Year 2024-2028

DEVELOPMENT AND EXPANSION PROGRAMME

Planning Horizon: 2024 – 2028

GUYANA POWER & LIGHT INC.

December 15th, 2023

Table of Contents

1. Executive Summary

1.2 Introduction

The Government and GPL remain cognizant that access to affordable, reliable, clean, and sustainable energy remains a priority among the several supporting pillars of the economic development trajectory of Guyana and its Citizens.

The Government and GPL intend to achieve the above by strengthening the aim of the Development and Expansion Programme to support the Low Carbon Development Strategy (LCDS) - 2030, National Energy Priorities and specifically, the Sustainable Development Goal (SDG) No.7 and other international climate change commitments.

The key objectives of this Programme include but are not limited to increasing access to reliable and modern electricity services, improving network reliability and quality of electric services, increasing the renewable energy share in the grid, and improving operational efficiency through aggressive reduction of technical and non-technical losses.

1.3 GPL Electricity Demand Outlook

The significant increase in the electricity demand is premised on unprecedented growth of the total number of customers and energy intensity per customer. The driving factors of the increasing electricity demand are invariably rooted in the current steep growth of the various economic sectors.

Historical data for the period 2011-2022 revealed that GPL power systems (DBIS & Isolated group of Power Systems) experienced escalating electricity demand. Gross generation has been increasing at an average annual rate of 4.9% or by 41.72 GWh per annum, moving from 653.4 GWh in 2011 to an estimated 1,154 GWh by the end of year 2023. The historical average 5-year gross generation increased by 7%, that is, from 876.83 GWh in 2019 to an estimated 1,154 GWh in 2023. Comparing year 2022 gross generation with 2023, the increase is estimated at 12%, that is, from 1,030 GWh in 2022 to an estimated 1,154 GWh by the end of 2023. The non-coincidental peak demand of the aggregated GPL power systems experienced an annual average growth of 6.7% or 8.54 MW per annum, that is, from 90.1 MW in 2011 to 191.6 MW (suppressed peak demand) in 2023. In the recent 5 years, the aggregated GPL power system experience a 9.1% growth rate in its non-coincidental peak demand, that is, from 126.8 MW in 2019 to 191.6 MW in 2023. Comparing 2022 peak demand with 2023, the increase is estimated at 17.9%, that is, from 162.6 MW in 2022 to 191.6 MW in 2023.

Within the current 5-year planning period, significant growth is expected in the GPL customer base, adding approximately 120 MW to GPL power systems by the year 2028. See Table 1 for summarised details. Table 2 summarises that an estimated total of 23,611, originating as a result of planned infrastructural developments and a total of 589 unserved customers are estimated to be added to the GPL power systems by the year 2028.

In addition to the above, an additional estimated total of 15,812 customers are considered in the current GPL customer growth projection for 2024-2028. This additional total number of customers represents a combination of the estimated total of 109 self-generating clients, the experience of current customers subletting/converting a section of their property to business endeavours, which can include small shops, supermarkets and apartment(s), public illumination for highways/roadways and streets, drainage pump stations, potable water supply stations for existing and new housing schemes and electric vehicles (EVs).

Table 1: Breakdown of Planned Infrastructural Development Project

Load Demand Components Planned Infrastructural Developments (PID)	Total No. of Projects	Estimated No. of Customers - GPL Only	Estimated No. of Customers - GPL & Linden	Estimated PID & UsA Demand by 2028 (MW) - GPL Only	Estimated PID & UsA Demand by 2028 (MW) - GPL & Linden
CH&PA Housing Projects	69	23,536	25,617	76	77.5
School/Educational Development	28	28	28	4	4.0
Hospitals/Health care Improvements	18	18	18	12.1	12.1
Hotels/Apartment Complex	14	14	14	16	15.6
Commercial and Industrial Projects	16	15	17	12	12.2
sub-total PID	**145**	**23,611**	**25,694**	**119.2**	**121.4**
Unserved Areas (UsA) - No. of Customers	**N/A**	**589**	**589**	**0.8**	**0.8**
Total		**24,200**	**26,283**	**120.0**	**122.2**

The Linden power utility reported a total of 2,695 unserved customers, which would be addressed within due course of its development plans.

Table 2: Regional breakdown of potential total number of customers

Region No.	No. of New Potential Customers by		Utility Company
	Planned Infrastructural Development	Unserved Areas	
2	1,552	38	GPL
3	6,651	25	
4	12,458	221	
5	1,977	236	
6	466	56	
7	507	13	
sub-total GPL Only	**23,611**	**589**	
10	2,083	2,695	LECI (Linden)
Total	**25,694**	**3,284**	

For the year 2023, it is expected that GPL will have a total of 225,002 customers. Assuming a steady percentage share among the tariff groups (Residential – 91.2 %, Commercial – 8.31% and Industrial - 0.49%) and referencing the total number of potential customers resulting from Planned Infrastructural Development, addressing unserved areas, and the estimated additional 15,812 customers, the projected total number of customers for the aggregated GPL power system in year 2028 is 265,014 – an increase of 40,012 relative to year 2023. See Table 3 for further details.

Table 3: Breakdown of GPL customer projection

Year (GPL ONLY)	2022	2023	2024	2025	2026	2027	2028
No.of Residential Services	199,838	205,385	211,412	217,838	224,889	232,749	241,769
No.of Commerical Services	18,221	18,695	19,225	19,784	20,404	21,096	21,890
No.of Industrial Services	863	922	988	1,062	1,146	1,243	1,354
Total No. of Services	**218,922**	**225,002**	**231,625**	**238,684**	**246,440**	**255,088**	**265,014**

With the annual projection of the total number of customers, Table *4* shows the project sales for the current planning period.

Table 4: GPL projected sales for the current planning period

Annual Sales (GPL ONLY)	2022	2023	2024	2025	2026	2027	2028
Residential Sales (MWh)	394,229	438,866	580,721	777,885	947,616	1,082,285	1,236,655
Commercial Sales (MWh)	116,254	128,126	171,787	212,136	240,668	273,545	312,035
Industrial Sales (MWh)	242,567	292,940	404,992	522,402	620,165	773,444	926,863
Total Sales (MWh)	**753,050**	**859,932**	**1,157,500**	**1,512,423**	**1,808,449**	**2,129,273**	**2,475,553**

Total losses for the year 2022 were reported at 24.92% and it is estimated to be 23.43% by December 31st, 2023 - a 1.49% reduction relative to the previous year. In consideration of the planned T&D and metering projects, which are essentially geared towards ensuring that GPL achieves its operational and planning targets, and specific strategic approach to curb commercial/non-technical losses, total losses are expected to be 9.96% by December 31st, 2028 - an estimated 13.48% reduction relative to year 2023. See Table 5 for further details.

Table 5: GPL Project losses breakdown for 2024-2028

Year	2023	2024	2025	2026	2027	2028
Total Losses factor (%)	23.43%	22.20%	20.47%	17.32%	12.09%	9.96%
Technical loss factor (%)	*9.52%*	*9.31%*	*9.11%*	*8.88%*	*7.48%*	*6.88%*
Non-Technical loss factor (%)	*13.92%*	*12.89%*	*11.36%*	*8.43%*	*4.61%*	*3.08%*

Accounting for the above-projected sales, losses and the aggregated power plant's auxiliary demand, the projected required annual gross generation for the current planning period for the total GPL power system is shown in Table 6.

Table 6: GPL Projected Net grid export and Gross Generation for 2024-2028

Year	2023	2024	2025	2026	2027	2028
Gross Generation (GWh)	1,154.0	1,529.1	1,952.8	2,244.7	2,489.4	2,825.4
Aux Demand (GWh)	30.9	41.3	51.1	57.4	67.2	76.1
Aux Demand (% of Gross Gen.)	2.68%	2.70%	2.62%	2.56%	2.70%	2.69%
Net Grid Export (GWh)	1,123.1	1,487.8	1,901.7	2,187.2	2,422.2	2,749.3
Total Losses (GWh)	263.2	330.3	389.3	378.8	292.9	273.8
Sales (GWh)	859.9	1,157.5	1,512.4	1,808.4	2,129.3	2,475.6

Referencing Table 6, the following are the 10-year demand forecasts for individual GPL power systems.

1. **DBIS** – gross generation is required to grow at an estimated rate of 20% per annum over the next 5 years, and 13% per annum over the next 10 years to satisfy the forecast annual peak demand as shown in Table 7.

Table 7: DBIS 10-year demand forecast

DBIS	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Gross Generation (GWh)	1,094.38	1,444.28	1,844.23	2,120.53	2,352.07	2,669.17	2,879.86	3,111.25	3,204.71	3,300.56	3,443.64
Aux Demand (GWh)	27.48	36.07	46.54	53.83	62.30	70.70	76.28	82.41	84.88	87.42	91.21
Net Export (GWh)	1,066.90	1,408.20	1,797.69	2,066.69	2,289.77	2,598.47	2,803.58	3,028.84	3,119.82	3,213.14	3,352.42
Total Losses (%)	23.55%	22.37%	20.64%	17.48%	12.23%	10.08%	9.07%	8.47%	7.88%	7.28%	6.68%
Technical Losses (%)	9.56%	9.48%	9.27%	9.04%	7.62%	7.00%	6.49%	6.39%	6.29%	6.20%	6.10%
Non-Technical Losses (%)	13.98%	12.89%	11.36%	8.43%	4.61%	3.08%	2.58%	2.08%	1.58%	1.08%	0.58%
Total Losses (GWh)	251.21	314.98	370.96	361.22	279.97	261.98	254.19	256.58	245.70	233.91	224.08
Sales (GWh)	815.69	1,093.23	1,426.73	1,705.48	2,009.80	2,336.49	2,549.38	2,772.26	2,874.12	2,979.23	3,128.35
Load Factor (pu)	0.69	0.71	0.74	0.74	0.74	0.76	0.76	0.77	0.76	0.76	0.76
Peak Demand (MW)	181.30	232.21	284.50	327.12	362.84	400.92	432.57	461.25	481.36	495.76	517.25

It is important to highlight that year 2022 demand forecast was developed using established econometric modelling techniques, having a top-down approach, while for year 2023, the results are based on the application of simple regression using a bottom-down approach. Figure 1 clearly shows there is a strong statistical correlation between the forecast results of the DBIS developed in the years 2022 and 2023. As such, it can be assumed that the projected GWh and MW for the DBIS have a high probability of realisation.

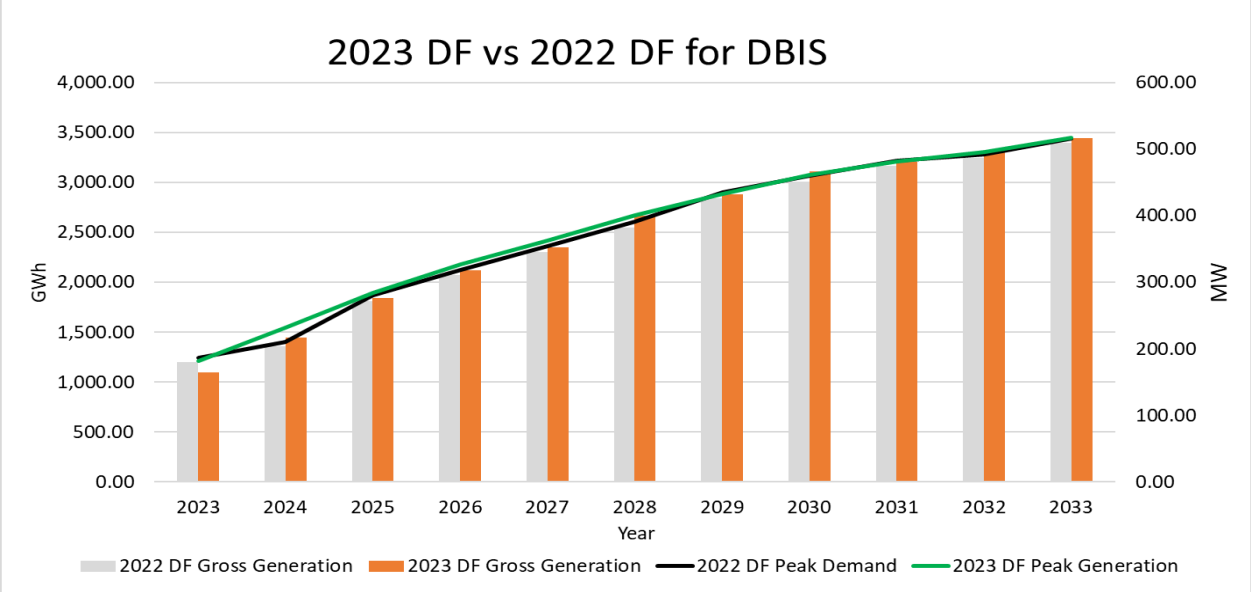

Figure 1: Comparison of DBIS Demand Forecasts: Year 2022 vs Year 2023

2. **Anna Regina** – as the larger isolated power system, primarily driven by rice cultivation and other agricultural activities, gross generation is required to grow at an estimated rate

of 21% per annum over the next 5 years to satisfy the forecast annual peak demand as shown in Table 8.

