GWI'S APPLICATION FOR ENVIRONMENTAL AUTHORIZATION AT PORT

MOURANT WATER TREATMENT PLANT

NAME OF PROJECT: **Improving the carbon footprint of water supply through the use of Renewable Energy Sources**

NAME OF DEVELOPER/COMPANY: **GUYANA WATER INCORPORATED**

CONTACT DETAILS: **DENISE WOOLFORD**

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DATE PREPARED AND BY WHOM. **APRIL 22, 2022 (MS. DENISE WOOLFORD)**

1. Detailed description of the proposed project:

(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 (daycare 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.

The Port Mourant water treatment plant is one of GWI's water sand filtration treatment plants located on the coast of Guyana (please refer to figure 2 for image). Established in the year 2000, it is located in Administrative Region 6 (East Berbice-Corentyne). It lies approximately 2Km from the Atlantic Ocean on an area of about 30,330 m^2. The installed capacity of the water treatment plant is 6.9 MLD initially. The treatment plant incorporates a manganese filter system and uses a chlorine dosing of 0.3 mg/L for disinfection. Its original design boundary spanned 18 villages from Miss Phoebe (eastern boundary) to Nigg (western boundary). The coverage of the distribution area is approximately 3.2km on either side (east and west) from the Port Mourant facility. The plant currently serves all villages initially designed, which has a customer base of over 4,500 households. This is tantamount to approximately 16,000 persons.

The GPS co-ordinates of the location are 6.25958 N, -57.35132 W with elevation of 2m MSL. The aerial/ google imagery of the identified location for Solar PV integration is shown below:

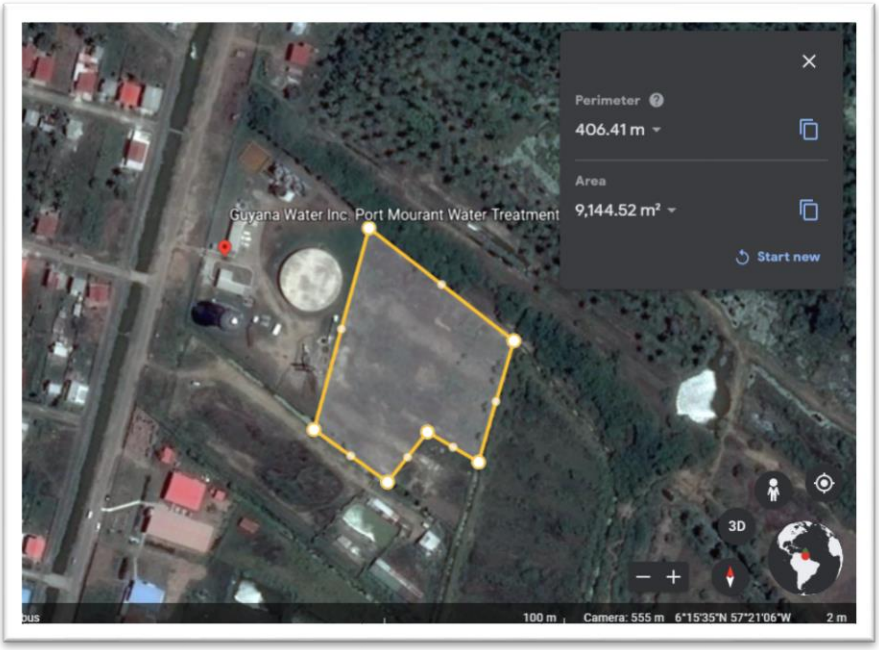


Figure 1 : Image of the Port Mourant Water Treatment Plant

There are no activities to the north and east of the solar farm project area, domestic buildings to the south, and the PMWTP to the east. The area is generally flat and with predominantly clay soil. The proximity of sensitive receptors are as follows:

	<50 meters	*50m-100m*	*101m-500m*	*501m-1000m*	*>1km*
Sensitive ecosystems e.g. Wetlands/Mangroves					√
Protected Areas					√
Major Water Courses				√	
Threatened or endangered flora and fauna					√
Residences		√			
Place of Worship				√	
Schools				√	
Hospitals					√
River / Sea Defence					√

