28.9 MW HFO Power Generation Solution / Guyana Power and Light Incorporated.

PROJECT SUMMARY

Guyana Power & Light Inc. / the Government of Guyana

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Glossary of Terms:

1. GTE-Gas to Energy
2. NGL- Natural Gas Liquids
3. CCGT- Combined Cycle Gas Turbine

4. NESC- National Electrical and Safety Codes
5. EPC-Engineering, procurement, and construction (contracts).
6. RFP – Request for Proposal

1. INTRODUCTION:

The Guyana Power and Light Incorporated is submitting this Project Summary to provide the Environmental Protection Agency with all the relevant information required for the processing of its Environmental Authorization Application for the construction and operation of a **28.9 MW HFO Power Generation Solution, Power Plant.**

This project will connect the Power Plant to the current National Grid, expand it and improve its overall reliability and stability.

2. PROJECT DESCRIPTION:

The **28.9 MW HFO Power Generation Solution, Power Plant** is geared at producing and transmitting electrical power generated by seventeen (17) 1.7MW Hyundai self-contained engines. Together, these engines will have an installed capacity of 28.9 MW, which will feed to the existing Columbia Substation via the installation of a 4160/69KV transformer. Additional support to the network will be supported via the installation of a 4160/13.8KV transformer. Both transformers will be located in the western boundary/direction of the Power Plant which will feed into the existing National Grid. The substation will further distribute electricity directly to customers within it vicinity (Mahaicony and Mahaica).

2.1. Physical Location of Project:

The 28.9 MW HFO Power Generation Solution, Power Plant facility will be located at Colombia- Demerara Mahaica, Guyana. This project will occupy a total of Five (5) acres of land.

Coordinates of Project Site:

- 6° 38' 37.75"N
- 57° 52' 34.83"W
- 6° 38' 32.11" N
- 57° 52' 32.04"W
- 6° 38' 36.32" N
- 57° 52' 30.04"W
- 6° 38' 36.28" N
- 57° 52' 30.86"W

2.2. Distance of project from stipulated locations

Figure 1: Google Satellite Imagery of Power Plant

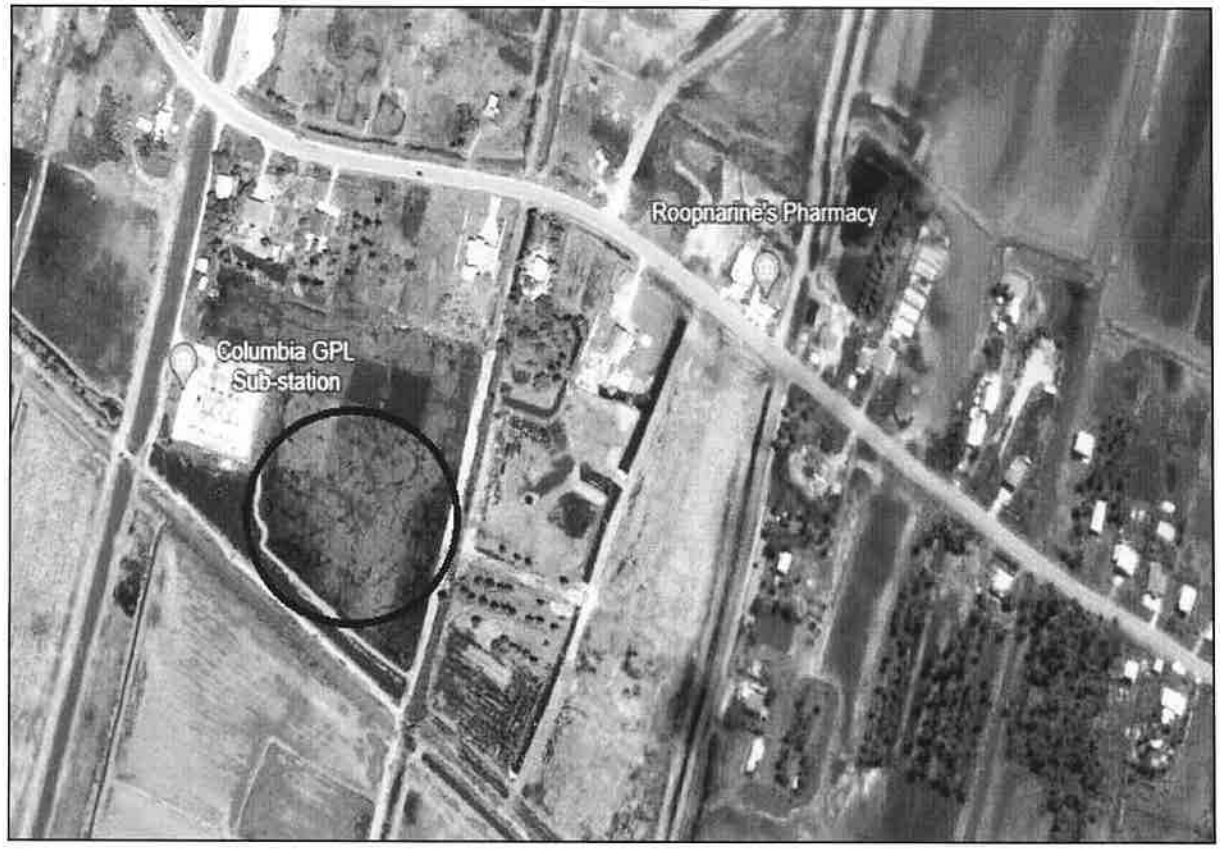
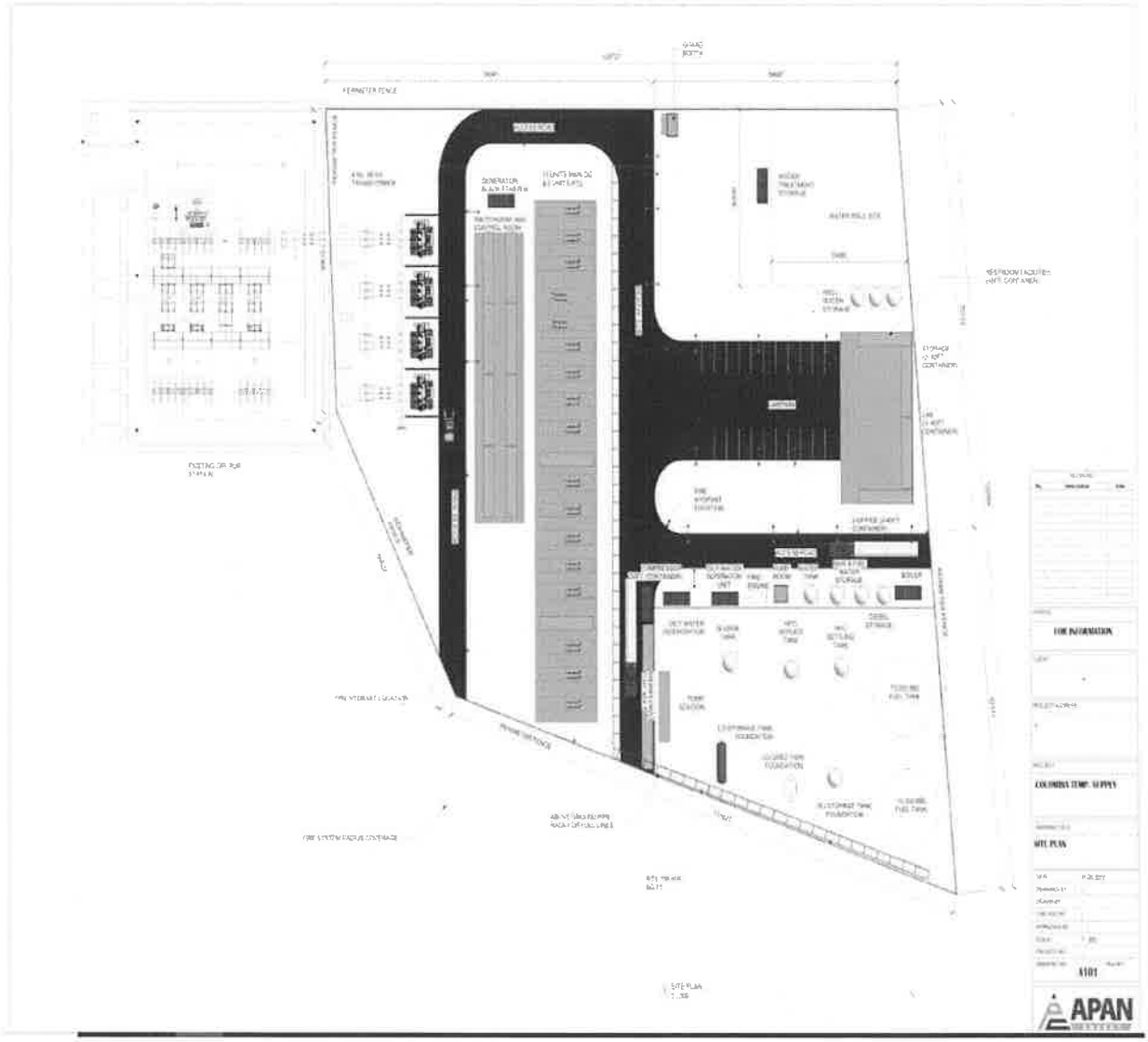