Table 8: Anna Regina's 10-year demand forecast

Anna Regina	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Gross Generation (GWh)	42.76	59.47	76.25	87.25	96.43	109.56	118.48	127.98	131.69	135.60	141.53
Aux Demand (GWh)	3.37	4.69	6.01	6.88	7.60	8.63	9.34	10.09	10.38	10.69	11.16
Net Export (GWh)	39.39	54.78	70.24	80.37	88.83	100.92	109.14	117.89	121.31	124.91	130.38
Total Losses (%)	21.68%	19.44%	17.93%	15.18%	10.61%	8.74%	8.22%	7.69%	7.17%	6.64%	6.12%
Technical Losses (%)	8.80%	8.19%	8.01%	7.82%	6.59%	6.05%	5.96%	5.88%	5.79%	5.70%	5.61%
Non-Technical Losses (%)	12.87%	11.25%	9.92%	7.36%	4.02%	2.69%	2.25%	1.82%	1.38%	0.94%	0.51%
Total Losses (GWh)	8.54	10.65	12.59	12.20	9.42	8.82	8.97	9.07	8.69	8.30	7.98
Sales (GWh)	30.85	44.13	57.65	68.17	79.41	92.10	100.18	108.83	112.62	116.61	122.40
Load Factor (pu)	0.66	0.70	0.71	0.72	0.74	0.74	0.75	0.75	0.75	0.75	0.75
Peak Demand (MW)	7.37	9.70	12.26	13.83	14.88	16.90	18.03	19.48	20.04	20.64	21.54

3. **Leguan** – from the perspective of demand and as an island with rice cultivation being its economic back bone, gross generation is required to grow at an estimated rate of 22% per annum over the next 5 years to satisfy the forecast annual peak demand as shown in Table 9.

Table 9:Leguan 10-year demand forecast

Leguan	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Gross Generation (GWh)	2.24	3.21	4.10	4.69	5.19	5.91	6.38	6.89	7.09	7.31	7.63
Aux Demand (GWh)	0.01	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05
Net Export (GWh)	2.23	3.19	4.08	4.67	5.16	5.87	6.34	6.85	7.05	7.26	7.58
Total Losses (%)	17.22%	15.39%	14.20%	12.01%	8.39%	6.91%	6.49%	6.07%	5.66%	5.24%	4.83%
Technical Losses (%)	6.99%	6.46%	6.32%	6.16%	5.19%	4.77%	4.70%	4.63%	4.56%	4.49%	4.42%
Non-Technical Losses (%)	10.23%	8.94%	7.88%	5.85%	3.20%	2.14%	1.79%	1.44%	1.10%	0.75%	0.40%
Total Losses (GWh)	0.38	0.49	0.58	0.56	0.43	0.41	0.41	0.42	0.40	0.38	0.37
Sales (GWh)	1.84	2.70	3.50	4.11	4.73	5.47	5.93	6.43	6.65	6.88	7.21
Load Factor (pu)	0.67	0.69	0.71	0.73	0.76	0.77	0.77	0.77	0.77	0.77	0.77
Peak Demand (MW)	0.38	0.53	0.66	0.73	0.78	0.88	0.95	1.02	1.05	1.08	1.13

4. **Wakenaam** – as the geographically larger electrified island in the Essequibo River where rice cultivation is also the key economic driver, gross generation is required to grow at an estimated rate of 19% per annum over the next 5 years to satisfy the forecast annual peak demand as shown in Table 10

Table 10: Wakenaam 10-year demand forecast

Leguan	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Gross Generation (GWh)	2.24	3.21	4.10	4.69	5.19	5.91	6.38	6.89	7.09	7.31	7.63
Aux Demand (GWh)	0.01	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05
Net Export (GWh)	2.23	3.19	4.08	4.67	5.16	5.87	6.34	6.85	7.05	7.26	7.58
Total Losses (%)	17.22%	15.39%	14.20%	12.01%	8.39%	6.91%	6.49%	6.07%	5.66%	5.24%	4.83%
Technical Losses (%)	6.99%	6.46%	6.32%	6.16%	5.19%	4.77%	4.70%	4.63%	4.56%	4.49%	4.42%
Non-Technical Losses (%)	10.23%	8.94%	7.88%	5.85%	3.20%	2.14%	1.79%	1.44%	1.10%	0.75%	0.40%
Total Losses (GWh)	0.38	0.49	0.58	0.56	0.43	0.41	0.41	0.42	0.40	0.38	0.37
Sales (GWh)	1.84	2.70	3.50	4.11	4.73	5.47	5.93	6.43	6.65	6.88	7.21
Load Factor (pu)	0.67	0.69	0.71	0.73	0.76	0.77	0.77	0.77	0.77	0.77	0.77
Peak Demand (MW)	0.38	0.53	0.66	0.73	0.78	0.88	0.95	1.02	1.05	1.08	1.13

5. **Bartica** – as Guyana's gate to the mining industry, gross generation is required to grow at an estimated rate of 24% per annum over the next 5 years to satisfy the forecast annual peak demand as shown in Table 11.

Table 11: Bartica 10-year demand forecast

Bartica	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Gross Generation (GWh)	12.17	18.94	24.08	27.44	30.37	34.81	37.47	40.42	41.59	42.86	44.78
Aux Demand (GWh)	0.01	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05
Net Export (GWh)	12.16	18.92	24.06	27.41	30.34	34.77	37.43	40.38	41.55	42.82	44.73
Total Losses (%)	22.57%	20.18%	18.61%	15.75%	11.00%	9.06%	8.51%	7.97%	7.42%	6.88%	6.33%
Technical Losses (%)	9.17%	8.47%	8.29%	8.08%	6.81%	6.26%	6.17%	6.08%	5.98%	5.89%	5.80%
Non-Technical Losses (%)	13.40%	11.71%	10.33%	7.67%	4.19%	2.80%	2.35%	1.89%	1.44%	0.98%	0.53%
Total Losses (GWh)	2.74	3.82	4.48	4.32	3.34	3.15	3.19	3.22	3.08	2.94	2.83
Sales (GWh)	9.42	15.10	19.58	23.09	27.00	31.62	34.25	37.16	38.47	39.88	41.90
Load Factor (pu)	0.66	0.65	0.68	0.71	0.73	0.76	0.76	0.84	0.85	0.85	0.85
Peak Demand (MW)	2.10	3.33	4.04	4.41	4.75	5.23	5.63	5.49	5.59	5.76	6.01

1.4 Current Status of Power Generation

The GPL power systems are divided into two main groups: the Demerara Berbice Interconnected System (DBIS) and the Isolated Group of Power Systems. With the GOE II 46.5 MW power plant – DP5 in commercial operation, GPL's aggregated number of power plants currently stands at 13, and totals 186.3 MW of firm available generation capacity. The DBIS aggregated available capacity of 154.4 MW comprises 9 power plants and the isolated group of power systems, 19 MW resulting from 4 power plants.

The isolated group of power systems comprise Anna Regina, Wakenaam, Leguan and Bartica – one power plant in each power system.

Demerara Berbice Interconnected System

In the DBIS, HFO-fired generator units account for 90.6% and LFO-fired, 9.4% of the total available capacity. For the Isolated Systems, 15% of the total capacity is HFO-fired and 85% is LFO-fired. See Table 12 for further details.

Table 12: Breakdown of GPL's Total Firm Available Generation Capacity by fuel type

Fuel Type	Demerara	Berbice	Total DBIS	Anna Regina	Wakenaam	Leguan	Bartica	Total Isolated	Total GPL
MWs of HFO	151.0	17.8	**168.8**	4.5	0.0	0.0	0.0	**4.5**	**173.3**
MWs of LFO	3.4	14.1	**17.5**	9.9	1.1	1.2	4.7	**17.0**	**34.5**
Total Available Capacity (MW)	**154.4**	**31.9**	**186.3**	**14.4**	**1.1**	**1.2**	**4.7**	**21.5**	**207.8**
Fuel Type	**Demerara**	**Berbice**	**Total DBIS**	**Anna Regina**	**Wakenaam**	**Leguan**	**Bartica**	**Total Isolated**	**Total GPL**
% of HFO	97.8%	55.8%	**90.6%**	31.3%	0.0%	0.0%	0.0%	**21.0%**	**83.4%**
% of LFO	2.2%	44.2%	**9.4%**	68.8%	100.0%	100.0%	100.0%	**79.0%**	**16.6%**

In the DBIS, 12 generator units totalling 53.1 MW are considered aged, surpassing their maximum operational lifespan of 25 years. For the majority period of the year 2023, the average total available capacity is 186.3 MW (Table 13), where the DBIS is currently saddled with a total

of 62.6 MW of unreliable capacity - 53.1 MW is from units surpassing their operational lifespan and 9.5 MW, highspeed mobile, LFO-fired generator units.

Table 13: Summary of existing power generation profile: 2023-2028 (DBIS)

DBIS	Year	2023	2024	2025	2026	2027	2028
Demerara	Total Available Capacity (MW)	154.4	154.4	154.4	154.4	154.4	154.4
	Reliable Capacity (MW)	108.9	108.9	108.9	108.9	108.9	108.9
	Unreliable Capacity (MW)	45.5	45.5	45.5	45.5	45.5	45.5
	Cold Reserve Capacity (MW)	-	-	-	-	-	-
	Accumulated Cold Reserve (MW)	-	-	-	-	-	-
Berbice	Total Available Capacity (MW)	31.9	31.9	31.9	23.8	23.8	14.8
	Reliable Capacity (MW)	14.8	14.8	14.8	14.8	14.8	14.8
	Unreliable Capacity (MW)	17.1	17.1	17.1	9.0	9.0	-
	Cold Reserve Capacity (MW)	-	-	-	8.1	-	9.0
	Accumulated Cold Reserve (MW)	-	-	-	8.1	8.1	17.1
DBIS Total	Total Available Capacity (MW)	186.3	186.3	186.3	178.2	178.2	178.2
	Reliable Capacity (MW)	123.7	123.7	123.7	123.7	123.7	123.7
	Unreliable Capacity (MW)	62.6	62.6	62.6	54.5	54.5	54.5
	Cold Reserve Capacity (MW)	-	-	-	8.1	-	9.0
	Accumulated Cold Reserve (MW)	-	-	-	8.1	8.1	17.1

In the year 2023, the recorded suppressed peak demand on 27th September 2023 was 172.9 MW. This peak demand was supported reliably by an available firm capacity of 176.9 MW. Table 14 shows that with the loss of one of the largest generator units (9.3 MW), the outcome will invariably result in Energy Not Served – taking the form of either load shedding or partial or total system shutdown.

In the year 2023, these events were recorded in different instances, with the certainty of total shutdown resulting from increased forced outages of generator units.

The results for 2024-2028 shown in Table 14 are premised on the scenario of no increase in firm installed generation capacity and do not include the committed generation expansion projects. These results aim to demonstrate the minimum required firm generation capacity for the current planning period of 2024-2028.

As the peak demand increases the reliability of the DBIS will exacerbate, even with significant improvements in addressing forced outages of generator units. The results shown in Table 14 demonstrate the invariable need to boost firm generation capacity in the DBIS. As such, Table 14 shows the minimum firm generation capacity required to mitigate the loss of a 9.3 MW generator unit (N-G-1 event) for the period 2024-2028.

The Government of Guyana, through GPL, has already commenced addressing the generation capacity issues with the construction of a 28.9 MW HFO-fired power plant at Columbia, Mahaicony, East Coast Demerara. This plant will be integrated with the DBIS through the 69/13.8kV substation at Columbia and is expected to be commissioned by 15th December 2023.