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

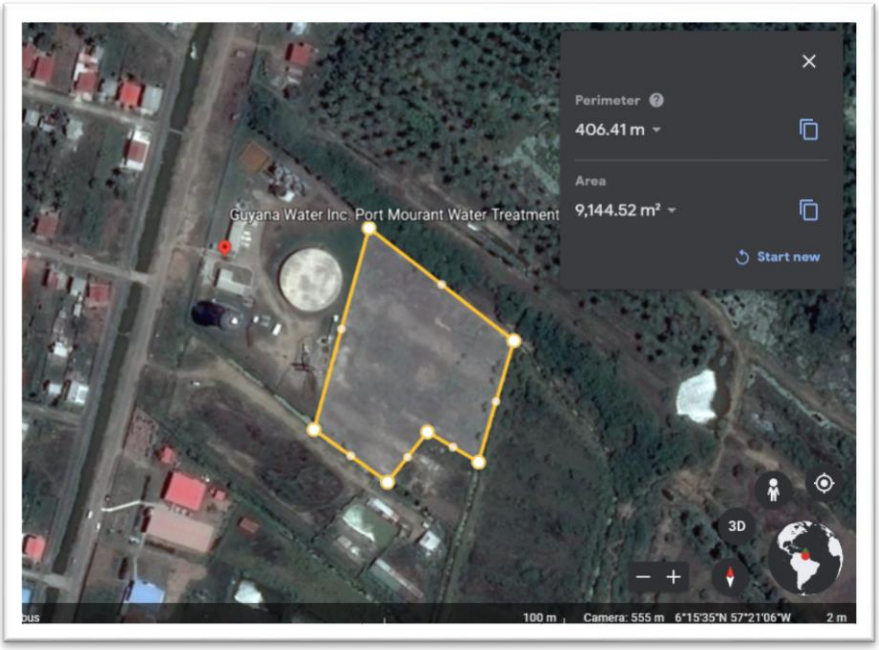
The Port Mourant Water Treatment Plant has an estimated annual energy output from a 400 kWp solar PV system is (590MWh). This is equivalent to approximately 1490 PV panels requiring approximately 9,200m^2. Based on the required landmass, no feasible and reasonable alternative are currently available by GWI. In the event the proposed location cannot be used, approval will need to be sought from the Government of Guyana for land.

(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).

The area is generally flat with predominantly clay soil covered by vegetation. There is minimal impact on the soil from the existing infrastructure - the physical plant infrastructure. There will be little to no environmental impact from the solar farm since minimal clearance of vegetation or no disturbance of water bodies is required. Land clearing, of secondary vegetation primarily grass, will be completed as part of the preparatory works to install the panel modules for the solar farm. Sensitive ecosystems e.g. Wetlands/Mangroves, Protected Areas, Major Water Courses and Threatened or endangered flora and fauna are all located more than 1km away.

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

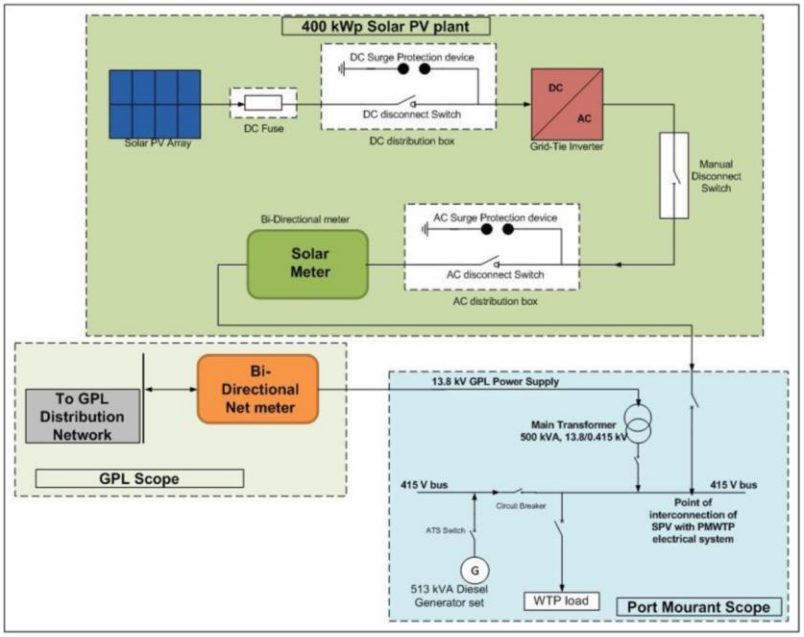
a. an accurate indication of the proposed site position, as well as, the positions of alternative site/s, if any; b. closest town/s, if any; c. names of major and minor access road/s to the site; d. identification of receiving waterbodies; e. identification of any existing or proposed intake and discharge structures; and f. identification of effluent/emission discharge points. The map shall also include a north arrow and a legend.