Figure 2: Conceptual Layout of Power Plant



2.2.1. Settlement/Indigenous Communities:

There are no known Indigenous communities at the project site or surrounding areas.

2.2.2. Land Dispute:

There are no existing land disputes for the earmarked site.

2.2.3. General/Predominant Land use currently

The land at the site for the Power Plant is predominantly abandoned Rice cultivation plots (agricultural lands). As such, there are no residential, commercial, institutional, and industrial or mix use of the parcel of land earmarked for the project site.

Table 1: Proximity to various locations/ Sensitive receptors

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

3. Baseline Information on the Physical, Ecological and Social Environment

3.1. Physical Environment

3.1.1. Land:

The land at the site for the Power Plant is predominantly abandoned Rice cultivation plots (agricultural lands) and is vegetated with overgrown grass and shrubs.

3.1.2. Drainage and Access Roads

Drainage trenches or canals are to the located East, South and West of the site beyond the embankments, which implode the land. The access road is situated to the West of the facility.

3.1.3. Soil and Site Elevation

The project site is located within the 'Low Coastal Plain' Geographic Region of Guyana. The Low Coastal Plane is a South-East/ North-West, 434 km/270 mile long stretch which varies in width along Guyana's coast and is estimated to be 1.5m below high tide level. Thin layers of Pagasse (organics) cover soft clays in some areas and overly two distinct coastal Clay formations, the recent Holocene dated Demerara formation and the older Pleistocene dated Coropina formation. The Demerara formation consists of shallow, very soft to soft silty clays and clays while the Coropina formation are described as deep, stiff, grey and mottled clays.

3.2. Stratigraphy

Subsurface stratigraphy was described during the drilling exercise based on Standard Penetration Test resistance values (N values) and visually and physically inspected samples on site using aspects of ASTMD2488 for describing and identifying soils.

3.3. Topsoil (OH)

Topsoil was dark brown silty clays with organic matter. Very soft to soft Silty Clay (CH/MH) Brown- Grey silty clays with distinct lenses and pockets of silt were encountered in each borehole from depths of 0.5 m to approximately 20 m.

Standard penetration tests conducted generally resulted in resistance (N values) of less than 4. In some cases in these weak soils, no standard penetration resistance (N value) was recorded as the weight of the Standard penetration test hammer sank the split barrel sampler without blows being applied.

Medium Silty Clay (CH/MH) Grey silty clays were encountered in each borehole from depths of 20 m to approximately 25 m with Standard penetration test resistance (N values) of less than 8.6.4 Very Stiff Silty Clays - Hard Mottled Clay (CH).

A significant increase in penetration resistance was encountered between 25m to 30m in each borehole where a progression from Light grey- grey silty clays to hard mottle clays with traces of blue and orange colour was encountered. Standard penetration tests conducted generally resulted in resistance (N values) of more than 30.