Table 14: Capacity reserve margin and impact of N-G-1 on the DBIS

Year	2023	2024	2025	2026	2027	2028
Current State						
Peak Demand (MW)	181.3	232.2	284.5	327.1	362.8	400.9
Avail. Gen. Capacity (MW)	176.9	186.3	186.3	186.3	186.3	186.3
Capacity Reserve (MW)	**-4.4**	**-45.9**	**-98.2**	**-140.8**	**-176.5**	**-214.6**
CRM (%)	**-2.4%**	**-19.8%**	**-34.5%**	**-43.0%**	**-48.7%**	**-53.5%**
Largest Generator Unit (MW)	9.3	9.3	9.3	9.3	9.3	9.3
Impact Factor: N-G-1	**-0.5**	**-4.9**	**-10.6**	**-15.1**	**-19.0**	**-23.1**
Outcome of an N-G-1 Event	**ENS**	**ENS**	**ENS**	**ENS**	**ENS**	**ENS**
Min. Required MW to Satisfy Spinning Reserve Capacity						
Spinning Reserve - Min.	150%	150%	150%	150%	150%	150%
Spinning Reserve (MW)	13.95	13.95	13.95	13.95	13.95	13.95
Additional Capacity (MW)	**18.4**	**59.9**	**112.1**	**154.8**	**190.5**	**228.6**
Total DBIS Available Capacity (MW)	**195.3**	**246.2**	**298.4**	**341.1**	**376.8**	**414.9**
Capacity Reserve (MW)	13.95	13.95	13.95	13.95	13.95	13.95
Impact Factor: N-G-1	1.5	1.5	1.5	1.5	1.5	1.5
Outcome of an N-G-1 Event	**NI**	**NI**	**NI**	**NI**	**NI**	**NI**

Further, the Government of Guyana, through the Guyana Power & Gas Inc. and Gas-to-Energy Task Force, is currently constructing the 300 MW Gas-to-Energy power plant at Wales, West Bank Demerara and associated relevant facilities. This power plant will be interconnected with the DBIS at three critical points (Vreed-en-Hoop, Golden Grove, and Sophia), supplying reliable, cheaper, and cleaner electricity. The plant is expected to be commissioned circa Q1 of the year 2025. In the interim, the 28.9 MW HFO-fired power plant at Columbia is expected to serve the increasing demand of the DBIS.

The 28.9 MW HFO-fired, and 300 MW Gas-to-Energy power plant projects are classified as committed power generation projects. The benefits of these projects are evaluated probabilistically, and the high-level results are presented in section 1.7.1 on page 14 of this executive summary.

Isolated Group of Power Systems

In the Isolated group of Power Systems, the total unreliable capacity stands at 8.7 MW. Albeit small in capacity, regarding supply-demand, it is considered significant for the smaller power systems. See Table 15 for full breakdown details of each isolated power system.

The isolated group of power systems are lesser complex and as such, primary focus is placed on their contingency capacity. The contingency capacity is the amount of MW remaining after accounting for the power system's peak demand and the required spinning reserve (150% of the largest generator unit). The target is to ensure that the contingency capacity is equal to or greater than the one of the generator unit's capacity.

Table 15: Power generation profile: 2023-2028 (Isolated group of Power Systems)

ISOLATED SYSTEMS	Year	2022	2023	2024	2025	2026	2027	2028
Anna Regina	Total Available Capacity (MW)	14.4	11.4	12.9	14.4	14.4	14.4	14.4
	Reliable Capacity (MW)	4.5	1.5	3.0	4.5	4.5	4.5	4.5
	Unreliable Capacity (MW)	5.6	5.6	5.6	5.6	5.6	5.6	5.6
	Cold Reserve Capacity (MW)	-	-	-	-	-	-	-
	Accumulated Cold Reserve (MW)	-	-	-	-	-	-	-
Wakenaam	Total Available Capacity (MW)	1.15	1.15	1.15	1.15	1.15	1.15	1.15
	Reliable Capacity (MW)	0.82	0.82	0.82	0.82	0.82	0.82	0.82
	Unreliable Capacity (MW)	0.33	0.33	0.33	0.33	0.33	0.33	0.33
	Cold Reserve Capacity (MW)	-	-	-	-	-	-	-
	Accumulated Cold Reserve (MW)	-	-	-	-	-	-	-
Leguan	Total Available Capacity (MW)	1.23	1.23	1.23	1.23	1.23	1.23	1.23
	Reliable Capacity (MW)	-	-	-	-	-	-	-
	Unreliable Capacity (MW)	1.23	1.23	1.23	1.23	1.23	1.23	1.23
	Cold Reserve Capacity (MW)	-	-	-	-	-	-	-
	Accumulated Cold Reserve (MW)	-	-	-	-	-	-	-
Bartica	Total Available Capacity (MW)	4.7	4.7	4.7	3.3	3.3	3.3	3.3
	Reliable Capacity (MW)	3.3	3.3	3.3	3.3	3.3	3.3	3.3
	Unreliable Capacity (MW)	1.4	1.4	1.4	-	-	-	-
	Cold Reserve Capacity (MW)	-	-	-	1.4	-	-	-
	Accumulated Cold Reserve (MW)	-	-	-	1.40	1.40	1.40	1.40
Isolated System	Total Available Capacity (MW)	21.5	18.5	20.0	20.1	20.1	20.1	20.1
	Reliable Capacity (MW)	8.6	5.6	7.1	8.6	8.6	8.6	8.6
	Unreliable Capacity (MW)	8.6	8.6	8.6	7.2	7.2	7.2	7.2
	Cold Reserve Capacity (MW)	-	-	-	1.40	-	-	-
	Accumulated Cold Reserve (MW)	-	-	-	1.40	1.40	1.40	1.40

Referencing the existing available generation capacity and forecast peak demand, Table 16 shows the annual contingency capacity of each isolated power system in the event of no generation expansion.

- **Anna Regina**: Insufficient contingency capacity from year 2025.
- **Bartica**: Insufficient contingency capacity from year 2024.

- **Wakenaam**: Insufficient contingency capacity from year 2024.
- **Leguan:** Insufficient contingency capacity from year 2025.

Table 16: Contingency Capacity Projection of Isolated Group of Power Systems

Existing Available Firm Capacity, MW	2023	2024	2025	2026	2027	2028
Anna Regina						
MAN (MW)	1.5	3.00	4.50	4.50	4.50	4.50
Mobile Sets (MW)	9.9	9.9	9.9	9.9	9.9	9.9
Total Anna Regina (MW)	**11.4**	**12.9**	**14.4**	**14.4**	**14.4**	**14.4**
Min Required Spinning Reserve (MW)	**2.25**	**2.25**	**2.25**	**2.25**	**2.25**	**2.25**
Net Capacity (MW)	**9.15**	**10.65**	**12.15**	**12.15**	**12.15**	**12.15**
Peak Demand (MW)	**7.37**	**9.7**	**12.26**	**13.83**	**14.88**	**16.9**
Contingency Capacity (MW)	**1.78**	**0.95**	**-0.11**	**-1.68**	**-2.73**	**-4.75**
Bartica						
Cummins (MW)	3.3	3.3	3.3	3.3	3.3	3.3
Mobile Units (MW)	1.4	1.4	0	0	0	0
Total Bartica (MW)	**4.7**	**4.7**	**3.3**	**3.3**	**3.3**	**3.3**
Min Required Spinning Reserve (MW)	**1.68**	**1.68**	**1.68**	**1.68**	**1.68**	**1.68**
Net Capacity (MW)	**3.02**	**3.02**	**1.62**	**1.62**	**1.62**	**1.62**
Peak Demand (MW)	**2.15**	**3.33**	**4.04**	**4.41**	**4.75**	**5.23**
Contingency Capacity (MW)	**0.87**	**-0.31**	**-2.42**	**-2.79**	**-3.13**	**-3.61**
Wakenaam						
Caterpillar (MW)	1.15	1.15	1.15	1.15	1.15	1.15
Total Wakenaam (MW)	**1.15**	**1.15**	**1.15**	**1.15**	**1.15**	**1.15**
Min Required Spinning Reserve (MW)	**0.62**	**0.62**	**0.62**	**0.62**	**0.62**	**0.62**
Net Capacity (MW)	**0.53**	**0.53**	**0.53**	**0.53**	**0.53**	**0.53**
Peak Demand (MW)	**0.46**	**0.54**	**0.66**	**0.74**	**0.81**	**0.91**
Contingency Capacity (MW)	**0.07**	**-0.01**	**-0.13**	**-0.21**	**-0.28**	**-0.38**
Leguan						
Caterpillar (MW)	1.23	1.23	1.23	1.23	1.23	1.23
Total Leguan (MW)	**1.23**	**1.23**	**1.23**	**1.23**	**1.23**	**1.23**
Min Required Spinning Reserve (MW)	**0.62**	**0.62**	**0.62**	**0.62**	**0.62**	**0.62**
Net Capacity (MW)	**0.62**	**0.62**	**0.62**	**0.62**	**0.62**	**0.62**
Peak Demand (MW)	**0.38**	**0.51**	**0.62**	**0.65**	**0.72**	**0.81**
Contingency Capacity (MW)	**0.24**	**0.11**	**0.00**	**-0.03**	**-0.1**	**-0.19**

Notwithstanding the above results, given that each power system will be equipped with a Solar PV farm and firm BESS capacity, the capacity reserve margin of each power system will be increased, making the power systems more efficient and stable, respectively. See sections 11 and 12 for further details.

1.5 Current Status of Transmission and Distribution Systems

The present transmission and distribution systems provide electricity supply coverage to approximately 99.73% of the total number of households on the Coastland, inclusive of Bartica.

Albeit recorded transmission and distribution reliability indices are currently below their maximum thresholds (Table 17), the current performance is not conductive for sustainable economic development – SAIFI is high and SAIDI durations are too long.

Table 17: T&D reliability indices

Year	T&D Reliability	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Target
2022	SAIFI	7.41	6.26	6.93	6.72	6.10	8.26	7.02	7.77	5.68	7.75	5.51	8.82	**84.18**	**90**
	SAIDI	4.84	6.58	5.90	5.07	8.01	7.30	4.75	8.56	5.72	7.52	8.20	7.37	**79.82**	**95**
2023	SAIFI	2.90	4.44	4.59	5.84	5.34	5.49	4.83	4.84	3.28	4.32	4.15	3.91	**53.92**	**90**
	SAIDI	3.79	4.55	3.72	6.12	5.39	4.85	4.75	7.04	4.45	5.42	5.64	5.17	**60.90**	**95**
Improvements	SAIFI	-61%	-29%	-34%	-13%	-12%	-34%	-31%	-38%	-42%	-44%	-25%	-56%	**-36%**	
	SAIDI	-22%	-31%	-37%	21%	-33%	-34%	0%	-18%	-22%	-28%	-31%	-30%	**-24%**	

One of the salient contributing factors to high SAIFI and SAIDI is thermal stress of transmission and distribution infrastructure. This situation arises due the transmission and distribution system not being expanded at the required rate to address the increasing electricity demand portfolio reliably – resulting from new housing schemes, commercial and industrial zones, and increase in energy intensity per household.

Within the total GPL power system, the majority of the network-related challenges are experienced in the DBIS. A summary of the key critical issues currently experienced, and which the Company is aggressively working to address within the shortest possible time frame, are as follows:

1. Reduced life span of pole structures due to poor poles and cross-arms material quality.
2. Minimal redundancy in the transmission system frequently results in delayed scheduled maintenance, which usually fails line hardware components.
3. High voltage drops due to a combination of long feeder lengths, high electricity demands, and low power factor presented primarily by maximum demand customers.
4. Widespread outages due to fault clearing by protection relay scheme at substation level for feeders without Auto reclosers.
5. Poor operation visibility and the absence of remote control and supervision for sections of primary distribution feeders result in a high dependency on customer fault reports.
6. Lack of adequate and timely availability of T&D resources.
7. Lack of proper monitoring of condition and performance of T&D networks; and
8. Delayed implementation of upgrades and other corrective actions, which include vegetation management.

Figure 2 shows monthly SAIFI of each power system. Peak SAIFI coincides with April. This is expected due to the Easter activities, which usually result in the entanglement of flying objects with power lines. Nevertheless, the current T&D team continues developing field strategies to further reduce SAIFI. Further, it the trend also shows that high SAIFI correlates with the annual rainfall periods. While this is factual, it is also a strong indication that the current T&D infrastructure are not resilient to climate change vulnerability.