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

Project Summary Guide

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



There is one on-site personnel to generate solid waste as consumables. These consumables are stored in refillable containers. The estimated solid waste generation is 0.4015 metric tons per year.

No pollutants will be generated from the solar farm during its construction and design life. At the end of the design life of the panels, GWI will prioritise the recycling and reclamation of any recyclable components after which, disposal of the remaining components in accordance to Guyana Environmental Protection Agency's (EPA) guidelines will be done. Approximately 17% of a panel by weight can be recycled. This comprises the solar panel's aluminium frame and junction box that will be sold to licensed scrap metal dealers in Guyana. The remaining 83% of a solar panel's materials (including glass, silicon and polymer back sheeting) will be disposed. This portion also includes hazardous materials which will be disposed in accordance with the Hazardous Waste Management Regulations of EPA.

As it relates to the existing water treatment plant, any solid waste generated on site is disposed of at the respective landfill sites. The treatment process includes backwashing of the filters. This produces approximately 500 m^3 (5% of the 10 MLD plant capacity). Backwash water is primarily water with precipitated iron particles from the treatment process. Backwash water is discharged into the drainage system.

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

Total land area occupied by the existing water treatment plant and the proposed solar farm is 18,884.33 m^2. The total capital investment for the existing and proposed projects is GYD 1,729,497,288. This entails the production and distribution of 10 MLD equivalent to 300,000 m^3/month of groundwater. The treated water is currently distributed to the eastern and western parts of PMWTP, extending up to 3 km in each direction.

The annual energy consumed is 1.27 million KWh of fossil fuels. The proposed project would allow for the utilization of 0.59 million KWh generated from renewable energy sources (the sun).

Annual Energy generation from Solar (400 kWp)	0.59 million kWh
Annual Energy consumption of PMWTP	1.27 million kWh

400kW renewable energy generated

(iii) Activities associated with all development stages from construction to closure: a. operation and production processes and alternative design/s considered; b. a guide for all stages of the project from raw material to the finished product; and c. technical description of the proposed project's process/activity accompanied by a Process Flow Diagram/s;

The identified area is shadow-free and has uneven black soil. Considering the climatic conditions like rainfall and flooding, it is recommended for installing solar PV panels on a mounting structure of 4 to 5 ft elevation from the ground. Physical verification of site dimensions and GPS coordinates of the available ground area were calculated. The total identified area available for solar PV installation is around 9,144 m2 (98,425 sq.ft). The panels will face south fixed at a tilt of 6.8° equivalent to the latitude of Guyana. The utilisation of area depends on the size of the panel, and its efficiency defines potential power generation capacity.

Area required for 1 kWp solar PV system : 90 - 100 sq.ft.

Solar PV system conversion efficiency : 18 -21%

Maximum capacity of solar PV system that can be integrated on the overall available area is : 984 kWP

Proposed area to utilise for solar PV power plant (400 kWP) : 40,000 sq.ft (3700 sq.m)

Daily power generation of 10 kWp system (average) : 41 kWh (Based on the earlier installations)