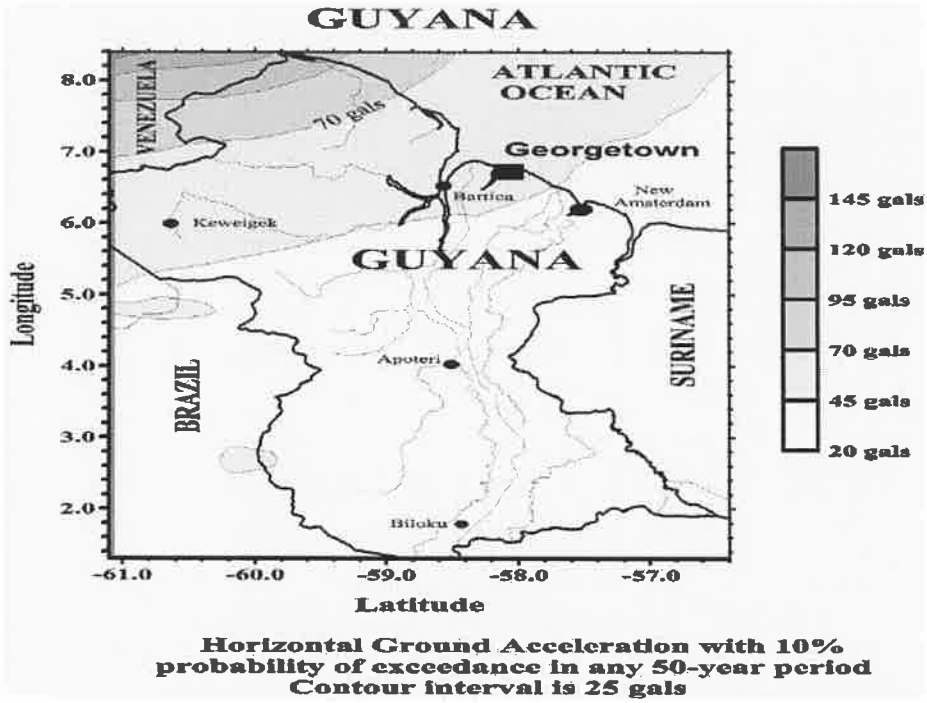
3.4. Ground Water table conditions

Immediate ground water levels in boreholes were not recordable at the time of this investigation. The site was covered by 8"- 12" of surface water because of recent rainfall and lack of drain.

3.5. Seismicity

Peak Ground Acceleration data depicted on the OAS Seismic Hazard Map of Guyana ranges between 45-70 gals in the project area. According to the Global Earthquake Model PGA scale also, Guyana has a low vulnerability to seismic activities. Guyana is located on the South American Plate, South of the Caribbean and South American plate boundary.

Figure 3: OAS Seismic Hazard Map-Guyana



3.6. Ecological Environment:

3.6.1. Land use

The land previously used for agricultural purposes- rice cultivation is imploded and approximately 8" -12" inundated which remained stagnant after periods of rainfall.

3.6.2. River use

There are no rivers located within the vicinity of the Project.

3.6.3. Flora at the Earmarked project site:

The land at the site is populated with grass and shrubs.

3.6.4. Biodiversity:

There is no critical biodiversity expected at this area and the land is of low value to most wildlife.

3.7. Social Environment:

3.7.1. Human Habitation:

Currently, there is no human habitation at the Colombia Project site. The land is unoccupied, however there are some residential properties located on the Northern section opposite the Project site.

3.7.2. Cultural and Traditional Use of project site:

There are no known cultural or traditional uses of the proposed site.

4. PROJECT LAYOUT:

4.1 Land Size: The approved land size for the Project is approximately Eight (8) Acres.

5. PROJECT DESIGN:

The project will utilize Seventeen (17) Himsen-Hyundai Engines, along with supporting structures and components, which will feed to the existing Columbia substation via the installation of a 4160/69KV transformer. Additional support to the network will be supported via the installation of a 4160/13.8KV transformer; equipment will together form a Power Generating facility with an output of 28.9 MW.

5.1. Technical Specifications

Figure 4: Engine technical specifications

TECHNICAL DETAILS

ENGINE

Engines:	17- 1700 KW Himsen 9H21/32 Generator
Year :	2016
Manufacturer :	Himsen
Fuel Type :	HFO
KW :	1700
Hz :	60
Voltage :	4160
RPM :	900
Hours :	6700

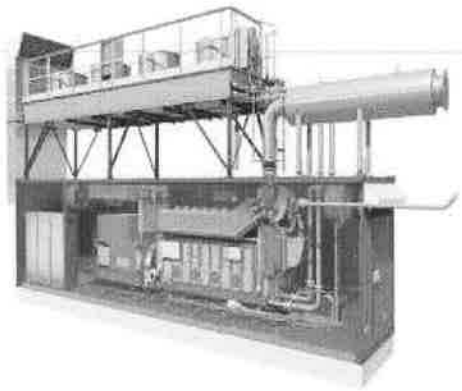
HEAT RATE

Specific Consumption at Engine & Heat Rate

100% Load	Unit	900rpm	1000rpm
Fuel Oil Consumption	g/kWh	183	185
Lube oil consumption	g/kWh	0.6	0.6
Heat Rate	KJ/kWh	7,814	7,899
Diesel Oil or Heavy Fuel Oil	KJ/kWh	8,313	8,404

Dimensions

Speed	Cyl.	Dimensions			Dry Mass (ton)	
		L	W	H	Genset	Total weight
900/1000 rpm	6	12	2.4	3.4	26.1	42
	8	12	2.4	3.4	29.1	48
	9	12	2.4	3.4	31.7	5



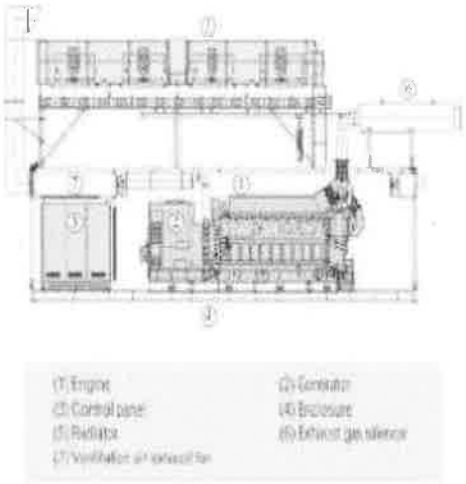


Figure 5: Engine technical specifications

GENERATOR

Generator/Alternator and transformer(s) technical parameters

Principal Data for H21/32 Gen-Set

Type of Engine		4-stroke, vertical, direct injection single acting and trunk piston type with turbocharger and inter-cooler
Cylinder Configuration		in – line
Number of Cylinder		5 – 6 – 7 – 8 – 9
Rated Speed	rpm	720 750 900 1000
Power per Cylinder(kW)	kW	160 160 200 200
Cylinder Bore(mm)	mm	210
Piston Stroke(mm)	mm	320
Swept Volume per Cylinder	dm^3	11.1
Mean Piston Speed	m/s	7.7 8.0 9.6 10.7
Mean Effective Pressure	bar	24.1 23.1 24.1 21.7
Compression Ratio		17:1
Direction of Engine Rotation		Clockwise Viewed from Generator Side (Non-Reversible)
Cylinder Firing Order	5H21/32	1 – 2 – 4 – 5 – 3
	6H21/32	1 – 4 – 2 – 6 – 3 – 5
	7H21/32	1 – 2 – 4 – 6 – 7 – 5 – 3
	8H21/32	1 – 3 – 5 – 7 – 8 – 6 – 4 – 2
	9H21/32	1 – 3 – 5 – 7 – 9 – 8 – 6 – 4 – 2