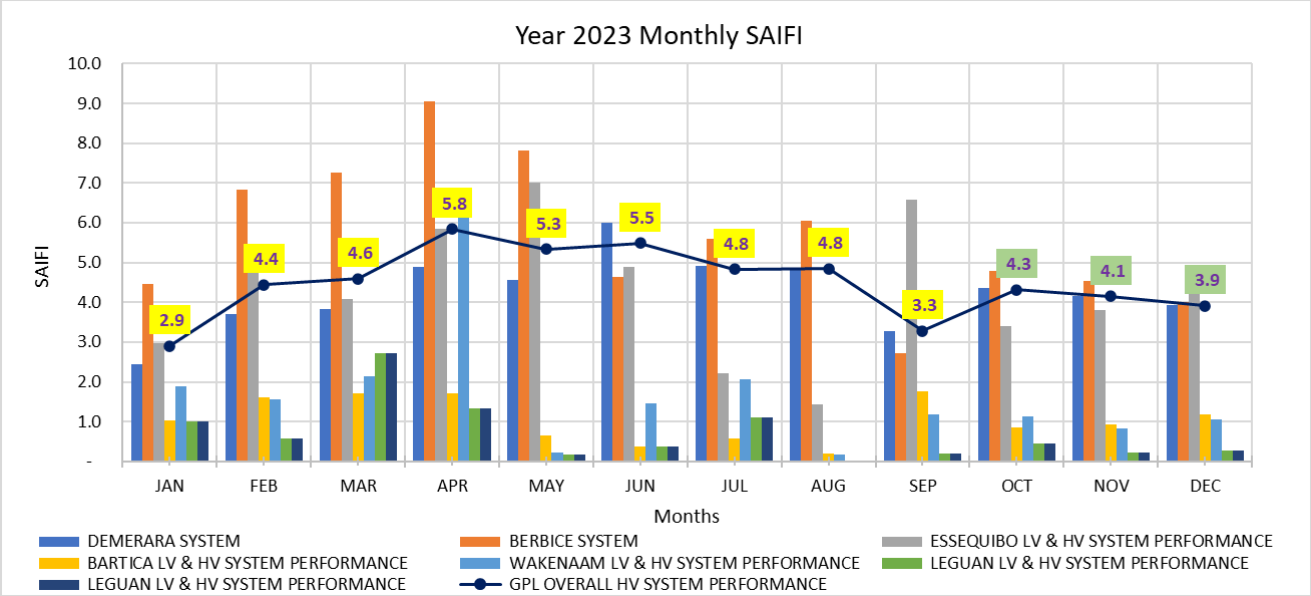

Figure 2: Year 2023 monthly SAIFI

Historically, the SAIFI index of each power system has been varying annually due to many reasons, which include but are not limited to the followings:

1. Execution of maintenance schedule.
2. Execution of works per the recommendation of the pole inspection report.
3. Quality of maintenance work
4. Quality of pole inspection execution and reporting.
5. availability of line hardware materials to complete schedule maintenance works.
6. Effects of Climate Change impacts – increase ambient temperatures and dust particles.
7. Effects of Weather impacts – heavy rainfall and wind gusts
8. Vehicular accidents
9. Accidents related to excavators.
10. Vegetation incumbrances

While current monthly SAIDI is low relative to historical values, in consideration of the projection of the national economic plans, it will be invariable required to lower this index, bring it into the range of minutes per year per customers.

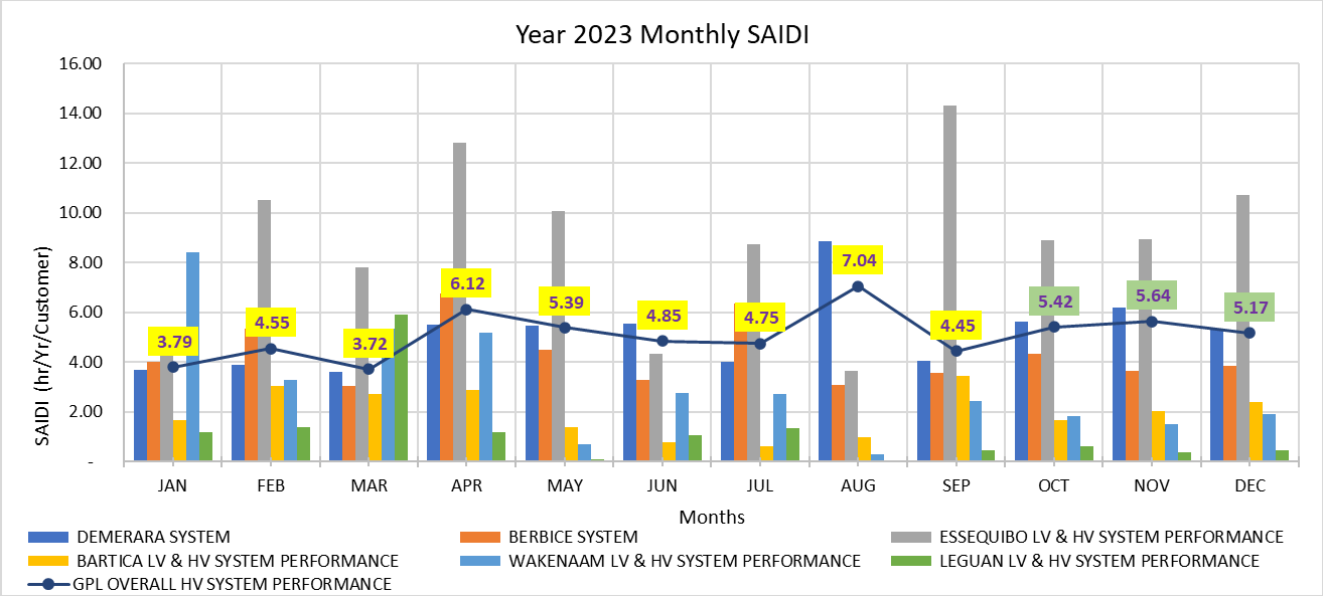

Figure 3: Year 2023 monthly SAIDI

In light of the electricity demand forecast relative to the increase geographic spread customer demands, the current T&D infrastructure will be further thermally stressed, and SAIFI and SAIDI will invariably be exacerbated. GPL is cognizant of the adverse effects of the above on sustainable economic development and remains committed to improving further the SAIFI and SAIDI indices of each power system. This Development and Expansion Programme includes T&D projects to reduce SAIFI and SAIDI.

1.6 Expansion Planning Criteria

In consideration of the aim of the Development and Expansion Programme and its objectives, GPL has developed the following planning criteria:

- **Power Generation:** Use of Loss of Load Probability (LOLP) or Loss of Load Expectation (LOLE) at LOLP ≤ 0.27% per year or LOLE ≤ 1 day/year. The LOLP is a probabilistic metric that indicates the probability of the total available firm generation capacity being unable to satisfy the forecast electricity demand. In the event of a high probability, there would be a corresponding high Expected Energy Not Served (EENS). Additionally, Unserved Served Energy (USE) indicates the demand that could not be met due to a shortage in generation and/or transmission capacity due to transmission congestion.
- **Transmission and Distribution:**
    - Compliance with section 2.6 of the Planning Code for Transmission Reliability Criteria.

- Compliance with section 2.7 of the Planning Code for Voltage Regulation Standards.
- Configure primary distribution feeders to achieve a thermal loading and total backbone length by at least 50%, respectively; and
- Provide backup circuits to mitigate contingencies at the primary distribution level, where applicable and not constrained by the geographic layout of the customer base.

1.7 Power Generation Expansion Plan

The power generation expansion plan for the current planning period is based on probabilistic simulations using Plexos. These simulations take into consideration the generator unit capacity, unit cost of generation (fixed and variable), maintenance schedule and rate, forced outage rate and mean time to repair forced outages of all generators.

1.7.1 Demerara Berbice Interconnected System

The following probabilistic results shown in Table 18 are based on the committed power generation projects for the DBIS. The probabilistic results indicate that for year 2024, the 28.9 MW HFO-fired project will not provide the DBIS with the requisite capacity to achieve the generation planning target – LOLP ≤ 0.27%, which will result in expected energy not served (EENS) – load shedding.

In year 2025, the LOLP is estimated to be 43.72%. This is mainly because of the updated commissioning dates of the 300 MW GTE project: Phase 1 of 183 MW in Q2/Q3 of 2025 and Phase 2 of 112 MW in Q4 of the same year.

It is important to note that the 300 MW GTE project will deliver an installed capacity of 295 MW plus a grid forming 30MW/30MWh BESS, totalling 325 MW of firm capacity. Further, for year 2025, the GuySOL project will add a total of 10 MWp Solar PV projects in Berbice. While the committed capacity for year 2025 is registered at 335 MW, only the 325 will be firm capacity.

The difference between generation capacity and firm generation capacity is that the former considers the sum of conventional and non-conventional generator capacities and the latter, only conventional capacities. For non-conventional generator capacities, these include the total solar PV rooftop capacity of 7.7196 MWac, GuySOL 10 MWp solar PV project in Berbice – year 2025, and 15 MWp in Linden, which is estimated to be connected to the DBIS in year 2027.

Table 18: DBIS Probabilistic results of committed generation projects

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Committed Capacity (MW)
2023	1094.38	181.30	222.92	215.20	33.90	6367.20	9.55	28.9
2024	1444.28	232.21	222.92	215.20	-17.01	40246.81	31.53	0.00
2025	1850.91	284.50	557.92	540.20	255.70	133766.06	43.72	325.0
2026	2135.94	327.12	549.82	532.10	204.98	41.29	0.01	0.00

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Committed Capacity (MW)
2027	2531.87	380.31	579.82	547.10	166.79	70.06	0.03	15.0
2028	2844.32	421.73	570.82	538.10	116.37	478.54	0.21	0.00

The probabilistic results shown in Table 19 indicate that with the recommended 50.4 MW of conventional generation capacity and 15MW/15MWh grid forming BESS, the DBIS in year 2024 will operate stably and reliably – achieving LOLP target. Further in year 2025, with an additional 15MW/15MWh grid forming BESS capacity, the DBIS will be capable of achieving the LOLP target for the remaining years of the current planning period.

Table 19: DBIS Probabilistic results of committed and recommended generation projects

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Additional Generation Capacity (MW)
2023	1094.38	181.30	222.92	215.20	33.90	6367.20	9.55	0.00
2024	1460.19	232.21	288.32	280.60	48.39	164.88	0.31	65.40
2025	1866.51	284.50	638.32	620.60	336.10	511.36	0.79	15.00
2026	2138.39	327.12	630.22	612.50	285.38	2.40	0.00	0.00
2027	2536.62	380.31	660.22	627.50	247.19	6.58	0.00	0.00
2028	2847.70	421.73	651.22	618.50	196.77	25.29	0.01	0.00

Table 20 summarises the committed and recommended generation projects, which would result in the DBIS operating stably and reliability for the current planning period and support future developments.

Table 20: DBIS List of Committed and Recommended Generation Projects

New Generators (DBIS)	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
DBIS Solar-DER	Non-Firm Capacity	7.72	-	-	-	-	-
28.9 MW EPC- Columbia (APAN)	Firm Capacity	28.90	-	-	-	-	-
50.4 MW Power Plant	Firm Capacity	-	50.40	-	-	-	-
DBIS BESS 15 MW/ 30 MWH	Firm Capacity-B	-	15.00	-	-	-	-
DBIS BESS 15 MW/ 30 MWH	Firm Capacity-B	-	-	15.00	-	-	-
GUYSOL - Berbice	Non-Firm Capacity	-	-	10.00	-	-	-
300 MW GTE - Simple Cycle	Firm Capacity	-	-	183.00	-	-	-
300 MW GTE - Combine Cycle	Firm Capacity	-	-	112.00	-	-	-
300 MW GTE Project BESS	Firm Capacity-B	-	-	30.00	-	-	-
GUYSOL Linden BESS	Firm Capacity-B	-	-	-	-	15.00	-
GUYSOL Linden Solar PV	Non-Firm Capacity	-	-	-	-	15.00	-
Total New Additions - Generators		**36.62**	**65.40**	**350.00**	**-**	**30.00**	**-**
Total Accumulated Additions - Generators		**36.62**	**102.02**	**452.02**	**452.02**	**482.02**	**482.02**
Annual Non-Firm Capacity		**7.72**	**-**	**10.00**	**-**	**15.00**	**-**
Annual Firm Capacity - Generators		**28.90**	**50.40**	**295.00**	**-**	**-**	**-**
Accumulated Firm Capacity - Generators		**28.90**	**79.30**	**374.30**	**374.30**	**374.30**	**374.30**

New Generators (DBIS)	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
Existing Firm Capacity - Generators		186.30	186.30	186.30	178.20	178.20	169.20
Total Firm Capacity - Generators		215.20	265.60	560.60	552.50	552.50	543.50
Accumulated Firm Capacity - BESS		-	15.00	60.00	60.00	75.00	75.00
Grand Total Firm Capacity - Generators + BESS		215.20	280.60	620.60	612.50	627.50	618.50

1.7.2 Anna Regina

The committed generation projects for Anna Regina include the 8MWp Solar PV and 6 MW/12MWh BESS GuySOL Project, scheduled to be commissioned by year 2025.