Daily power generation from SRTPV system (400 kWp) : 1,640 kWh

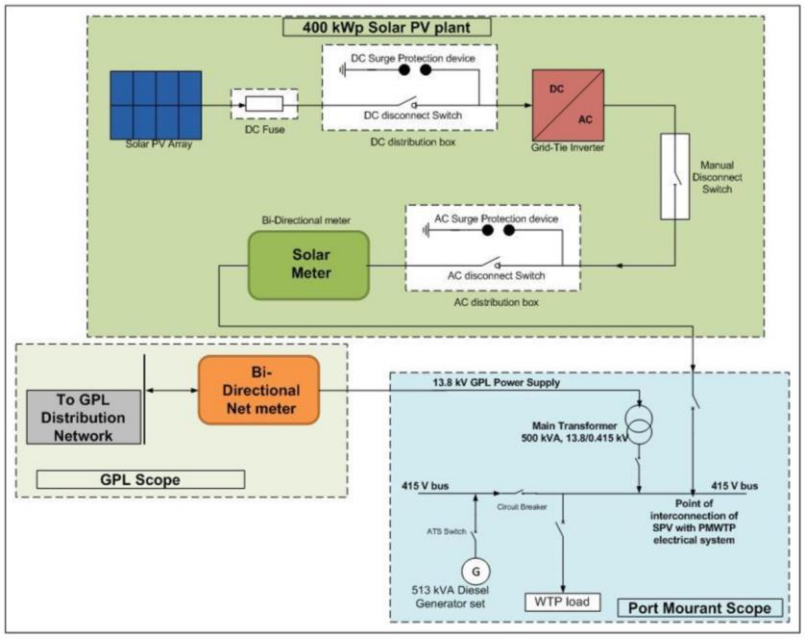
The scope for the auxiliary works includes all design & engineering, procurement & supply of equipment and materials, testing at manufacturer's works, multi – level inspections, packing and forwarding, supply, receipt, unloading and storage at site, associated civil works, services, permits, licences, installation and incidentals, insurance at all stages, erection, testing and commissioning of a technical building suitable for the storage of solar inverters and batter bank; a perimeter fence around the 400 kW (AC) Grid Interactive Solar PV Power Plant; and site preparation in accordance with the technical specifications.

For the installation of the solar panels, works include all design & engineering, procurement & supply of equipment and materials, testing at manufacturer's works, multi – level inspections, packing and forwarding, supply, receipt, unloading and storage at site, associated civil works, services, permits, licences, installation and incidentals, insurance at all stages, erection, testing and commissioning of 400 kW (AC) Grid Interactive Solar PV Power Plant and performance demonstration with associated equipment and materials on turnkey basis.

The capacity of the solar PV power plant (400 kWp) to be installed under net energy metering, shall be restricted to 80% of the main transformer capacity of the WTP. Suitability of power evacuation through 415V low voltage distribution network (cable sizing and protections) shall be reviewed by the supplier. The SPV installation shall meet with all interim interconnection requirement of GPL. The existing guidelines is for integration of SPV of 100 kW and above system to grid developed by GPL to be adhered along with technical IEC standards for various components of SPV system.

Both civil and electrical works will be required and include construction of the structure to elevate the panels and a room to house the inverter, switchgear and the installation of electricity metering and monitoring equipment. AC power from the inverter room will be routed to the switch gear at the pumping station. This power will be coupled with the main

bus bar system for the pumping station incorporating an automatic transfer switch (ATS), which will be coupled either with the generator or with the Power Utility System.



Solar PV plant can be safely integrated with the PMWTP electrical system by using suitable smart controllers to allow hassle-free synchronisation of solar and grid power mode and solar and DG power mode.

The proposed project will require an isolated/strip footing or pile foundation to be used to mount the panel modules thereby minimizing the surface coverage at the site upon completion. Landscape drainage is included in the scope of works to mitigate against flooding at the site. No other major infrastructural works would be required as these already exist for the PMWTP. The Technical Specifications that will guide the implementation of the proposed project is attached.

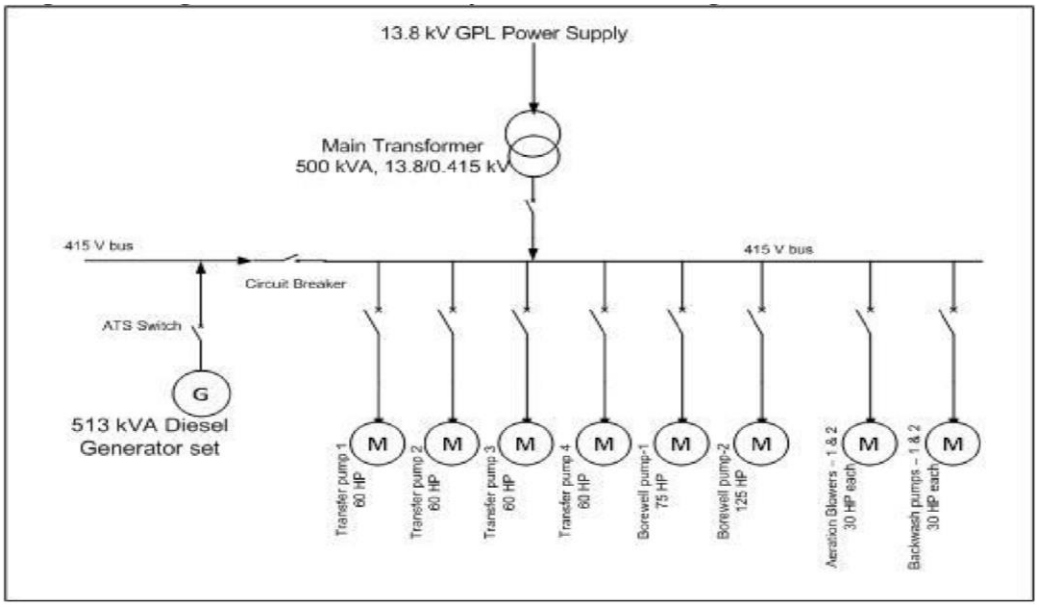
(iv) Use of Natural Resources: approximate quantities of raw materials required at each stage of the project and their possible sources;

Raw Materials	***Unit***	***Quantity***
Landscaping		

White Sand Lower Sub-Base	***m^3***	***4500***
White Sand/Sand Clay Lower Sub-Base	***m^3***	***3000***
Roof		
2 x 6 green heart	***bm***	***216***
1 x 8 green heart	***bm***	***65***
Excavation & Filling		
75mm white sand	***m^3***	***3.5***

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

The project receives water from 2 GWI owned wells located within the confines of the project's compound. The facility receives electricity from GPL at 13.8 kV, which is stepped down to 415V using a 500 kVA power transformer. There is an emergency back-up diesel generator of 513 kVA rated capacity. The single line diagram of the electrical layout is shown below.



(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;

There is one on-site personnel to generate solid waste as consumables used during the process are stored in refillable containers. The estimated solid waste generation is

0.4015 metric tons per year. Glass, silicon and polymer back sheeting (at the end of the design life of the project) will be disposed in accordance to Guyana Environmental Protection Agency's (EPA) guidelines.

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

Activities	Half-year 1 (months)						Half-year 2 (months)						Half-year 3 (months)					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Preparation Activity 1 (Establishment of the Project Management Unit)																		
Execution Activity 1 (Approvals from EPA including environmental and social safeguards)																		
Preparation Activity 2 (The purchase of data gathering equipment for field measurement, data collection -including comprehensive energy assessments at all locations)																		
Execution Activity 2 (Final design of Grid-tied PV systems and approval)																		
Preparation Activity 3 (Tender Preparation and Contract Award)																		
Execution Activity 3.1 (Procurement of items, civil works and electrical installation, testing commissioning of PV system)																		
Execution Activity 3.2 (Project management)																		
Preparation Activity 4 (Documentation - Preparation of SOP for system maintenance)																		
Execution Activity 4 (Training of staff in water loss detection and reduction under component 2.1)																		

(viii) Decommissioning plan (where applicable).

The Port Mourant Water Treatment Plant has a life span of at 25 years but this is extended with continuous maintenance and upgrades which can expand a plant life to 50 years. In the event of the plant, all consumables, such as fuel and oil, will be relocated to existing plants to be utilized. Materials that can be recovered from the plant will be recovered and utilized at existing treatment plants. Materials from the plant that cannot be recovered will be disposed of appropriately at the approved landfill.

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;

a. ***Impacts to Land/Soil****:*

There is minimal impact on the soil from the existing infrastructure. The physical plant infrastructure is the only area covered. All other surfaces are covered by vegetation. The structures for the solar farm will be placed on strip foundation and the remaining surface left covered with vegetation.

b. ***Impacts to Water (both ground and surface)****:*

The source of water to the treatment plant is groundwater. There are two active groundwater wells feeding the water treatment plant at a depth of 398 m and 438 m which, together, produce between 220 to 300 m^3/hr. As a result there is a direct impact on groundwater levels within this area. The static water level for the two wells are 10.9 m and 10.81 m while the dynamic water levels are 26.78 m and 23.89 m. Surface water is impacted by an influx of water from the backwashing process.

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

The identified impacts will not cross country borders.

(iii) the magnitude and complexity of the impacts;

The impacts from the project will be restricted to the confines of the water treatment plant's compound.

(iv) the probability of the impacts;

Low.

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

a. ***Impacts to Land/Soil****:*

- ***Land not used for infrastructure will be covered with vegetation to reduce the compaction***
- ***Increase drainage within the compound.***

b. ***Impacts to Water (both ground and surface)****:*

- ***Groundwater abstraction is capped to meet the capacity of the plant in order to maintain the levels.***
- ***Backwash water is discharged into nearby surface waterways.***

(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.

This project will not pose any cumulative impacts with other projects.

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

No economic or social risks were identified for the proposed project and negligible environmental impacts were identified.

The project is not intended to be designed in such a way to negatively impact the environment. The PV modules which are the most voluminous component of the system will be mounted on the roofs of the corporate buildings and on the roofs and vacant land within the Port Mourant water treatment plant's compound. There will be little to no environmental impact since there would be no clearance of vegetation or disturbance of water bodies. At the end of the design life of the panels, GWI will prioritise the recycling and reclamation of any recyclable components after which, disposal of the remaining components in accordance to Guyana Environmental Protection Agency's (EPA) guidelines will be done. Approximately 17% of a panel by weight can be recycled. This comprises the solar panel's aluminium frame and junction box that will be sold to licensed scrap metal dealers in Guyana.

The remaining 83% of a solar panel's materials (including glass, silicon and polymer back sheeting) will be disposed.

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

Nil

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

Main pre-conditions and assumptions:

- ***Land is suitable for the stated purpose;***
- ***Government's support to sustain the investment;***
- ***Adequate funding will be put in place to support the full implementation;***
- ***Willingness of contractors to bid and execute the project within the proposed budget.***
- ***Those trained will be retained;***

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).

GWI's financial performance is inadequate over the years (a net operating annual loss of over USD 20 million). The essential item of the overall cost structure is energy. Present yearly energy consumption across GWI facilities is 46.6 million kWh. Electricity accounts for more than 60% of GWI's operating costs. In 2020, GWI spent more than US$13.7million on electricity, and GWI's electricity consumption was over five per cent of the total electricity generated by the

country's electric utility (GPL). To reduce energy costs from ever increasing electricity tariffs is of paramount importance for the improvement of the quality of service being provided to the population of Guyana, as well as for the achievement of GWI's economic sustainability.

Guyana's government emphasizes increasing the role of renewable energy in the energy mix in the country to meet the feature energy demands sustainably. Renewable energy plays a critical role in reducing dependence on imported fossil fuels while at the same time reducing oil import bills and increasing energy security. Water treatment plants are ideal end-users for integrating solar PV power plants under a grid-tie net metering scheme. Port Mourant is a water treatment plant that is energy-intensive, where grid-tie-based solar PV system integration is a potential option.

As a part of the low carbon development strategy (LCDS), solar PV power projects are encouraged by the Government of Guyana. The GPL customers who wish to set up a gridtied renewable energy plant shall be reviewed from the GPL side to ensure the safety and reliability of the grid. It is directed to restrict the solar PV system capacity to 80% of the transformer rating of the facility.

Based on the existing GPL transformer rating (500 kVA), it is proposed to install a solar PV power plant of 400 kWp. The proposed system can generate a maximum peak power of 320 kWp range. The estimated annual energy output from 400 kWp solar PV system is 0.59 million kWh. The solar PV power generation share can substitute close to 45% of the present energy consumption level. The reduction in energy bill after integration of solar PV power plant could be above 40%. The project can also lead to other social and economic benefits in terms of direct jobs creation and reduction in the monthly electricity expenditure for the water utility.