System	Name Descriptions	Normal Operating Range at Rated Power	Alarm Setting	Autostop of Engine	Remarks
Control Speed	Engine speed	Rated Speed (rpm)		113%(1st) 115%(2nd) of rated speed	
		720/750/900/1000			
Fuel Oil System	Fuel oil leakage level		High level		
	Fuel oil pressure inlet engine (for Continuous HFO operation)	4.0 ~ 6.0 bar (MDO)			
		8^{+2}_{-1} bar (HFO)	P_{HFO} < 6.0 bar		
	Fuel oil pressure inlet engine (for Continuous MDO operation)	7.0 ~ 8.0 bar (MDO)	P_{MDO} < 6.0 bar		
	Fuel oil temperature inlet engine	30 ~ 45 ℃ (MDO)			
		110 ~ 140 ℃ (HFO)	150 ℃		
Lub. Oil System	Lub. oil pressure drop-filter	0.1 ~ 1.0 bar	> 1.5 bar	2.0 bar (if applied)	
	Lub. oil pressure inlet engine after filter	4.0 ~ 5.0 bar	< 3.5 bar	3.0 bar	
	Lub. oil temperature inlet engine	60 ~ 70 ℃	> 80 ℃		
	Lub. oil pressure inlet TC	2.0 ~ 4.0 bar	1.5 bar		
	Oil mist detector (option)		High level	High level	
	Lub. oil level in base frame		Low/high level		
	Prelubricating oil level		Low level		
Cooling Water System	LT water pressure inlet engine	1.5 ~ 4.5 bar	< static+0.4 bar		
	LT water temperature inlet engine	30 ~ 40 ℃	> 45 ℃		
	HT water pressure inlet engine	2.5 ~ 4.5 bar	< static+0.4 bar		
	HT water temperature outlet engine	75 ~ 85 ℃	> 90 ℃	>95 ℃	
Combustion Gas System	Cylinder pressure	Max. ~ 200 bar	-	-	Refer to shop test result
	Deviation from average of cylinders	Max. ±5bar			-
	Charge air pressure after cooler	2.5 ~ 3.2 bar			
	Charge air temperature after cooler	35 ~ 55 ℃			
	Deviation from average of cylinders	±50℃	±70℃		-
	Exh. gas temperature inlet TC	420 ~ 550 ℃	> 580 ℃		
	Exh. gas temperature outlet TC	250 ~ 380 ℃	> 450 ℃		
Compressed Air System	Compressed air inlet pressure	5 ~ 7 bar	< 4.5 bar		For 5,6,7cyl
		8 ~ 10 bar	< 7.5 bar		For 8,9 cyl.

5.2.Mechanical Specifications:

Below are the details on the following:

1. Water treatment unit(s),
2. Oily water treatment,
3. Maintenance water tank,
4. HFO buffer tank, LFO tank
5. Containment walls for all fuel storage tanks,
6. Pumping facilities for filling and discharge of HFO bulk storage tank for a complete tank farm facility.

Water Details on water treatment unit(s) – "dependent on the quality of the extracted water well" COLOMBIA TEMP. Power Plant Station will be utilizing the following sources of water for the processes on site: Ground water (primary source). Treated water will be utilized for the following services and/or pieces equipment: Heavy fuel oil (HFO) Purifier Unit Oily Water Separator Cooling Water Expansion Tanks T/C Cleaning Nozzle HFO Treatment Unit (HTU) for LO Purifier Unit Boiler.

5.3.Water Treatment System:

The water treatment unit will utilize of the following sub-components for water treatment:

1. Filters

2. Pumps

3. Tanks

5.4.Details of the Sludge and Oily Water Disposal system

The COLOMBIA TEMP. Power Plant Station will utilize a wastewater and waste products disposal system for all process waste. The drainage network consists of various trenches and pits throughout the site for waste processing products (Oily water; HFO; LO; etc.) piped to a storage tank and then treated in oily water separator system for additional treatment and sludge disposal.

The Sludge and Oily Water Disposal system consists of the following main components:

1. Drainage Network (Inclusive of Pits; Submersible Pumps)
2. Point of Delivery/Unloading (Multiple ports)
3. Pump station Unit - Sludge Unloading pump.
4. Pump station Unit – Sludge Transfer Pump
5. Oily Water storage Tank
6. Sludge Storage Tank
7. Oily Water Interceptor
8. Electric Heaters

5.5. HFO Fuel System

Details on the Fuel Oil system: The COLOMBIA TEMP. Power Plant Station will utilize HFO as the primary and sole source of fuel. HFO will be delivered to site via tankers and stored for processing and utilization in bulk storage tanks housed within a tank form. The facility will be provided with an on-site tank capacity of thirty (30) days to support a minimum plant utilization of approximately fourteen (14) MDU units at any point in time.

The Fuel oil system consists of the following main components.

1. Point of supply (delivery point – multiple ports)
2. Pump station Unit – HFO unloading pump.
3. Pump station Unit – HFO transfer pump.
4. Pump station Unit – HFO supply pump
5. HFO Storage Tank complete with storage heater
6. HFO Purifier Unit
7. HFO Settling Tank
8. HFO Service Tank

The HFO Treatment unit (HTU) provides fuel oil to the engines within acceptable parameters as well as treats the Lube Oil (LO) via the Lube Oil purifier unit.

The HFO treatment unit consists of the following main components:

1. LO Purifier
2. Purifier Feed Pump
3. Sludge Pump
4. Sludge Tank
5. Control Panel
6. Viscosity Controller
7. FO Booster Unit
8. FO Steam Heater
9. Nozzles

The HFO Treatment unit will be housed within a forty (40) foot container complete with Ventilation, lighting and communication. The COLOMBIA TEMP. Power Plant Station will be outfitted with two (2) HTU that will supply the MDU units.