In addition to this project, Table 21 shows the probabilistic results, where it is recommended for Anna Regina power plant's firm generation capacity to be bolstered by a total of 3.4 MW in year 2024 and 1.7 MW in 2028. With the recommended addition of firm generation capacity, not only would the Anna Regina power system be capable of achieving its generation planning targets, but also be able to operate stably, efficiently, and reliably for the current planning period and further afield. Additionally, the reliable power system will certainly foster developments and increase in electricity sales.

Table 21: Anna Regina's probabilistic results of committed and recommended generation projects

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Additional Generation Capacity (MW)
2023	42.76	7.37	11.69	11.40	4.03	70.53	1.11	0.00
2024	59.47	9.70	16.59	16.30	6.60	2.80	0.05	3.40
2025	77.62	12.26	32.09	23.80	11.54	2.68	0.04	0.00
2026	92.08	13.83	32.09	23.80	9.97	0.00	0.00	0.00
2027	103.40	14.88	32.09	23.80	8.92	0.03	0.00	0.00
2028	116.59	16.90	33.79	25.50	8.60	0.07	0.00	1.70

Table 22 summarises the committed and recommended generation projects, which would result in the DBIS operating stably and reliability for the current planning period and support future developments.

Table 22: Anna Regina's List of Committed and Recommended Generation Projects

Anna Regina	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
AR GUYSOL Solar PV	Non-Firm Capacity	-	-	8.00	-	-	-
AR GUYSOL BESS	Firm Capacity	-	-	6.00	-	-	-
AR Solar-DER	Non-Firm Capacity	0.29					
AR HFO Unit (2x1.7 MW)	Firm Capacity	-	3.40	-	-	-	-
AR HFO Unit (1x1.7 MW)	Firm Capacity	-	-	-	-	-	1.70
Total Non-Firm Capacity		0.29	-	8.00	-	-	-

Anna Regina	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
Total Firm Capacity		-	3.40	6.00	-	-	1.70
Total Accumulated Firm Capacity		-	3.40	9.40	9.40	9.40	11.10
Existing Firm Capacity		**11.40**	**12.90**	**14.40**	**14.40**	**14.40**	**14.40**
Grand Total Firm Capacity		**11.40**	**16.30**	**23.80**	**23.80**	**23.80**	**25.50**

1.7.3 Bartica

For year 2023, the reserve capacity is 2.55 MW, however, the LOLP is 0.85%. The high LOLP is attributed to recent events related to the unavailability events of generator units at the power plant. However, in year 2024, the probabilistic simulation results recommend the addition of 2 MW firm capacity in Bartica (Table 23). It is recommended for this capacity to be furnished by a 2MW/2MWh BESS. Using a BESS will aid in maximising the solar farm's production and addressing power system stability issues simultaneously. To ensure customers have access to reliable electricity services, it is further recommended to install an additional 1.1 MW firm generation capacity in year 2026 and 2 MW by 2028.

Table 23: Bartica probabilistic results of committed and recommended generation projects

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Additional Generation Capacity (MW)
2023	12.54	2.15	7.72	4.70	2.55	40.03	0.85	0.00
2024	19.32	3.33	9.72	6.70	3.37	0.08	0.00	2.00
2025	24.82	4.04	8.32	5.30	1.26	4.30	0.11	0.00
2026	27.47	4.41	9.42	6.40	1.99	0.89	0.04	1.10
2027	30.63	4.75	9.42	6.40	1.65	3.48	0.12	0.00
2028	35.86	5.23	11.42	8.40	3.17	0.01	0.00	2.00

Given the above results, Table 24 summarises the list of recommended firm generation and BESS capacities to further improve the reliability of electricity supply, and efficiency of Bartica's power system.

Table 24: Bartica List of Committed and Recommended Generation Projects

Bartica	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
Bartica LFO Unit (1x1.1 MW)	Firm Capacity	-	-		1.10		
Bartica BESS 2 MW/ 2 MWH	Firm Capacity	-	2.00	-	-	-	2.00
Bartica Solar-DER	Non-Firm Capacity	0.16	-	-	-	-	-
Bartica Solar Farm PV+BESS	Non-Firm Capacity	1.26	-	-	-	-	-
Total Non-Firm Capacity		**1.42**	**-**	**-**	**-**	**-**	**-**
Total Firm Capacity		**-**	**2.00**	**-**	**1.10**	**-**	**2.00**
Total Accumulated Firm Capacity		**-**	**2.00**	**2.00**	**3.10**	**3.10**	**5.10**
Existing Firm Capacity		**4.70**	**4.70**	**3.30**	**3.30**	**3.30**	**3.30**
Grand Total Firm Capacity		**4.70**	**6.70**	**5.30**	**6.40**	**6.40**	**8.40**

1.7.4 Wakenaam

The probabilistic results shown in Table 25 illustrate that Wakenaam's current firm generation capacity of 1.15 MW remains reliable. As electricity demand increases, the UAE-CREF grant-funded 750 kWp Solar PV plus 1,151 kWh grid forming BESS project, which will be commissioned in Q1 of 2025, would bolster the generation capacity and capacity reserve of the grid, thereby satisfying the annual demands reliably.

Table 25: Wakenaam probabilistic results of committed generation project

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Additional Generation Capacity (MW)
2023	2.48	0.46	1.17	1.15	0.69	3.12	0.26	0.00
2024	3.22	0.54	2.32	1.55	1.01	2.56	0.21	0.00
2025	4.13	0.66	2.32	1.55	0.89	0.26	0.02	0.00
2026	4.75	0.74	2.32	1.55	0.81	0.46	0.03	0.00
2027	5.30	0.81	2.32	1.55	0.74	1.15	0.09	0.00
2028	5.96	0.91	2.32	1.55	0.64	3.46	0.29	0.00

It must be highlighted that the current firm generation capacity of 1.15 MW comprises a 0.325 MW aged generator unit (26 years old) for which maintenance spares have become obsolete. As a result, its replacement with a generator unit having equal or slightly larger capacity will certainly yield the same probabilistic results shown in Table 25.

To summarise the above results from a project perspective, Table 26 shows the benefits of the UAE-CREF grant-funded project to the overall firm generation capacity of the Wakenaam power system.

Table 26: Wakenaam List of Committed Generation Projects

Wakenaam	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
Wakenaam Solar PV	Non-Firm Capacity	-	0.75				
Wakenaam BESS	Firm Capacity		0.40				
Wakenaam Solar -DER	Non-Firm Capacity	0.02					
Total Non-Firm Capacity		**0.02**	**0.02**	**0.75**	**-**	**-**	**-**
Total Firm Capacity		**-**	**-**	**0.40**	**-**	**-**	**-**
Total Accumulated Firm Capacity		**-**	**-**	**0.40**	**0.40**	**0.40**	**0.40**
Existing Firm Capacity		**1.15**	**1.15**	**1.15**	**1.15**	**1.15**	**1.15**
Grand Total Firm Capacity		**1.15**	**1.55**	**1.55**	**1.55**	**1.55**	**1.55**

1.7.5 Leguan

While currently equipped with 3x 410 kW LFO-fired generator units, it is recommended to bolster the Leguan power system with a 4th 410 kW LFO-fired generator unit to curb LOLP excursion in year 2024. By June of year 2025, the Government of Guyana through the GEA would install a 600 kWp Solar PV farm and 600 kW grid form BESS. The probabilistic results shown in Table 27 indicate that 1.64 MW of firm generation capacity coupled with the grid

forming BESS capacity would render the Leguan power generation capacity reliable within the current planning period.

Table 27: Leguan probabilistic results of committed generation project

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Additional Generation Capacity (MW)
2023	2.24	0.39	1.25	1.23	0.84	0.66	0.02	0.00
2024	3.21	0.53	1.66	1.64	1.11	0.40	0.04	0.41
2025	4.22	0.66	2.86	2.24	1.58	0.39	0.03	0.00
2026	4.84	0.73	2.86	2.24	1.51	0.00	0.00	0.00
2027	5.28	0.78	2.86	2.24	1.46	0.01	0.00	0.00
2028	5.94	0.88	2.86	2.24	1.36	0.02	0.00	0.00

To summarise the above probabilistic results in the form of projects, Table 28 illustrates the relevant details and the available firm generation capacity for the current planning period.

Table 28: Leguan List of Committed Generation Projects

Leguan	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
Leguan Solar PV	Non-Firm Capacity	-	-	0.60	-	-	-
Leguan BESS	Firm Capacity	-	-	0.60	-	-	-
Leguan Solar-DER	Non-Firm Capacity	0.02	-	-	-	-	-
Leguan LFO Unit (1x0.41 MW)	Firm Capacity	-	0.41	-	-	-	-
Total Non-Firm Capacity		**0.02**	**-**	**0.60**	**-**	**-**	**-**
Total Firm Capacity		**-**	**-**	**0.60**	**-**	**-**	**-**
Total Accumulated Firm Capacity		**-**	**-**	**0.60**	**0.60**	**0.60**	**0.60**
Existing Firm Capacity		**1.23**	**1.23**	**1.23**	**1.23**	**1.23**	**1.23**
Grand Total Firm Capacity		**1.23**	**1.23**	**1.83**	**1.83**	**1.83**	**1.83**

1.8 Transmission and Distribution Expansion Plan

The transmission and distribution systems connect the customers to the collective fleet of dispatched generators. In this programme, there are several annually planned capital projects to upgrade and expand the transmission and distribution systems to support GPL achieving its planning and Operation Standard and Performance targets. See section 5.3 on page 75 for specific details on corporate key performance indicators and targets, their relation to

The following EPC projects are currently in execution relative to the committed power generation projects and are expected to be completed during year 2024 and 2025:

1. US$27.5 million 28.9 MW HFO-fired complete modular power plant and grid interconnection ancillaries.
2. US$159.9 million 300 MW GTE Power Evacuation Project:

A. New Transmission Lines and Line Upgrades

1. 24.79 km double circuit 230 kV transmission lines: 300 MW GTE Project Site to Goedverwagting Substation

2. 0.58 km three single-circuit 69 kV transmission lines: 300 MW GTE Project Site to Wales Industrial Substation.
3. 9.14 km double circuit 69 kV transmission lines from Wales Industrial Substation to Wales Commercial/Residential Substation
4. 19 km 69 kV transmission line from Wales Residential/Commercial Substation to Vreed-en-Hoop Substation.
5. A total of 33.9 km of upgrade to the existing 69 kV transmission line from Golden Grove Substation to Sophia Substation.

B. New Substations and Expansions

1. 2x375 MVA 230/69 kV and 2x60 MVA 69/13.8 kV Substation at Goedverwagting.
2. 69 kV Wales Industrial Substation located at 300 MW GTE Project Site.
3. 3x35 MVA 69/13.8 kV Wales Residential/ Commercial Substation.
4. Bay expansion at Vreed-en-Hoop for partial integration of the 300 MW GTE Project into the Western Section of the DBIS at 69 kV.

In addition to the above, the following projects are recommended to address current thermal overloading constraints, reduce technical losses, improve transmission and distribution reliability indices and efficiency, and power quality issues. The following projects totalling US$395.5 million are recommended to be completed by year 2025:

1. Upgrade 2 x 11.8 km 69 kV transmission lines between Garden of Eden and Golden Grove Substations.
2. Upgrade and Parallel 69kV transmission lines between New Sophia and Good Hope Substation (L16).
3. Upgrade and Parallel 69kV transmission lines between Good Hope and Columbia Substation (L17).
4. Replace 69kV submarine transmission line with double circuit 69kV overhead line.
5. Upgrade 69kV transmission line section between Blairmont to Canefield Substation on L21.
6. Construction of 69kV line between Edinburgh and Hydronie Substations.
7. Construction of 69kV line between Garden of Eden and Kuru Kururu Substations.
8. Construction of a new 20 MVA, 69/13.8 kV substation at No. 53 Village, Corentyne Berbice.
9. Construction of Williamsburg 69/13.8 kV Substation.
10. Construction of Ogle 69/13.8 kV Substation.
11. Construction of 69/13.8 kV Substation at Hydronie
12. Construction of 69/13.8 kV Substation at Kuru Kururu.

13. Construction of 69/13.8 kV Substation at Enmore/Victoria with associated 69 kV transmission line.
14. Construction of 69/13.8 kV Substation in Georgetown (Kington/at Princess Street).
15. 69/13.8 kV Substation transformer upgrade at Good Hope Substation.
16. Upgrade to Old Sophia 69/13.8 kV Substation.
17. Procurement of one 35 MVA, 69/13.8 kV, fully equipped mobile substation.
18. Install a total of 55 MVAr fixed, detuned capacitor banks across the DBIS at 69 kV. The interconnection sites and capacities are as follows:
    1. New Sophia Switching Substation – 15 MVAr
    2. Edinburgh Substation – 10 MVAr
    3. Columbia Substation – 15 MVAr
    4. No. 53 Substation – 15 MVAr

With regards to the distribution system, the following are additional projects to be completed by year 2024/25:

1. 4x feeders for Wales Industrial substation, each having approximately 8 km.
2. 4x feeders for Wales Residential/Commercial substation, each having approximately 5 km.
3. 6x feeders for the Goedverwagting substation, each having approximately 5 km.
4. Procure and install 80 Auto Reclosers and 160 sectionalisers.
5. Procure and install 15 Automatic Power Factor Correction Capacity Banks.
6. Procure and install 120 fault current indicators.
7. Upgrade the following feeders:
    1. Golden Grove F3 – 14.8 km of network to be upgraded.
    2. New Georgetown F1 – 17.25 km of network to be upgraded.
    3. Good Hope F4 – 29.6 km of network to be upgraded.
    4. Edinburgh F2 – 94 km of network to be upgraded.
    5. Canefield F1 – 1.4 km of network to be upgraded.
    6. Canefield F4 – 1.4 km of network to be upgraded.
    7. Canefield F3 – 27.9 km of network to be upgraded.
    8. Garden of Eden F1 – 94.29 km of network to be upgraded.
    9. Anna Regina - South Feeder - Express to Onderneeming – 10 km of network to be upgraded.
    10. Anna Regina South Feeder – 8 km of network to be upgraded.
    11. Anna Regina West Feeder – 17 km of network to be upgraded.

12. Extend Anna Regina West Feeder by 16 km to supply electricity to residents of Lake Capoey and Tapakuma.
13. Garden of Eden F2 – 16.4 km of network to be upgraded.
14. Garden of Eden F3 – 19.1 km of network to be upgraded.
15. No. 53 – both feeders – 47.7 km of network to be upgraded.
16. Leguan Feeder Voltage Upgrade – from 4.16 kV to 13.8 kV.
17. JICA Grant: The Grant covers expenses for line conductors and automatic power factor correction capacitors only. GPL to finance the balance of line hardware materials, labour, and transportation costs for these projects. The outstanding works are as follows:
    - Golden Grove F1/F2 -- System Improvement - Express Feeder – 50% remaining.
    - Onverwagt F2 -- System Improvement -No. 7 to Ithica W.C.B Express Feeder – 60% remaining.

8. Power Plant Switchgear Upgrades:
    1. Wakenaam Power Plant.
    2. Leguan Power Plant.
    3. Upgrade tie-lines between DP2 -DP3.
    4. Upgrade 13.8 kV Switchgear at DP2.
    5. Upgrade Grounding Transformer at DP3.
    6. Upgrade Grounding Transformer at DP4.
    7. Generator Neutral Earthing Resistors at DP4.
    8. Upgrade 13.8 kV Switchgear at DP3.

To further improve transmission and distribution reliability, efficiency and operational flexibility, additional investments in this section of the power system are recommended. A summary of these investments, includes for year 2026 to 2028 and attract a total estimated cost of US$491.7 is as follows:

1. Construction of 230/69 kV Williamsburg Substation
2. Construction of 230 kV, 144 km double circuit transmission line from Goedverwagting to Williamsburg
3. A total of 470.7 km of 15 new and upgraded 69 kV transmission lines.
4. 19x 69 kV transmission lines extension totalling 52 km to allow for the interconnection of 12x new 69/13.8kV substations (see 15.1 section on page 136 for more details).
5. Procure and install additional 4 x 5 MVAr multi-step mobile 69 kV capacitor banks.
6. To benefit from Smart Grid, a total of 76 feeders, totalling approximately 409km, are recommended for existing and new substations.
7. Procure and install an additional 120 Auto Reclosers and 240 sectionalisers.

8. Procure and install an additional 35 Automatic Power Factor Correction Capacity Banks.
9. Procure and install 180 fault current indicators.

1.9 Total System Losses and Sales

Thought total losses have been reducing annually and achieving planned targets, especially non-technical, it needs to be decreased further to reflect a positive impact on revenue. For this reason, the Company is enforcing the Electricity Sector Reform Act (ESRA) to further its endeavour of reducing non-technical/commercial losses. The current level of non-technical/commercial losses relative to the required investment to satisfy the forecast demand are not sustainable. In general terms, the salient sources of losses, which will be addresses with the requisite investment, are but not limited to the following:

1. Electricity theft by customers and unregistered “users”.
2. Customers with faulty meters.
3. Billing system (meter reading errors, under estimations);
4. Thermally stressed T&D infrastructure; and
5. Substandard network design and maintenance.

Total losses are forecasted to reduce from 24.92% in year 2022 to 23.43% by the end of 2023 – a reduction of 1.49%. In year 2022, total losses were targeted at 24.1%. Given the above, although the loss reduction target would be achieved, it remains a corporate mandate to further reduce losses – especially non-technical losses. In alignment with planned T&D, energy metering and supervision, and Smart Grid-related investments, total losses are projected to be 9.96% by year 2028. Figure 4 show the annual disaggregation of system losses (technical and non-technical/Commercial).

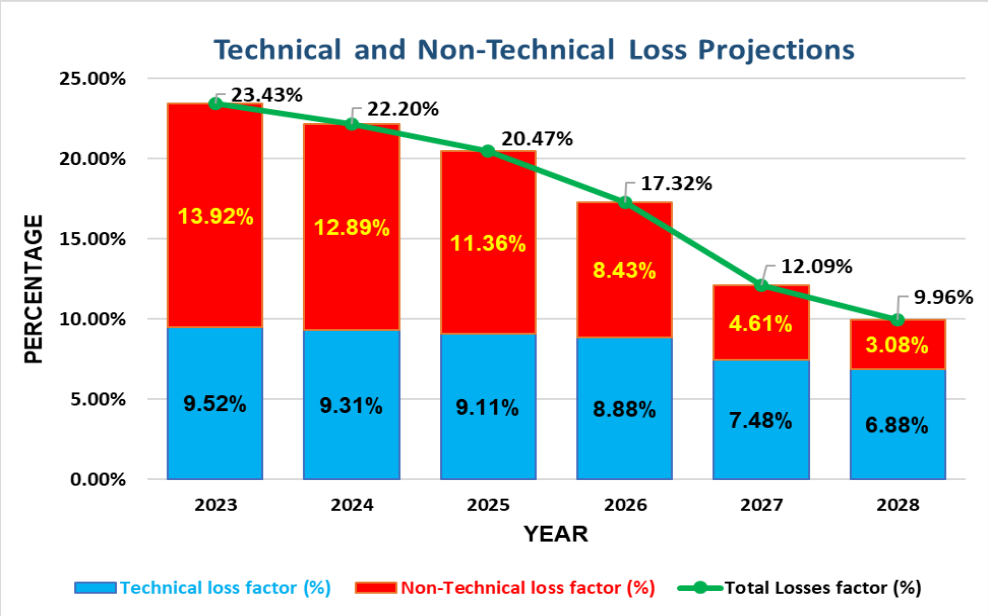

Figure 4: Loss Reduction Projections – Total GPL power systems only

In summary, the investment plan to address system losses include but are not limited to the following:

1. Installation of 180,300 AMI meters complete with new service lines and associated materials,
2. Installation of 20,000 energy efficient LED streetlamp as part of a proposed streetlamp upgrade programme.
3. Regular inspection of areas with new, reinforced networks to reduce illegal connections,
4. Efforts to encourage prosecution of all cases of illegal electricity extraction, and
5. Execution of a Social Management Programme to educate consumers on the impact and consequences of electricity theft.
6. Execution of a Social Management Programme to educate consumers on the use of energy efficient lighting and impact and consequences of installing illegal streetlamps.
7. Reduce and deter electricity theft by carrying out regular:
    a. Field assessment of customers, especially those with zero consumption accounts
    b. Monitoring of defaulting customers
    c. Removal of illegal connections and prosecuting of persons caught.
8. Reduce billing system errors and estimations by:
    a. Verification of all streetlights within NDC's and Municipalities
    b. Implementation of the Street lamp upgrade programme.

Further details relative to the above list can be found in section 18 on page 151.

Referencing the total system losses and forecast gross generation, Figure 5 provides a projection of Net Grid Export, Sales, and Total Losses.

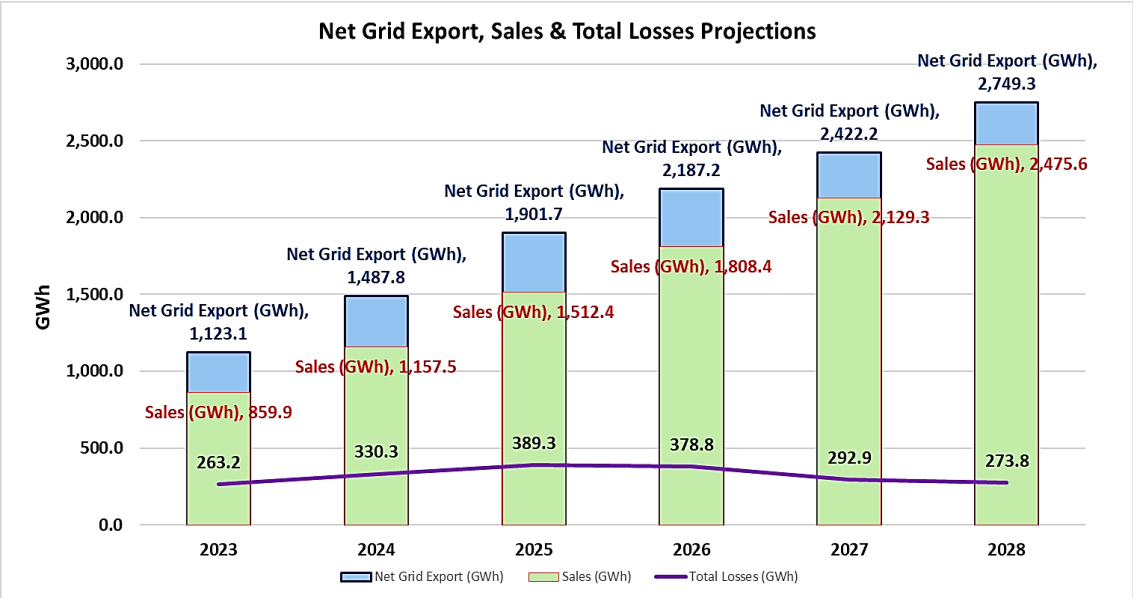

Figure 5: Project net grid export and sales of total GPL power systems

Total GPL sales for year 2022 closed at 753.05 GWh and it estimated that by the end of 2023, it would be 859.9 GWh – a 14.2 % increase. Concomitant with the forecast increase of the number of customers, energy consumption intensity and planned investments to improve power system reliability and stability, sales is projected to increase at an average of 23.8% per annum during the life of this Programme, reaching 1,512 GWh in year 2025, and 2,475 GWh in 2028.

1.10 Tariff

The reduction of tariffs remains a priority for the Government of Guyana and GPL. Whilst the Company's operating license provides a tariff mechanism to adjust rates to ensure profitability and self-sustainability, GPL will continue to adopt prudent operating practices to reduce losses and improve generation efficiency in its efforts to sustain lowered tariffs to all customers.

During 2015 and 2016, when world market fuel prices declined, the Company applied a fuel rebate of five percent (5%) and ten percent (10%) respectively. In addition, tariffs were reduced by five percent (5%) in year 2016. The aggregated effect was a twenty percent (20%) reduction in tariffs over year 2014. During the year 2021, the fifteen (15%) fuel rebates were removed and concurrently the headline tariffs were reduced by the same amount thus concretising the reduction in rates.

Despite steady increases in world market fuel prices from year 2015, when prices were below US$40 a barrel at the end of that year to more than US$90 a barrel currently, an increase of over 125% the Company has not applied any fuel surcharge or tariff increases as provided for under its license.

Whilst lowered and sustained tariffs are among the Company's primary objectives, GPL remains challenged to fund network and generation improvement projects without debt financing and grants from multi-lateral concessional lending agencies.

The following factors have a major influence on GPL's ability to lower Tariffs from the current level of approximately US$ 23 cents per kWh. A review of the projected financial performance for the period to Year 2028 highlights the following:

i) Growth in Sales Demand

The significant growth in demand (increase of approximately 145%) over the five (5) year period is projected to have a favourable impact on the generation of profits and operating cash flows. The projections have included a 50% reduction in tariffs from the beginning of year 2026.

ii) Losses (Technical and Commercial losses)

Losses are projected to decline from 23.43% to 9.96%. Further reductions in losses will have a positive impact on the financial performance and would improve the ability of the company to lower tariffs even further.

iii) Cost of Generation

By year 2025, generation using natural gas supplied by way of the planned gas pipeline is projected to provide more than 80% of the required generation. The price at which the electricity is sold to GPL is therefore extremely important and will have the most impact on the ability of the company to lower tariffs by 2025. These projections assume a rate of US five (5) cents per kWh at which GPL will purchase the electricity from the Independent Power Producer.

iv) GPL's Debt Burden

The projections indicate that by the end of 2028, GPL's Related Parties Non-Current Liabilities consisting mainly of loans from the Government of Guyana would increase from approximately G$100 billion to more than G$384 billion.

GPL has negotiated with the Ministry of Finance, the extension of the moratorium on servicing the majority of the current outstanding debt until the year 2026. Discussions are ongoing to extend this moratorium to all of the remaining debt.

Converting this debt to equity, would strengthen GPL's financial position and better position the company to continue to reduce tariffs while at the same time improve its capacity to deliver a stable and high-quality electricity supply to the Nation.

1.11 Capital Programme and Financial Projections

Table 29 to Table 32 below provide summarised details on the capital Programmes, Profit and Loss Account, Cash Flow Statement and Balance Sheet, respectively, for the current planning horizon.

Table 29: Planned Capital Programmes and Investments: 2024-2028

Development and Expansion Projects	US$	Annual Budget (US$)				
		2024	2025	2026	2027	2028
		US$	US$	US$	US$	US$
Conventional Generation	77,110,063	73,391,434		352,629		3,366,000
Solar PV and Battery Energy Storage System	119,885,714	70,800,000	46,285,714			2,800,000
69 kV Transmission Lines (include Sub.Exp.Cost)	286,527,779	65,354,699	71,656,232	79,380,005	58,804,219	11,332,624
230 kV Transmission Lines (Include Sub.Exp.Cost)	82,676,093			45,471,868	37,204,225	
Upgrade - Existing 69/13.8 kV Substation	73,616,671	42,552,103	30,107,937	339,721	616,910	
New 69/13.8 kV Substation	276,255,090	106,969,217	58,541,841	42,275,027	46,722,118	21,746,887
230 kV Substation - New	31,218,477		9,365,543	12,487,391	9,365,543	
New Primary Distribution Feeders	48,937,446	18,210,201	8,817,859	7,556,428	9,346,748	5,006,210
Upgrade to Existing Primary Distribution Network (Technical Loss Reduction)	29,090,616	22,855,373	2,626,316	1,236,498	1,223,785	1,148,644
Transmission Reactive Reinforcement	13,512,390	6,854,315	5,701,076	660,000	297,000	
GNCC/Smart Grid	18,640,000				200,000	18,440,000
Power Plant Upgrades	26,651,582	12,231,539	6,300,000	452,927	321,197	7,345,919
Studies	700,000	700,000				
Meter Upgrades/Replacements (Non-Technical Loss Reduction)	91,135,000	10,730,000	18,264,750	19,203,000	20,879,500	22,057,750
Electrification (Unserved Areas)	994,104	462,809	377,863	50,200	63,053	40,179
New Services	23,827,178	3,692,265	3,935,331	4,323,902	5,488,502	6,387,178
Buildings	14,738,725	6,409,506	3,746,144	1,616,524	1,616,551	1,350,000
Company Tools	35,494,499	11,313,770	10,110,073	4,500,447	6,923,195	2,647,014
Information Technology	1,739,273	989,631	561,180	59,371	62,753	66,338
GRAND TOTAL US$	**1,252,750,701**	**453,516,861**	**276,397,859**	**219,965,938**	**199,135,299**	**103,734,744**
Guyana Dollars Equivalent (GY$ Billion)	**269,655**	**97,620**	**59,495**	**47,348**	**42,864**	**22,329**

Source of Funding – Loans facilitated through the Government of Guyana.

Table 30: Profit & Loss Account

	2023 Latest Estimate	Yr 2024 Proj	Yr 2025 Proj	Yr 2026 Proj	Yr 2027 Proj	Yr 2028 Proj
	$'M	$'M	$'M	$'M	$'M	$'M
REVENUE						
Turnover	42,975	58,846	77,066	46,031	54,209	63,017
Rebate						
NET REVENUE	**42,975**	**58,846**	**77,066**	**46,031**	**54,209**	**63,017**
GENERATION COSTS						
Fuel & Freight	34,190	49,685	34,664	4,709	5,713	12,150
Operation & Maintenance	5,076	7,021	6,257	1,159	1,500	2,599
Purchased Power (IPP costs)	2,758	2,768	8,734	22,074	24,037	25,475
	42,024	**59,474**	**49,655**	**27,942**	**31,250**	**40,224**
GROSS INCOME	**951**	**(628)**	**27,411**	**18,088**	**22,959**	**22,793**
EXPENSES						
Employment Costs	6,022	6,997	7,697	8,466	9,313	10,244
Repairs & Maintenance T&D	694	1,841	2,351	2,701	2,994	3,398
Depreciation	3,601	3,678	3,682	9,169	12,599	15,673
Administrative Expenses	2,721	3,348	3,616	3,905	4,218	4,555
Bad Debts Provision	568	883	1,156	690	813	945
	13,606	**16,747**	**18,502**	**24,932**	**29,937**	**34,815**
NET (LOSS)/PROFIT FROM OPERATIONS	**(12,655)**	**(17,375)**	**8,909**	**(6,844)**	**(6,978)**	**(12,022)**
INTEREST EXPENSE	1,445	1,941	6,518	8,474	10,029	11,036
	(14,100)	**(19,316)**	**2,391**	**(15,317)**	**(17,007)**	**(23,058)**
OTHER INCOME	882	971	1,117	1,284	1,477	1,698
NET (LOSS)/PROFIT BEFORE TAX	**(13,218)**	**(18,345)**	**3,508**	**(14,033)**	**(15,530)**	**(21,359)**
TAXATION	(2,644)	(3,669)	702	(2,807)	(3,106)	(4,272)
NET (LOSS)/PROFIT FOR THE YEAR	**(10,574)**	**(14,676)**	**2,806**	**(11,226)**	**(12,424)**	**(17,088)**

In accordance with GPL's Licence, the Shareholder is entitled to a target rate of return on equity of 8% per annum.

Table 31: Cash Flow Statement

Guyana Power & Light	Yr 2024	Yr 2025	Yr 2026	Yr 2027	Yr 2028
Cash flow Statement for the year ended	Proj	Proj	Proj	Proj	Proj
December 31st	$'M	$'M	$'M	$'M	$'M
OPERATING ACTIVITIES					
Profit/(Loss) before Taxation	**(18,345)**	**3,508**	**(14,033)**	**(15,530)**	**(21,359)**
Adjustments for:					
Depreciation	3,678	3,682	9,169	12,599	15,673
Deferred Income	10	47	(80)	21	23
Interest Expense	1,941	6,518	8,474	10,029	11,036
Amortization of Customer Projects					
Operating (loss)/profit before WC changes	**(12,716)**	**13,755**	**3,529**	**7,119**	**5,372**
Working Capital (WC) Changes					
Change in Inventories	(3,429)	2,689	(1,564)	(1,798)	(2,068)
Change in receivables and prepayments	(5)	(2,237)	(1,997)	3,401	(896)
Change in payables and accruals	(20,203)	2,541	(1,275)	693	1,154
Change in related parties	0	0	0	0	0
Taxes paid/refunded	3,669	(702)	2,807	3,106	4,272
Net Cash (Outflow)/Inflow - Operating Activities	**(32,684)**	**16,047**	**1,501**	**12,520**	**7,834**
INVESTING ACTIVITIES					
Acquisition of Property, plant and equipment	17,790	88,092	61,945	59,888	40,804
Increase in WIP	8,920	(9,531)	(3,037)	(1,121)	(5,134)
Net Cash Outflow - Investing Activities	**26,710**	**78,561**	**58,908**	**58,767**	**35,670**
FINANCING ACTIVITIES					
Movement in non current related parties	59,634	67,266	64,668	55,260	37,474
Interest paid	(1,941)	(6,518)	(8,474)	(10,029)	(11,036)
Customer deposits	256	1,392	955	800	1,102
Increase in advances customer financed projects	279	375	257	215	296
Decrease in advances customer financed projects					
Net Cash (Outflow)/Inflow - Financing Activities	**58,229**	**62,515**	**57,407**	**46,247**	**27,836**
NET MOVEMENT IN CASH AND CASH EQUIVALENTS	**(1,166)**	**(0)**	**(0)**	**(0)**	**0**
CASH AND CASH EQUIVALENTS AS AT BEGINNING OF YEAR	(2,834)	(4,000)	(4,000)	(4,000)	(4,000)
CASH AND CASH EQUIVALENTS AS AT END OF YEAR	**(4,000)**	**(4,000)**	**(4,000)**	**(4,000)**	**(4,000)**
Represented By:					
Cash on Hand and at Bank	**(4,000)**	**(4,000)**	**(4,000)**	**(4,000)**	**(4,000)**

Table 32: Balance Sheet

	Unaudited 2023	Year 2024	Year 2025	Year 2026	Year 2027	Year 2028
	G$'m	G$'m	G$'m	G$'m	G$'m	G$'m
ASSETS						
Non Current Assets						
Tangible Fixed Assets	42,537	56,649	141,059	193,835	241,124	266,255
Intangible Fixed Assets	832	832	832	832	832	832
Work in Progress	15,485	24,405	14,874	11,837	10,716	5,582
Investment SEI	3,105	3,105	3,105	3,105	3,105	3,105
Other Assets	10,514	10,514	10,514	10,514	10,514	10,514
	72,473	**95,505**	**170,384**	**220,123**	**266,291**	**286,289**
Current Assets						
Inventories	9,685	13,114	10,426	11,990	13,788	15,856
Related Parties	26,634	26,634	26,634	26,634	26,634	26,634
Receivables	4,206	4,212	6,449	8,446	5,044	5,941
Other Assets	411	411	411	411	411	411
	40,937	**44,371**	**43,920**	**47,480**	**45,878**	**48,842**
TOTAL ASSETS	**113,410**	**139,876**	**214,304**	**267,604**	**312,169**	**335,131**
EQUITY AND LIABILITIES						
Capital and Reserves						
Share Capital	23,118	23,118	23,118	23,118	23,118	23,118
Accumulated (Deficit)/Surplus	(31,822)	(42,396)	(57,072)	(54,266)	(65,492)	(77,917)
Retained Income	(10,574)	(14,676)	2,806	(11,226)	(12,424)	(17,088)
	(19,278)	**(33,954)**	**(31,148)**	**(42,374)**	**(54,799)**	**(71,886)**
Non Current Liabilities						
Deferred Tax	183	183	183	183	183	183
Grants and Customer Financed Projects	1,073	1,352	1,727	1,984	2,199	2,495
Provision for Decommissioning	243	243	243	243	243	243
Customer Deposits	4,770	5,026	6,418	7,374	8,174	9,276
Non-Current Related Party	99,902	159,536	226,802	291,470	346,730	384,204
	106,170	**166,340**	**235,373**	**301,253**	**357,529**	**396,401**
Current Liabilities						
Bank Overdraft	2,834	4,000	4,000	4,000	4,000	4,000
Deferred Income- Prepaid Meters	142	152	199	119	140	163
Payables	23,342	3,138	5,680	4,406	5,099	6,253
Other Liabilities	200	200	200	200	200	200
	26,518	**7,490**	**10,079**	**8,725**	**9,439**	**10,616**
TOTAL EQUITIES AND LIABILITIES	**113,410**	**139,876**	**214,304**	**267,604**	**312,169**	**335,131**

2. Introduction

2.1 General

The Guyana Power and Light Inc. (GPL) is integral in supporting the fast-paced development of Guyana's economy, consistent with its mandate to provide reliable, affordable, and quality electric services to its present and future customers, which also includes complying with all applicable legislations, regulations, standards and Government's National and International Commitments.

The discovery, and establishment of an Oil and Gas sector, and commercial production of oil have catapulted the country's economy to such a prominent level that Guyana is currently one of the fastest-growing economies in the world. According to the 2023 mid-year report, Guyana recorded a 59.5% growth in its Real Gross Domestic Product (RGDP) and a 12.3% growth surge in the non-oil sector.

The economic sectors associated with electricity, which include the forestry and fishing sectors, have expanded by an estimated 7.6%. The rice and livestock industries have also grown by 3.2% and 9.4%, respectively. Further, the manufacturing sector is estimated to have grown by 17.7%, construction by 44.1% and the services industry by 9.1%. The extractive sector (mining and quarry) experienced an overall growth of 89.9%, with strong progress noted in the petroleum subsector, which saw a growth of 98.4%.

Demerara-Berbice Interconnected System (DBIS)

On 27th September 2023, the DBIS recorded a peak demand of 172.9 MW, which was supported by an aggregated available generation capacity of 176.9 MW. It must be underscored that the estimated total self-generating capacity, which is primarily within the remit of the private sector, is estimated to be circa 58 MW. As a result, the estimated current potential peak load demand of the DBIS is approximately 235 MW.

The Government of Guyana remains cognizant of the importance of reliable generation capacity. It provided debt financing to GPL to facilitate the construction of the first largest power generation facility in the Country – 46.5 MWs at Garden of Eden. This plant was commissioned on 1st October 2021.

In year 2023, with continued assistance from the Government, Guyana Power & Light Inc. and APAN Energy Services Inc. signed an EPC Contract in July 2023 for a turnkey 28.9 MW HFO-fired power plant at Columbia, Mahaicony, East Coast Demerara. This plant will comprise 17x1.7 MW containerised generator units. The planned commercial operation date of this power plant is 15th December 2023. With the 28.9 MW in service, the total available firm generation capacity of the DBIS would be 215.2 MW.

In the DBIS, a total of 53.1 MW of available generating capacity – 12 generator units have already surpassed their economic lifespan of 20 years and maximum operation life of 25 in

service. Also, LFO-fired, high-speed generation capacity accounts for a total of 9.5 MW. As a result, the total unreliable capacity in the DBIS is currently 62.6 MW.

In year 2023, because of the combined impact of increasing demand for electricity and absence of adequate generation contingency capacity, scheduled maintenance (minor and major overhauls) of generator units has been delayed. The ripple effect of delayed maintenance surface as increased forced outages, which adds to the already existing unreliable capacity in the DBIS.

At the end of year 2023 the total available capacity is estimated to be 215.2 MW. However, in year 2024, the forecast peak demand is 232.2 MW. As a result, the DBIS will require additional firm power generating capacity to ensure that it can satisfy customers' electricity demand reliably.

Relative to the increasing demand for electric power, there are transmission corridors currently experiencing congestion due to reasons that range from thermal stress, age, lowered conductor emissivity and failing splicing/repair joints.

It must be re-emphasised that maintenance ensures the transmission lines remain reliable, resilient, and efficient. Over the past years, scheduled transmission line maintenance has been constrained by the absence of back-up transmission lines. As a result, scheduled outages of transmission lines to complete dire needed maintenance works have been a challenge. Case in point are the following 69 kV transmission corridors where line trips have already resulted in either massive load shedding, or partial or total system shutdowns:

1. Garden of Eden power plant to Sophia (L1, L2, L3 and L4)
2. Kingston to Sophia (L5)
3. Vreed-en-Hoop to Kingston (LS6)
4. Sophia to Good Hope (L16)
5. Onverwagt to Canefield (L21)

Given the current radial configuration of the 69 kV transmission system, the availability of each section of transmission line is extremely critical to ensure the DBIS remains intact to serve customers' growing demand for electricity reliably. However, in consideration of Guyana's forecast economic environment, there must be back-up/redundant transmission lines to ensure the power systems' security and reliability remain intact – compliant with the relevant sections of the National Grid Code.

In consideration of the increasing electricity demand, the available total number and capacity of distribution feeders are currently limited to satisfying customers' increasing need for reliable and efficient electricity supply. At this level, the following substation feeders are exposed to the greater share of load increase due to current development trends:

1. Garden of Eden – East Bank Demerara
2. Golden Grove – East Bank Demerara
3. New Georgetown – East Bank Demerara and Central Georgetown

4. Kingston – Central Georgetown
5. Old Sophia – Central and Greater Georgetown, and East Coast Demerara
6. Good Hope – East Coast Demerara
7. Canefield – East Bank Berbice and Lower Corentyne
8. No. 53 – Upper Corentyne, Berbice.

Coupled with the absence of back-up or alternative distribution feeders, line maintenance works have been severely impacted. This gives rise to the current low reliability and efficiency of feeders associated with the above-listed substations. As a result of the rapid and massive pace of unfolding developments across Guyana, distribution feeder lengths are invariably increased. This is also another contributing factor to the low current reliability performance of the distribution system in the DBIS.

In the group of isolated power systems, power generation and distribution reliability are not in such a critical state as the DBIS. As development continues to spread further from the current focal points, it will be required to apply the DBIS experience to the group of isolated power systems in advance.

Isolated Group of Power Systems

On the **Essequibo Coast**, for most parts of year 2023, the power plants and feeders have been operating relatively reliable. Together, these systems have been supporting the current increase in electricity demand; improving the livelihood of residents progressively.

In year 2023, peak demand was recorded at 6.5 MW at the Anna Regina power plant, which was supported by the total available generation capacity of 11.7 MW. It must be highlighted that during this peak demand period, only one of the three 1.8 MW generator unit is considered reliable. The balance of 9.9 MW is considered unreliable due to the total capacity originating from high-speed mobile LFO-fired generator units.

The current installed capacity at the Anna Regina power plant can satisfy the forecast demand until the end of 2024. This projection is premised on the execution of schedule maintenance to ensure forced outages remain low.

The Anna Regina power plant is currently outfitted with four (4) feeders. The heavier loaded is the South Feeder (Anna Regina to Supernaam), followed by the North Feeder (Anna Regina to Charity). Within the narrow stretch from Charity to Supernaam, the Government of Guyana has been opening new housing areas, rebuilding schools, upgrading hospitals, and promoting agricultural activities, specifically rice cultivation.

Recently, GPL completed pre-feasibility works to extend the West Feeder to supply electricity to residents of Lake Capoey and Tapakuma. The Government of Guyana, through the GuySOL Project, will install a total of 8 MWp Solar Farm and an aggregated 6 MW/12MWh BESS to assist with reducing the risks associated with fuel price volatility and supply, and to further Guyana’s climate commitments. Nevertheless, as the demand for electricity increases, the

present power system will not be capable of operating reliably. Upgrades and expansion are necessary to address power system reliability and power quality issues.

As a result of the influx of immigrants within the **Bartica**, coupled with the revamping of the mining sector post-year 2020, the electricity demand has been increasing rapidly. In year 2023, peak demand was recorded at 2.1 MW, supported by an available 4.7 MW of firm LFO-fired generation capacity. The 1.5 MW Solar Farm and BESS have been assisting with curtailing fossil fuel consumption. However, while the electricity demand continues to increase, the stability of the power system will become a critical issue.

The four (4) feeders of Bartica have been operating efficiently and reliably.

Leguan and Wakenaam, while located within proximity to each other, these islands have experienced almost similar rates of economic growth. As a result, their electricity demands have strong statistical correlations. On these Islands, rice cultivation is the main economic activity and is the main driver of electricity demand. In year 2023, Leguan and Wakenaam recorded peak demands of 0.36 MW and 0.39 MW, respectively.

Leguan has a firm generation capacity of 1.23 MW to satisfy its electricity demand, while Wakenaam has 1.15 MW. Both power plants are equipped with LFO-fired generator units.

With a grant fund from the UAE-CREF, a 750 kWp Solar PV plus 1,151 kWh BESS (grid forming) project will be commissioned in Wakenaam during Q1 of year 2025.

The Government of Guyana/GEA will install a 600 kWp Solar PV farm with 800 kW BESS (grid forming) in Leguan. This project is expected to be completed by June of year 2025.

The two distribution feeders of Leguan and Wakenaam power systems, respectively, have been operating reliably and efficiently to date.

2.2 Positioning the 2024 – 2028 Development and Expansion Programme

GPL is cognizant of the changing and evolving global energy landscape as electricity generation from renewable energy resources is becoming more affordable and attractive for sustainable development. In addition, cheap and reliable electricity has become increasingly critical to national economic and socio-economic developments.

As the leading supplier of electricity services in Guyana, GPL has comprehensively reviewed its role within the context of supporting national economic development and has revised its core objectives and identified the critical issues, which form the building blocks of this Development and Expansion Programme. The core objectives and critical issues are presented below**:**

Corporate Objectives:

2.1.1 Customer Service

- Provide Customer Centred Quality, Reliable and Timely Products and Services.

  This is integral to improving the Company’s public image and ensuring the long-term business viability of GPL; and

- Build the Market: The demand for electricity services increases while the capital cost of renewable energy self-generation technologies is becoming more affordable. The Company recognizes the importance of lower tariffs, and improved service reliability to sustain and influence growth in its customer base and to extend services to benefit both self-generators and GPL through the increased use of renewables.

2.1.2 Employee Learning and Growth

- Ensure the Company is equipped with the requisite human resources capacity to undertake, operate, and maintain the expanded power systems.
- Ensure the Company's employees possess the requisite knowledge, skills, and competencies to continuously improve the quality of our products and services; and
- To stimulate, develop, and retain a highly engaged and active workforce.

2.1.3 Financials

- Reduce non-technical losses to improve the Company's revenue stream, cognisant with the relevant sections of the Electricity Sector Reform Act (ESRA) and applicable legislation(s).
- Ensure that there are sufficient financial resources to sustain the Company's operations within the short, medium, and long-term timeframes; and
- Mitigate against financial disruptions associated with the various risks currently being experienced by the Company, e.g., fuel price volatility and currency exchange rates.

2.1.4 Core Operations

- Provide a cost-effective electricity service: Electricity is critical to national economic and socio-economic developments. This is crucial to the positioning of the Company and dictates stakeholders' expected delivery of service in addition to competitive and affordable tariffs; and
- Provide a reliable electricity service: The Company intends to aggressively improve its reliability of service through investments in increasing its firm generation capacity, Battery Energy Storage Systems (BESS), upgrading and constructing new distribution feeders, transmission lines and substations and deploying modern and **S**elf-**M**onitoring, **A**nalysis, and **R**eporting **T**echnologies (SMART) to better manage, supervise and support the transmission and distribution systems remotely. These investments would improve power system reliability (LOLP, SAIFI and SAIDI), mitigate transmission and distribution contingencies and congestions, and aid in reducing technical and commercial losses.

2.1.5 Critical Issues

The Company focuses on and intends to prioritise the following four (4) critical issues to achieve operational excellence and corporate strategic objectives. These critical issues are premised on the need to:

1. Improve the Quality of Products and Services.
2. Strengthen Management.
3. Optimize GPL as a System; and
4. Reduce Technical and Commercial Losses.

To address these four (4) critical issues, the current Development and Expansion Programme has developed least-cost optimised expansion plans with technical merits in support of the needs within three (3) major power system blocks, Generation, Transmission and Distribution. With these plans realised, the Company intends to ensure the power system operates within the prescribed technical and economic limits to mitigate cost excursions, guarantee power system reliability and security, and deliver quality service to customers.

The technical limits are described in the National Grid Code.

Further, the Company has updated its human resources strategic plans to ensure that GPL has the requisite capacity to bolster its Development and Expansion Programme. Among the many strategies are the ongoing management restructuring, provision of capacity building and other related upskilling opportunities to employees with the objectives of narrowing the competency and skill gaps that embrace the operation of a modern power system and provide reliable services to customers.

2.3 Outline of Development and Expansion Programme: 2024-2028

- Section 3 (page 37) outlines the recent achievements of the Company.
- Section 4 (page 47) summarises the current major developments of the Company.
- Section 5 (page 65) defines the mandates, planning criteria, inputs, assumptions and describes GPL's Corporate Key Performance Indicators and Targets.
- Section 6 (page 94) presents the current status of power generation capacity.
- