact is considered moderate.
	Groundwater		

Prospect	Contamination of groundwater resources: Groundwater resources may be impacted during the construction stage from oil spills and leaks or due to improper storage and handling. Improper solid waste and wastewater management can also impact the groundwater resources. The effects are considered temporary and medium spread. Adequate measures can minimize potential effects. The impact is considered moderate.	Contamination of groundwater resources: Groundwater resources may be impacted by improper solid waste and wastewater management can also impact the groundwater resources. The effects are considered long term, and medium spread. Adequate measures can minimize potential effects. The impact is considered moderate.	Contamination of groundwater resources: Groundwater resources may be impacted during the decommissioning stage from oil spills and leaks or due to improper storage and handling. Improper solid waste and wastewater management can also impact the groundwater resources. The effects are considered long term, and medium spread. Adequate measures can minimize potential effects. The impact is considered moderate.
	Natural Habitat		
Prospect	Loss of natural habitat: The project site is considered highly disturbed with regards its	Visual effects: Solar panels reflection may affect birds as the main wildlife in the surroundings,	Noise levels: Noise generated by decommissioning activities is more likely to impact any

	vegetation, since the land allocated for the PV plant is an agriculture land (cane field beds) unattended. There are also low levels of biodiversity with regards to fauna. There is no indication of presence of threatened or protected flora or fauna species at the proposed site for construction. The impact is localized, long term, with low intensity due to the disturbed conditions of the site. The impact is considered minor. <u>Noise levels</u>: Noise generated by construction workers and machinery is more likely to impact any wildlife in the surrounding area of the site. The effects are limited to the project	and transmission lines may affect bird mortality. The effects will be long term and localized. PV plants can impact bird communities through habitat loss and the risk of avian collision mortality. The extrapolated mortality studies has shown based on a bird density of 38 to 50 species per ha (15 to 20 species per acre) may occur 4.5 bird fatalities per MW per year. For Prospect PV plant with 15 acres area or with 3 MW it's expected to impact 13.5 bird fatalities per 3 MW per year in a modest projection. Future data are needed in order to have a better accuracy in bird density and to understand the risk	wildlife in the surrounding area of the site. The effects are limited to the project site and immediate surroundings. Due to the low fauna biodiversity of the area the impact is considered minor.

	site and immediate surroundings. Due to the low fauna biodiversity of the area the impact is considered minor.	of PV solar energy developments on birds. The impact can be considered moderate.	
	Demography		
Prospect	Demography: During the construction phase an increase of population is expected in the area. While residents are expected to take part in some construction activities, there may also be the need for influx of workers with specific skills. The effects are considered temporary, and localized. In general, this will bring a positive socio-economic impact to the area. However, demographics are not expected to	Demography: Operation of the PV systems doesn't require a large group of staff. Additionally, maintenance and operational activities are expected to be carried out by GPL staff already living in the area. The effects will be long term, localized but insignificant with regards population increase due to system operation. The impact is considered minor. Socio-economic activities:	Demography: Decommissioning activities will need to ensure the quality of the GPL service is not affected negatively. In such case, the removal of the system is more likely to have an impact in the socio-economic activities of the area and its demography. For the purpose of this assessment, it is assumed that GPL service after decommissioning will be maintained, therefore, decommissioning of the system is

	be significantly impacted during this stage. The impact can be considered as minor.	An expected indirect impact of the operation of the PV systems is the increase of population in the area. The increase of energy production with the current reliable service from GPL, will naturally promote an expansion of socio-economic activities in the area thus impacting also the demography. This effect is considered high spread, long term and significant for the community. The impact is considered major.	not considered to have a significant impact.
	Employment		
Prospect	Employment: During the construction phase employment opportunities will be generated for local skilled and unskilled labour. There will also be a demand for local goods and	Employment: The operation of the PV systems will be managed by GPL staff. Therefore, a direct impact on employment generation is not expected during this phase.	Employment: Similarly, than the construction phase, there may be employment opportunities during the dismantling of the plant. However, this is expected to be in

	services which will have an impact on the earning capacity of local businesses. These impacts while positive are expected to be only temporary and localized. The impact is considered minor.	 Socio-economic activities: An expected indirect impact of the operation of the PV systems is the increase of employment in the area. The expected improvement on the reliability of the GPL service, will naturally promote an expansion of socio-economic activities in the area thus impacting employment opportunities. This effect is considered high spread, long term and significant for the community. The impact is considered major.	a much lesser extent than in the construction phase. The impact is considered minor.
	Displacement		
Prospect	Displacement: The proposed site is State-owned land. There are no human settlements or economic activities currently at the	No impacts expected on the operation phase.	No impacts expected in decommissioning phase.

	proposed site. Therefore, the project will not cause any type of displacement. The process for the GPL to obtain the Land Title has begun through a request to the NICIL. There are no foreseen issues for GPL to obtain the land title.		
	Livelihood		
Prospect	Livelihood: As discussed in the land use table, the designated land use for the site is in line with the proposed project. Therefore, the construction of the PV system is not expected to affect means of livelihood for persons in the area.	Livelihood: The operation of the PV system will increase energy security and access in the area and will support the development of a greener economy. It is highly likely that because of the project economic activities will expand and diversify bringing new employment opportunities and improving also the quality of life in the community. The effects will be spread at the community	Livelihood: For the purpose of this assessment, it is assumed that GPL service after decommissioning will be maintained, therefore, decommissioning of the system is not considered to have a significant impact.

		level and will be long term. There is also an anticipated positive effect on income generation opportunities for women. The impact is considered major.	
	Socio-cultural		
Prospect	Socio-cultural: While there may be a temporary increase of construction workers in the area, the local customs, cultures, and social relations are not expected to be significantly impacted. There are no cultural sites on the project site.	Socio-cultural: The operation of the PV systems is expected to be performed by local GPL staff. There are no expected impacts on local customs, culture, and social relations directly related to the operation of the PV systems.	Socio-cultural: There are no expected impacts on local customs, culture, and social relations directly related to the decommissioning of the PV systems.
	Infrastructure		
Prospect	Infrastructure: There is no expected disruption of energy or other services during construction activities. Unexpected events would have a brief and wide	Infrastructure: During the operation of the PV system, the energy service is expected to be reliable. Modular PV systems are resilient to disruptive events.	Infrastructure: For the purpose of this assessment, it is assumed that GPL service after decommissioning will be maintained, therefore,

	spread effect. However, effects can be minimized with adequate planning. Upgrading of the access road to the proposed site may create traffic disturbances. The use of the current trail should be considered and relevant stakeholders contacted to ensure no significant disruption of activities to users. The impact is considered moderate.	Even if a module is damaged, the system would remain operational. This will benefit the customers and will minimize power outage in the area. Water supply service is expected to be impacted positively, since power disruptions to the distribution system will also be minimized. Effects will be long term and spread at the community level. The impact is considered major.	decommissioning of the system is not considered to have a significant impact.
	Public Health and Safety		
Prospect	Health and Safety: During the construction phase there will be health and safety hazards on site and in areas surrounding the site due to increase vehicular traffic, heavy machinery operation, excavation, and other	Health and Safety: workers will be exposed to occupational hazards. The probability of occurrence can be minimized by strict adherence to occupational safety procedures.	Health and safety: Similarly, than in the construction phase, exposures to hazards are expected from the decommissioning activities. Health and safety procedures shall be observed to minimize the effects.

	construction activities. The effects will be localized and temporary. However, the effects can be minimized by strict adherence of the Contractor to approved safety procedures. Influx of construction workers may lead to increase in the prevalence of sexually transmitted diseases among the local population, as well as sexual violence. Considering that local labor is expected to play a major role, this concern can be regarded as low. However, health and awareness campaigns as well as a code of conduct indicating clear repercussions can minimize any effect.	The impact is considered minor.	The impact is considered moderate.

	The impact is considered moderate.		

(ii) the transfrontier nature of the impacts i.e. does it cross country borders or boundaries;

Response: Not applicable

(iii) the magnitude and complexity of the impacts;

Response: Not applicable

(iv) the probability of the impacts;

Response: Not applicable

(v) the duration, frequency and reversibility of the impacts; and

Response: Not applicable

(vi) Cumulative impacts with other projects: additional surveys and assessment may be required to determine whether existing projects in combination with the proposed project will have a significant cumulative effect on the receiving environment.

Response: Not applicable

5. Description of proposed environmental management and mitigation measures for all environmental, ecological and social impacts.

Prospect Environnemental Management Plan Construction Phase						
	Issue/ Impact	**Mitigation Measures**	**Monitoring Indicators**	**Responsibility for Implementation**	**Responsibility for Monitoring**	**Estimated Cost (US$)**
Air Quality	Dust generation	▪ Covering of stockpiles to minimize dust generation. ▪ Suppress dust from construction, stock piles and increased vehicular traffic by sprinkling water. ▪ Consider wind direction when stockpiling construction materials. Orientation shall avoid downwind residences or sensitive locations. ▪ Implement vehicle speed control though signage and	▪ PM monitoring. ▪ Dust generation observation. ▪ Complaints register.	All contractors on site.	Site Supervisor.	5,000

		speed bumps whenever necessary.				
	NO_x and CO_x emissions	▪ Regular maintenance of vehicles and on-site construction equipment.	▪ Equipment maintenance records according to schedule. ▪ Vehicle fitness certificates.	All contractors on site.	Site Supervisor.	10,000
	Noise	▪ Use of padding/noise isolators for construction equipment and machinery. ▪ Fixed noise sources or activities to be carried out away from site boundaries, particularly boundaries close to sensitive environments. ▪ Adequate maintenance of construction vehicles and machinery.	▪ Monitoring of dB. ▪ Complaints register. ▪ Equipment maintenance records according to schedule. ▪ Workers compliance to H&S procedures.	All contractors on site.	Site Supervisor.	5,000

		▪ Use of ear plugs or ear muffs for specific activities by workers. ▪ Stakeholders' consultation (immediate surroundings of site) to plan activities accordingly.	▪ Consultation records.			
Soil	Top soil loss	▪ Limit the removal of vegetation to the site footprint. ▪ Whenever possible, removed top soil should be conserved and used for remediation of affected areas.	▪ ESMP Compliance records.	All contractors on site.	Site Supervisor.	15,000
	Soil compaction and erosion	▪ Adequate drainage will be developed for the site. ▪ Planting grass or use of rocks under the solar panels is also recommended.	▪ ESMP Compliance records.	All contractors on site.	Site Supervisor.	

	Soil contamination	▪ Adequate disposal of waste materials. ▪ Provision of bounded areas or secondary containment for storage of oil/fuel with 110% capacity of the stored material. ▪ Provision of spill kits at relevant locations. ▪ Construction vehicles and machinery will be serviced regularly and off-site or at impervious surfaces to avoid soil contamination. ▪ Contaminated soil will be treated and/or disposed in adequate manner	▪ Complaints register. ▪ ESMP Compliance records.	All contractors on site.	Site Supervisor.	
Land Use (ROW)		▪ Current land use of the ROW is road reserves commonly	▪ Complaints register.	All contractors on site.	Site Supervisor.	

		used for installation of infrastructure networks such as the one for the proposed project. The new transmission lines for interconnection of PV Farm to the grid and substations will be done within the existing right of way (ROW). Therefore, there is no expected modification of the Land use of the proposed transmission lines. The impact is considered insignificant. New transmission/Interconnection line is about 531 meters in length.	▪ ESMP Compliance records.			
	Landscape and visual impact	▪ It is recommended to landscape the boundaries with adequate trees to provide a visual screen.	▪ ESMP Compliance records.	All contractors on site.	Site Supervisor.	5,000

		▪ Consultation meetings with aeronautical authorities with regards positioning and direction of solar panels to avoid conflicts with flying airplanes.	▪ Consultation meeting records.			
	Solid waste generation	▪ Waste will be disposed in an authorized landfill. ▪ Adequate planning and coordination will be done with the landfill management to manage the increased volume expected to be generated from the site. ▪ The site will be provided with an adequate number of bins for the disposal of domestic waste. ▪ Waste such as spent oil, oily rags, etc. will be stored on site	▪ ESMP Compliance records. ▪ Consultation records with solid waste management authorities. ▪ Complaints records. ▪ Valid contract with solid waste collection contractor.	All contractors on site.	Site Supervisor.	50,000

		and disposed through and approved waste disposal contractor. ▪ Burning of waste on-site will be prohibited. ▪ Adequate arrangements will be done for the frequent collection of domestic, construction and hazardous waste. ▪ The project will facilitate bins outside the site to food supply entrepreneurs and will arrange for the collection of such waste. ▪ Site and immediate surroundings cleanliness will be maintained always.	▪ Existence of at least one container bin outside the project site where food services providers are located (if necessary).			

	Surface water pollution	▪ Adequate drainage will be designed for the site to minimize run-off. ▪ Drainage system will be monitored and frequently maintained. ▪ Adequate temporary sanitary facilities will be provided for workers on-site while permanent facilities are constructed. ▪ Frequent collection of waste generated by sanitary facilities will be done by an EPA approved contractor. ▪ Provision of bounded areas or secondary containment for storage of oil/fuel with 115% capacity of the stored material.	▪ ESMP compliance records. ▪ Existence of temporary sanitary facilities. ▪ Valid contract with waste collection contractor.	All contractors on site.	Site Supervisor.	30,000

	Groundwater pollution	▪ Oil spills, fuel spill and other site contaminants will be rapidly cleaned. ▪ Adequate temporary sanitary facilities will be provided for workers on-site while permanent facilities are constructed. ▪ Frequent collection of waste generated by sanitary facilities will be done by an EPA approved contractor. ▪ Provision of bounded areas or secondary containment for storage of oil/fuel with 115% capacity of the stored material.	▪ ESMP compliance records. ▪ Existence of temporary sanitary facilities. ▪ Valid contract with waste collection contractor.	All contractors on site.	Site Supervisor.	
	Loss of natural habitat	▪ For the Prospect site the loss of natural habitat impact is considered minor and no	▪ dB monitoring.	All contractors on site.	Site Supervisor.	500

		mitigation measures are foreseen. ▪ Noise levels will be monitored and controlled as described above to minimize additional effects to fauna in the surrounding areas.				
	Demography and Employment	▪ Employment of local labourer should be maximized. ▪ Transparent recruitment process will take place.	▪ Employment records. ▪ Number of local labours employed at the site.	All contractors on site.	Site Supervisor.	1,000
	Socio-cultural	▪ Regular community consultation meetings will take place.	▪ Monthly community consultation records.	All contractors on site.	Site Supervisor.	5,000
	Infrastructure	▪ Timely and adequate public announcements with regards any service interruption due to	▪ Service interruption records.	All contractors on site.	Site Supervisor.	5,000

		the project, including road closures if necessary.	▪ Duration of service interruption.			
	Health and Safety	▪ Health and Safety plan will be implemented by contractor on site. ▪ Worker's awareness sessions on health and safety issues will be carried our regularly. ▪ awareness campaigns to the population and training to workers to mitigate community health and safety impacts ▪ All persons on site will use personal protective equipment (PPE).	▪ H&S Plan compliance records. ▪ H&S awareness sessions attendance records. ▪ Site emergency response and Fire Safety plans developed and implemented. ▪ ESMP compliance records.	All contractors on site.	Site Supervisor.	20,000

		▪ Site emergency response plans will be developed. Including Fire Safety Plan. ▪ Adequate fire-fighting equipment will be provided on site. ▪ Adequate signage on site and in surrounding areas should be visible and properly maintained. ▪ Traffic control and speed limits will be observed. ▪ Working hours will be limited to day-light, unless otherwise agreed with relevant stakeholders. ▪ Occupational hazards should be marked on site and staff trained on hazard recognition.	▪ Visible traffic and speed signage.			

		▪ Cleanliness of the site will be maintained at all times.				
	Health: HIV/AIDS	▪ Use code of ethics, conduct, and good practices from GPL standards and guidelines ▪ Especial Training, awareness, and education on the use of infection control measures in the workplace during the period of construction phase; ▪ Equip with appropriate equipment and materials to protect colleagues from the risk of exposure to HIV; ▪ Disseminate information on HIV/AIDS including occupational health and first aid training.	▪ Compliance with the code of ethics ▪ Behaviours which facilitate unintentional injuries and violence, ▪ Tobacco use, ▪ Alcohol and drug use, ▪ Sexual behaviours related to pregnancy and sexually transmitted diseases,	Health and safety officer. Program should be adapted to comply with local laws.	Health and safety officer	3,500

			▪ Unhealthy dietary behaviours, and ▪ Physical inactivity and being overweight.			

Prospect Environmental Management Plan Operation Phase						
	Issue/ Impact	**Mitigation Measures**	**Monitoring Indicators**	**Responsibility for Implementation**	**Responsibility for Monitoring**	**Estimated Cost (US$)**
Air Quality	Noise	▪ Use of padding/noise isolators for equipment. ▪ Adequate maintenance of vehicles and machinery.	▪ Monitoring of dB. ▪ Complaints register. ▪ Equipment maintenance records according to schedule.	GPL on-site staff	GPL Regional Supervisor.	10,000

Soil	Soil contamination	▪ Adequate disposal of waste materials. ▪ Provision of bounded areas for storage of oil/fuel with 115% capacity of the stored material. ▪ Provision of spill kits at relevant locations.	▪ ESMP Compliance records.	GPL on-site staff	GPL Regional Supervisor.	1,000
	Visual Impact	▪ Adequate landscaping of facilities. ▪ Solar panels will be installed at low distance from ground. ▪ Solar panel modules will be installed in visually aesthetical arrays.	▪ ESMP Compliance records. ▪ Complaints records.	GPL on-site staff	GPL Regional Supervisor.	10,000
	Solid waste generation	▪ Waste generated will be disposed in the community Hash Bosh Sanitary Landfill.	▪ ESMP Compliance records.	GPL on-site staff	GPL Regional Supervisor.	10,000

		▪ The site will be provided with an adequate number of bins for the disposal of domestic waste. ▪ Waste such as spent oil, oily rags, etc. will be stored on site and disposed of according to an approved plan and in line with EPA recommendations. ▪ Burning of waste on-site will be prohibited. ▪ Adequate arrangements will be done for the frequent collection of domestic and other waste. ▪ Site and immediate surroundings cleanliness will be maintained at all times.	▪ Compliance with Hazardous waste management plan. ▪ Complaints records. ▪ Valid contract with solid waste collection contractor.			

	Surface water pollution	▪ Adequate maintenance of drainage system. ▪ Adequate operation and management of sanitary facilities /septic tank. ▪ Collection of septage by EPA approved contractor.	▪ ESMP compliance records. ▪ Valid contract with waste collection contractor.	GPL on-site staff	GPL Regional Supervisor.	10,000
	Groundwater pollution	▪ Oil spills, fuel spill and other site contaminants will be rapidly cleaned. ▪ Adequate operation and management of sanitary facilities /septic tank. ▪ Collection of septage by EPA approved contractor.	▪ ESMP compliance records. ▪ Valid contract with waste collection contractor.	GPL on-site staff	GPL Regional Supervisor.	
Natural Habitat		▪ Noise levels will be monitored and controlled as described above to minimize	▪ dB monitoring. ▪ Bird density assessment.	GPL on-site staff	GPL Regional Supervisor.	1,000

		additional effects to fauna in the surrounding areas. ▪ The PV site should be fenced off to keep out some terrestrial wildlife. ▪ Bird kill mitigation strategies can be considered, including proven, environmentally safe technologies such as avian radars and Long-Range Acoustic Devices (LRADs) to keep birds away from the site, covering ponds to discourage water birds from loitering, and clearing additional land around the plant to make it less attractive and more visible to birds in flight. Some of the bird deaths occurred when the plant was in standby-mode, and the				

		mirrors were focused above the tower (Kagan, Rebecca A., 2014). Also, to avoid high mortality rate the Solar Panels angle can be arranged below damaging reflection intensity created by the mirror field. ▪ Installation of bird deterrent devices on the transmission line and monitoring of death birds per month				
	Health and Safety	▪ Health and Safety plan will be implemented by operator on site. ▪ Worker's awareness sessions on health and safety issues will be carried our regularly. ▪ awareness campaigns to the population and training to workers to mitigate	▪ H&S Plan compliance records. ▪ H&S awareness sessions attendance records. ▪ Site emergency response and Fire	GPL on-site staff	GPL Regional Supervisor.	20,000

		community health and safety impacts ▪ All persons on site will use personal protective equipment (PPE). ▪ Site emergency response plans will be developed. Including Fire Safety Plan. ▪ Adequate fire-fighting equipment will be provided on site. ▪ Adequate hazards signage on site should be visible and properly maintained. ▪ Traffic control and speed limits will be observed. ▪ Cleanliness of the site will be maintained at all times.	Safety plans developed and implemented. ▪ ESMP compliance records. ▪ Visible traffic and speed signage.			

Prospect Environmental Management Plan Decommissioning Phase						
	Issue/ Impact	**Mitigation Measures**	**Monitoring Indicators**	**Responsibility for Implementation**	**Responsibility for Monitoring**	**Estimated Cost (US$)**
Air Quality	NO_x and CO_x emissions	▪ Regular maintenance of vehicles and on-site equipment	▪ Equipment maintenance records according to schedule. ▪ Vehicle fitness certificates.	All contractors on site.	Site Supervisor.	10,000
	Noise	▪ Use of padding/noise isolators for equipment and machinery. ▪ Use of ear plugs or ear muffs for specific activities by workers. ▪ Stakeholders' consultation (immediate surroundings of	▪ Monitoring of dB. ▪ Complaints register. ▪ Equipment maintenance records according to schedule.	All contractors on site.	Site Supervisor.	5,000

		site) to plan activities accordingly.	▪ Workers compliance to H&S procedures. ▪ Consultation records.			
Soil	Soil contamination	▪ Adequate disposal of waste materials. ▪ Provision of bounded areas for storage of oil/fuel with 110% capacity of the stored material. ▪ Provision of spill kits at relevant locations. ▪ Vehicles and machinery will be serviced regularly and off-site or at impervious surfaces to avoid soil contamination.	▪ Complaints register. ▪ ESMP Compliance records.	All contractors on site.	Site Supervisor.	1,000

	Solid waste generation	▪ Waste will be disposed in an authorized landfill. ▪ Adequate planning and coordination will be done with the landfill management to manage the increased volume expected to be generated from the site. ▪ The site will be provided with an adequate number of bins for the disposal of domestic waste. ▪ Hazardous waste management plan will be developed by contractor. Hazardous waste such as spent oil, oily rags, etc. will be stored on site and disposed of according to an approved plan	▪ ESMP Compliance records. ▪ Consultation records with solid waste management authorities. ▪ Compliance with Hazardous waste management plan. ▪ Complaints records. ▪ Valid contract with solid waste collection contractor. ▪ Existence of at least one	All contractors on site.	Site Supervisor.	20,000

		and in line with EPA recommendations. ▪ Burning of waste on-site will be prohibited. ▪ Adequate arrangements will be done for the frequent collection of domestic, construction and hazardous waste. ▪ The project will facilitate bins outside the site to food supply entrepreneurs and will arrange for the collection of such waste. ▪ Site and immediate surroundings cleanliness will be maintained at all times.	container bin outside the project site where food services providers are located (if necessary).			
	Surface water pollution	▪ Drainage system will be monitored and frequently maintained.	▪ ESMP compliance records.	All contractors on site.	Site Supervisor.	20,000

		▪ Adequate temporary sanitary facilities will be provided for workers on-site. ▪ Frequent collection of waste generated by sanitary facilities will be done by an EPA approved contractor.	▪ Existence of temporary sanitary facilities. ▪ Valid contract with waste collection contractor.			
	Groundwater pollution	▪ Oil spills, fuel spill and other site contaminants will be rapidly cleaned. ▪ Adequate temporary sanitary facilities will be provided for workers on-site. ▪ Frequent collection of waste generated by sanitary facilities will be done by an EPA approved contractor.	▪ ESMP compliance records. ▪ Existence of temporary sanitary facilities. ▪ Valid contract with waste collection contractor.	All contractors on site.	Site Supervisor.	

	Demography and Employment	▪ Employment of local labourer should be maximized. ▪ Transparent recruitment process will take place.	▪ Employment records. ▪ Number of local labour employed at the site.	All contractors on site.	Site Supervisor.	1,000
	Health and Safety	▪ Health and Safety plan will be implemented by contractor on site. ▪ Workers awareness sessions on health and safety issues will be carried our regularly. ▪ awareness campaigns to the population and training to workers to mitigate community health and safety impacts ▪ awareness campaigns to the population and training to workers to mitigate	▪ H&S Plan compliance records. ▪ H&S awareness sessions attendance records. ▪ Site emergency response and Fire Safety plans developed and implemented.	All contractors on site.	Site Supervisor.	20,000

		community health and safety impacts ▪ All persons on site will use personal protective equipment (PPE). ▪ Site emergency response plans will be developed. Including Fire Safety Plan. ▪ Adequate fire-fighting equipment will be provided on site. ▪ Adequate signage on site and in surrounding areas should be visible and properly maintained. ▪ Traffic control and speed limits will be observed. ▪ Working hours will be limited to day-light, unless otherwise	▪ ESMP compliance records. ▪ Visible traffic and speed signage.			

		agreed with relevant stakeholders. ▪ Occupational hazards should be marked on site and staff trained on hazard recognition. ▪ Cleanliness of the site will be maintained at all times.				

6. A summary of minutes of any public consultations/ meetings held by the Project proponent with key stakeholders expressing their views and opinions.

Meeting Minutes for Prospect Village (October 21st, 2021)

Public Consultation Meeting for Prospect-Prospect, Berbice Utility Scale Solar PV Projects

NDC Community Ground, Prospect, Berbice

Public Consultation Report

Meaningful Consultation Meeting

The consultation meeting related to the above-mentioned project was conducted with the community members, as it was seen that they are the most crucial part of the implementation of the project; whilst taking into consideration the social and environmental impacts of such a project, as well as issues surrounding land ownership. All other relevant stakeholders were invited, and the meeting was held on Saturday October 21st, 2021 in the NDC Community Ground, Prospect, Berbice. The meeting was called to order at 2:30 PM.

MEMBERS PRESENT:

Name	**Position**
Amir Dillawar	Special Projects Coordinator
Thompson	NDC Councillor
Cheetra Singh	GPL Social Management Specialist
David Armogan	Regional Chairman
Sheriann Beharry	NDC Chairperson
Isidro Ubaldo Espinosa	EES Team
Jamal Lewis	EES Team
Residents	Residents (Ten persons including four women)

1. **CALL TO ORDER**

- The meeting was called to order by Mr. Delaware followed by the Introduction of EES Staff
- Introduction of members of the table (GPL Staff, EES Staff, Regional Chairman)
- Introduction of Project: Outline of the presentation; Reason and importance of the meeting.
- Isidro explained the inherent value and importance of Guyana's natural resources before indicating the challenges of energy consumption, such as the economics of fuel importation. He then touched on the cons of high energy consumption being propelled

through the importation of fuel before delving into the economic, environmental, and social benefits of the project. He then assured stakeholders of the project's feasibility and its compliance with EPA's regulations.

2. MATTERS ARISING FROM THE MEETING

Project Funding – Mr. Chairman enquired about project funding and total investment.

Mr. Dillawar then explained the project was funded by RED+; the overall investment being US80 million which covered three areas; Berbice, Essequibo, and Linden. With 20 million being invested in Berbice to cover 10 megawatts that would be installed throughout the Berbice area.

Redistribution of power- Mr. Dillawar explained that three solar farms would be in the Berbice area, two being in the east and one in the west. However, the site at Prospect would be interconnected with the canfield powerplant to allow outward redistribution from the substation.

He further went on to explain that the 10 megawatts for the entire demerara Berbice interconnected system is a relatively small amount but is a significant first step in the integration of renewable energy in that section of the grid.

Site location- Ms. Beharry asked Mr. Delaware to speak on the location.

Mr. Dillawar then indicated the site would be in Plantation Prospect and spoke about the previous usage and ownership of the land. He further elaborated on how GPL plans to orient the solar panels and, reassured stakeholders the land is without dispute, considering GPL has engaged both GUYSUCO and NICIL concerning approval and land ownership.

Benefits- Resident asked about the benefits of

Mr. Dillawar indicated it's a national project which fosters energy supply diversification and builds system resilience in the network. While urging stakeholders to be cognizant while it's a cheaper form of energy it's not a large percentage of the grid, so energies produced would be about 2% of what is utilized in Demerara Berbice.

Blackout- Resident asked where the extra energy goes and would it be isolated.

Mr. Dillawar explained that the facility would produce power once the sun is shining and would have stored energy during a blackout or power outage. However, the extra energy goes directly into the grid and isn't redistributed in an isolated manner.

Lifespan- Resident asked of expected the lifespan

Mr. Dillawar explained that while each solar panel has a lifespan of twenty-five years, the equipment used to convert solar to megawatt has a lifespan of fifteen years however the farm or panel would still be capable of producing at its peak for another 10 years giving eighty 80% of its output.

Road network- Resident asked of road network leading to project site.

Mr. Dillawar indicated that there are established roads through canfield settlements that could be used or there is the option of improving the all-weather road that's in proximity to bridge or create access.

Mr. Dillawar concluded the meeting and open the floor for any other business

3. ANY OTHER BUSINESS

One resident enquired about his fluctuating light bill. Mr. Dillawar then advised him on the way forward and reassured him that he would personally investigate the situation.

4. CLOSING REMARKS

Chairman: Intention of the project is of great importance to Berbice in keeping renewable energy, and part of the government of Guyana deliverables. Thanks to the team that would have chosen Prospect/Canfield to be a recipient of the PV farm to benefit Berbice, and for consulting promptly allowing stakeholders to share meaningful concerns and perspectives.

The meeting concluded at 3:20 pm

7. A description of any assumptions, uncertainties and gaps in knowledge.

NA

8. A non-technical summary of the project (a summary of what the project is about in layman's language that clearly describes your project)

Funds from the Guyana-Norway Partnership will be utilized to execute a National Solar PV Project aligned with its plans to increase renewable energy penetration and grid stability in the power system. The project will be administered through the Inter-American Development Bank (IDB), with GPL as the Executing Agency. The execution of the projects that are a part of this program will support Guyana's transition to renewable energy and the diversification of the energy matrix via the use of cleaner and renewable energy sources in the electricity generation mix. Eight projects are currently proposed under Component 1: three sites (Prospect, Hampshire and Trafalgar) are vacant agricultural fields owned by the Government, to avoid land conflicts; two sites are former mining sites, those are Dacoura and Retrieve) in Linden; two sites are located on vegetated areas (Block 37 and Onderneeming) being the only feasible technical option for the respective areas, and one site in Charity.

The project will consist of 33MWp solar PV in three different grids as follows:

- ✓ 15MWp of Solar PV with a minimum of 22MWh (11MW, 2h) of battery storage for the Linden Isolated System.
- ✓ 8MWp of Solar PV with a minimum of 12MWh (6MW, 2h) of battery storage for the Essequibo Coast Isolated System.
- ✓ 10MWp of Solar PV for the Demerara-Berbice Interconnected System, specifically in Berbice.

Benefits

The development of a National Utility Scale Solar PV Program will generate benefits including:

- **Economic**

a) Diversification of the local economies within each proposed project area and overall, nationally due to a more reliable, stable form of electricity

b) Increase resilience to the volatility of the global fuel market:

- ✓ The diversification of the energy generation matrix of these grids will result in operational and maintenance cost savings for GPL.
- ✓ Significant reduction in Government subsidies which can be used for:
- ✓ System upgrades, including digitisation, improving overall system reliability and the resilience of GPL's and LECI's Transmission and Distribution networks.

Thereby, allowing GPL and LECI to provide increased value to their customers through more reliable and affordable electricity services in Guyana.

- **Social and Gender**

a) Improved efficiency in the health, education, water, and public safety sectors

b) Employment during construction and operation

c) Local training and institutional capacity

- **Environment**

a) Contribution to the mitigation of global climate change by reduced emissions of Greenhouse Gases.

b) The reduction and avoidance of CO2 emissions in electricity generation via the diversification of the energy supply matrix with the introduction of renewable energy-based sources of energy specifically,

- Linden is purposed to conserve 17,259 tCO2 (valued = US$1.04M).
- Essequibo will conserve 9,390 tCO2 (valued = US$1.04M).
- Berbice will save 10,671 tCO2 (valued = US$0.64M).

c) Reduction in the consumption of and dependence on fossil fuel for electricity generation.