5.6.Lube Oil System

Details on the Lubricating Oil system: The COLOMBIA TEMP. Power Plant Station will be outfitted with a lubricating oil system intended to support the internal lubricating oil system of the MDU. Given the nature of the operations, the system allows for the loading, storage, distribution and Purifying of the LO. The engine has its own internal lubricating oil system with wet type oil sump. Most of the oil passages are incorporated into the engine components and the equipment's of the system are mounted directly on feed block without pipe connections.

The Lubricating oil system consists of the following main components.

1. Point of supply (Delivery Point – Multiple ports)
2. Pump station Unit – LO Unloading pump.
3. Pump station Unit – LO transfer pump

4. LO Storage Tank 53
5. LO Used Tank
6. LO Purifier Unit (Internal HTU)

5.7.Fire Fighting System

Details on the Fire fighting system: The COLOMBIA TEMP. Power Plant Station overall fire fighting system shall consist of a combination of the following:

1. Fire Water Pumps (Electric Fire pump and Diesel Driven Fire engines rated for 1000 GPM minimum)
2. Fire water reservoir tank (120,000 Gal or Two (2) hours)
3. Hydrant system
4. Hose Cabinets
5. Deluge system for Tanks (Cooling)
6. Potable fire fighting extinguishers at various (CO2, foam and dry powder)

The following systems will be specifically protected by the fire fighting system:

1. MDU's
2. Exhaust systems
3. Fuel storage and distribution systems
4. Electrical installations
5. Working/Office spaces

5.8.Incinerator

The **Inciner8** Incinerator's bulk capacity, advanced secondary chamber technology and provision for automatic waste loading offer an effective and sustainable waste disposal method for several industries that produce a high daily volume of waste. The system delivers clean and tidy effective waste solutions, making the investment invaluable.

Capacity:

Industrial waste <1000 kg per day

6. PROJECTSIZE:

6.1.Capital Investment:

The estimated capital investment for the establishment of the 28.9 MW Power Plant at Colombia is currently pegged at 27.5 Million USD.

6.2.Production Rate:

The project will distribute 28.9 MW of electricity generated from the Colombia Power Plant.

6.3.Number of Employees projected for each stage:

Information will be provided once made available by contractor.

6.4.Source of Utility Services:

Guyana Water Incorporated (GWI) will supply water to the various Substations and the Guyana Power & Light Inc. (GPL) will supply Electrical power.

6.5.Development stages from construction to closure:

The planned activities associated with all development stages from construction to closure are, but not limited to, the following:

Table 2: The establishment of the 28.9MW Power Plant will include the following stages of development:

STAGE 1- Early Work	STAGE 2- Construction of 28.9MW Power Plant	STAGE 3- Operation
Site preparation- Land Clearing (Removal of Trees and vegetation at project sites).	Civil/Construction works for establishing a 28.9 MW Power Generating facility.	Pre-Commissioning of 28.9 MW Power Generating facility.
Excavation may be required in some area as part of site preparation	Installation and assembling of Equipment, Transmission lines connecting to Substation and transmission network.	Commissioningof28.9 MW Power Generating facility.
Establishing drainage networks where necessary	Connecting of all Transmission Lines to the appropriate Substations	Control via Contracted Operator and distribution via GPL's Transmission and Distributions Dept.

7. WASTE PRODUCTION AND MANAGEMENT:

Table 3: Waste during construction of 28.9 MW Power Plant

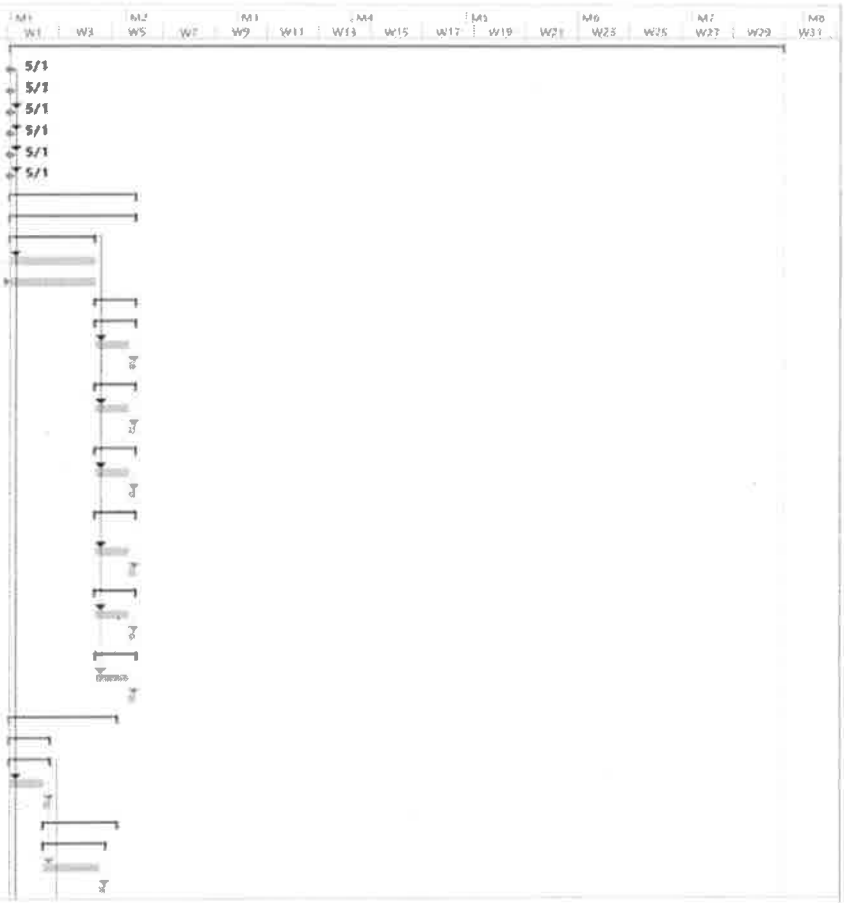
Waste Type	Source	Management/ Treatment	Quantity of Waste Generated
Gray water	Portable sinks on worksite	Gray water and Black water (Sewage) will be stored in tanks on site until removal via local waste disposal provider at various construction sites.	To be determined
Black Water(Sewage)	Portable toilets on worksite	Gray water and Black water (Sewage) will be stored in tanks on site until removal via local waste disposal provider at various construction sites.	To be determined
Runoffs from construction process(Sediments)	Land preparation process, excavation	During the course of construction, the contactor will perform, construct, and maintain on-site soil erosion and sediment control measures. Adequate drainage will be designed for the site to minimize run off Drainage systems will be monitored and frequently maintained 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	To be determined

Solid waste	Generated from workers onsite	Waste Generated by Workers during construction phase An EPA approved contractor will collect all waste generated on site. The site will be provided with an adequate number of bins for the disposal of domestic waste Burning of waste on-site will be prohibited	To be determined
Waste during operation of Power Plant			
Gray water	Portable sinks on worksite	Gray water will be directed to onsite drainage system and collection pits	To be determined
Black Water(Sewage)	Portable toilets on worksite	Black water (Sewage) will be directed to onsite sewage system.	To be determined
Storm Water run-off	Rainfall	All storm-water will be directed to established drainage system of the facility	To be determined
Hazardous Waste (Sludge)	By-product from the treatment of HFO Fuel	The Hazardous Waste (Sludge) will be directed to an Oily Water Tank, which will then be transported to the onsite "Oily Water Separation Unit". Whereby the oil waste will be separated and sent to an onsite Sludge Concentration Tank and the separated water will be discharged via the effluent discharge points of the facility.	To be determined

Oily Rags	Used during maintenance activities and others	All oily rags generated will be incinerated via the facility's onsite Incinerator.	Approximately 100 lbs. per month
Filters	By-Product from Operation.	All filters will be removed via an EPA authorized Hazardous waste disposal company.	To be determined
General non-hazardous waste	Generated by operators and other staff Control rooms/ security etc.	Utilizing external registered waste disposal company.GPL currently utilizes Cevons Waste Disposal Services-.	To be determined

Figure 6: Project Duration:

ID	Task Name	Duration	Predecessors
1	**28.9 POWER GENERATION PROPOSAL**	**180 days**	
2	**ADMINISTRATIVE**	**0 days**	
3	Award of Contract	0 days	
4	Signing of Contract	0 days	3
5	Receipt of Advance Payment	0 days	4
6	Kick-off Meeting (ACTUAL PROJECT START)	0 days	5
7	**Notice to Proceed (PROJECT START DATE)**	0 days	6
8	**ENGINEERING**	**30 days**	
9	**CIVIL DESIGN**	**30 days**	
10	**BASIC STUDIES**	**20 days**	
11	Geotechnical Report	20 days	2
12	Topographical Survey	20 days	11SS
13	**DESIGN & DRAWINGS**	**10 days**	
14	**Site Layout**	**10 days**	
15	Design & Submission	8 days	10
16	Revision and approval by End User	2 days	15
17	**Miscellaneous Equipments Foundations**	**10 days**	
18	Design & Submission	8 days	10
19	Revision and approval by End User	2 days	18
20	**Foundation Layout**	**10 days**	
21	Design & Submission	8 days	10
22	Revision and approval by End User	2 days	21
23	**Buildings Architechture & Structure design (Office Container/HFO Containers/Pump Room/Guard Booth)**	**10 days**	
24	Design & Submission	8 days	10
25	Revision and approval by End User	2 days	24
26	**Drainage and Roads**	**10 days**	
27	Design & Submission	8 days	10
28	Revision and approval by End User	2 days	27
29	**Perimeter Fence and Access Gate**	**10 days**	
30	Design & Submission	8 days	10
31	Revision and approval by End User	2 days	30
32	**MECHANICAL DESIGN**	**25 days**	
33	**DOCUMENTS**	**10 days**	
34	**Fire Protection System (Site)**	**10 days**	
35	Design & Submission	8 days	2
36	Revision and approval by End User	2 days	35
37	**DESIGN & DRAWINGS**	**17 days**	
38	**Containers/Guard Booth/Pump Room**	**15 days**	
39	Design & Submission	13 days	35
40	Revision and approval by End User	2 days	39



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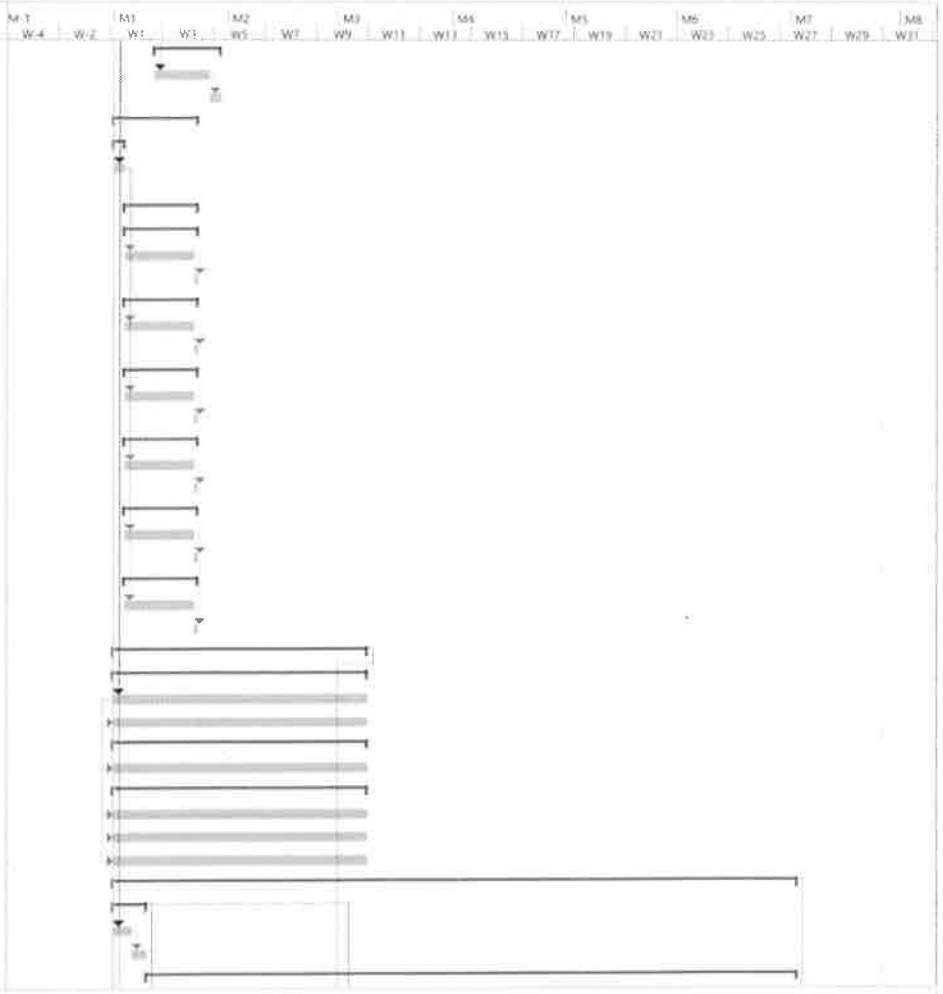
ID	Task Name	Duration	Predecessors
41	**Portable Fire Extinguisher Locations - Plant and Details**	**15 days**	
42	Design & Submission	13 days	34
43	Revision and approval by End User	2 days	42
44	**ELECTROMECHANICAL DESIGN**	**20 days**	
45	**DOCUMENTS**	**3 days**	
46	Submission of Manufacturer Equipment/Material Technical Specifications	3 days	2
47	**DESIGN & DRAWINGS**	**17 days**	
48	**Equipment General Layout**	**17 days**	
49	Design & Submission	16 days	46
50	Client Review	1 day	49
51	**Equipment Assembly and Details**	**17 days**	
52	Design & Submission	16 days	46
53	Client Review	1 day	52
54	**Support Structures Assembly and Details**	**17 days**	
55	Design & Submission	16 days	46
56	Revision and approval by End User	1 day	55
57	**Equipment & Support Structure Grounding Assembly & Details**	**17 days**	
58	Design & Submission	16 days	46
59	Revision and approval by End User	1 day	58
60	**Lightning Protection System Details**	**17 days**	
61	Design & Submission	16 days	46
62	Revision and approval by End User	1 day	61
63	**Exterior Lighting System**	**17 days**	
64	Design & Submission	16 days	46
65	Revision and approval by End User	1 day	61
66	**PROCUREMENT**	**60 days**	
67	**CIVIL**	**60 days**	
68	Earthworks Material	60 days	2
69	Prefabricated Material	60 days	68SS
70	**MECHANICAL**	**60 days**	
71	Mechanical Equipment	60 days	68SS
72	**ELECTROMECHANICAL**	**60 days**	
73	Support Structures	60 days	68SS
74	Electrical Equipment	60 days	68SS
75	**GENERATION PLANT & AUX COMPONENTS**	**60 days**	68SS
76	**CONSTRUCTION**	**160 days**	
77	**PRELIMINARIES**	**8 days**	
78	Mobilization-Establish Carpark, Site Office, Temporary Facilities	5 days	2
79	Site Preparation	3 days	78
80	**CIVIL WORKS**	**152 days**	



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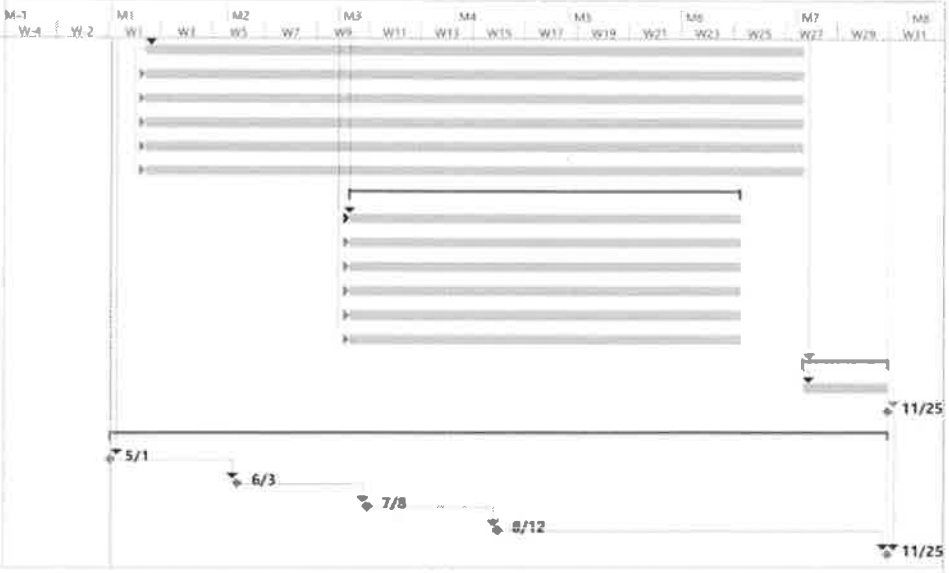
ID	Task Name	Duration	Predecessors
81	Construction of Perimeter fence, basewall and gates	152 days	77
82	Construction of Foundations & Plinths	152 days	81SS
83	Construction of Guard Booth, Pump Room	152 days	81SS
84	Installation of Tanks	152 days	81SS
85	Installation of Containers	152 days	81SS
86	Construction of Substation Roadways	152 days	81SS
87	**ELECTROMECHANICAL WORKS**	**90 days**	
88	Installation of Support Structures	90 days	77,66FS-5 days
89	Installation of Busbar system	90 days	88SS
90	Installation of Electrical Power Equipment, Transformer, Engines	90 days	88SS
91	Interconnection of equipment with conductors	90 days	88SS
92	Installation and termination of all power and multicore cables	90 days	88SS
93	Installation of lighting pole and light fixtures	90 days	88SS
94	**COMMISSIONING**	**20 days**	86
95	Commissioning & Testing	20 days	76
96	**ENERGIZATION (PROJECT COMPLETION DATE)**	0 days	95
97	**Payment Schedule**	**180 days**	
98	Advance Payment [15%]	0 days	4
99	Interim Payment #1 [35%]	0 days	98FS+30 days
100	Interim Payment #2 [20%]	0 days	99FS+30 days
101	Interim Payment #3 [15%]	0 days	100FS+30 days
102	Final Payment [15%]	0 days	96,101



1. Decommissioning plan:

Unknown at this stage of the Project

8. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES:

Table 4: Potential Environmental impacts from construction and operation of proposed project and Mitigation measures

Receptors	Source of impact	Possible effects of impact on human life and Environment	Mitigation measures
Construction of 28.9 MW Power Plant			
Soil	Land clearing and excavation for the construction of Power Plant and supporting components	Erosion and Compaction, Earthworks/ land clearing will disturb soils and ecosystems.	Adequate drainage will be developed for relevant sites and the Implementation of re-vegetation measures in critical areas where necessary.
Water Quality (Ground and Surface Water).	Earthworks related to site preparation can result in the discharge of sediment to canals or other drainage features	Runoffs from site Preparation can lead sedimentation in drains, canals and trenches. This can affect aquatic ecosystems and can affect human health. The Project has the potential to affect groundwater quality.	Adequate drainage will be designed for the site to minimize runoff Drainage systems will be monitored and frequently maintained 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
Air Quality	Emission from site	Dust Generation and Exhaust	Covering of Stockpiles to

	preparation activities to facilitate the construction of Power Plant and supporting components. Emissions from Equipment/ Machinery and Vehicles.	Emissions may affect Ambient Air Quality at the Project area on localized basis. Combustion from hydrocarbons can contribute to greenhouse gas emissions	minimize dust generation, Suppressing dust from construction, stockpiles and increased vehicular traffic by sprinkling water, Consideration of wind direction when stockpiling construction materials, and Orientation shall avoid downwind residences or sensitive locations. Regular maintenance of vehicles and on-site construction equipment
Noise and Vibration	Operation of Equipment and Machinery during construction	Noise Pollution may pose a nuisance to the tranquillity of the environment, and may have an impact on human health. Further, Increase Noise Pollution can affect wildlife (E.g. nesting birds etc.)	Noise and vibration shall be to control and limit noise and vibration level from activities at the source by the use of Best Practicable Means (BPM) and ensuring compliance with relevant legislation. Additionally, the use of ear plugs or ear muffs for specific activities by workers Activities will be limited to daylight hours, where practicable.

Flora and Fauna	Land Clearing for the construction of the power plant will require some amount of vegetation clearance.	Disturbance of Ecosystems, wildlife breeding/ feeding patterns, increased erosion and habitat destruction are all potential risk associated with the removal of small trees and vegetation at the project site.	Where practicable, trees, shrubbery, topsoil, grass, and other landscape materials shall be replanted/ reapplied.
Solid waste pollution	Waste Generated via site preparation activities and from workers during site preparation.	Garbage Pollution	An EPA approved contractor will collect all domestic waste generated on site. The site will be provided with an adequate number of bins for the disposal of domestic waste Burning of waste on-site will be prohibited
Potential Environmental impacts from operation of proposed project			
Soil	Spillages from plant operation: Potential Spillage of Fuel during Transfer Processes	Contamination of soil during Plant operating activities may lead to ground and surface water contamination, clogging of soil, thus preventing water and air movement required by plant and soil organisms, and it may also	The facility will have a designated fuel loading zone, which will be constructed with a concrete base and a collection pit for all potential spillages. This pit will be directed to the oily water

	Spillage via Effluent Discharge in the event of malfunctioning Oily Water Separators Movement of Sludge in the event of malfunctioning incinerator. Spillage during maintenance.	lead damages to soil ecosystems.	separator. Contractors will be required to provide a procedure for fuel transfer, with adequate mitigating and preventative measures to spillages. Contractors will also be required to have spill kits on fuel trucks and onsite during fuel transfer processes. The contractor will be required to provide an Emergency Response Plan for potential spillages and evidence that all relevant personnel received training on the ER plan and Fuel transfer Procedure. The facility will be fitted with an Oily Water Separator, whereby all effluent will pass through prior to discharge into environment. An Effluent Monitoring schedule will be established and regular effluent monitoring will be conducted. The Oily Water Separator will

			be maintained according to schedule. The Incinerator will be maintained in accordance with manual and further sludge samples will be tested to ensure compliance with Incinerator requirement. All Power Plants and areas with Hazardous waste and fuel will be supplied with Spill Kits. All relevant staff onsite will be trained on Emergency response in the event of a spillage.
Water Quality (Ground and Surface Water).	Spillages via effluent discharged from the facility.	Contamination of ground water sources Pollution of surface water. Damage to ecosystems.	All run-offs and storm water will be redirected to an established drainage system. The facility will be fitted with an Oily Water Separator, whereby all effluent will pass through prior to discharge into environment. An Effluent Monitoring schedule will be established and regular effluent monitoring

			will be conducted. The Oily Water Separator will be maintained according to schedule.
Air Quality	Emissions from Generating Engines and Incinerator during operation.	Emissions may affect Ambient Air Quality at the Project area. Combustion from hydrocarbons can contribute to greenhouse gas emissions.	Ensure compliance with environmental regulations by monitoring and minimizing emissions from the generating Engines. Monitor and analyze the performance of the generating engines to identify opportunities for improvement in scheduling, maintenance, and efficiency.
Noise	Operations of Generating Engines and Incinerator. Fire Drills.	Persistent noise may affect the tranquillity of the environment for residents in close-proximity of the Power Plant.	The engines will be housed in noise attenuating containers. The engines are fitted with mufflers to minimize noise emissions. Employees will be provided with noise protective PPE. The facility will comply with all Regulatory noise compliance requirements (Noise Limits). Fire Drills occur for a period of

			2 minutes, quarterly. Therefore, it pose no significant noise pollution.
Solid waste pollution	Waste Generated from operators on substation.	Garbage Pollution	An EPA approved contractor will collect all domestic waste generated on site. The site will be provided with an adequate number of bins for the disposal of domestic waste Burning of waste on-site will be prohibited

9. **BORDERS AND BOUNDARIES:**
The Project does not cross any Borders or Boundaries.

10. **MINUTES OF PUBLIC CONSULTATION/ MEETINGS:**
Given the current stage of the Project such as public hearing/activity is still to be conducted.

11. **PROPONENT WITH KEY STAKEHOLDERS:**
Given the current stage of the Project such as public hearing/activity is still to be conducted.

12. **A NON-TECHNICAL SUMMARY:**

This process starts with the use of Heavy fuel oils (HFO), taken from a bulk storage tank, pumped into a buffer tank, fed through HFO separators and then to a daily service tank for use by each of the Hyundai engine to generate power.

The engine(s), then utilize this fuel by injecting small amounts, at precise times within a cylinder. The cylinder contains compressed air, thus the combination of the air/ fuel mixture results in a spark that produces heat; this heat energy moves several pistons up and down. The up and down movement of these pistons is called a stroke and the consistent strokes of the engine's pistons generates electrical energy or Electricity. This Electrical power is fed to a grid, and then transmitted to a substation and subsequently to consumers.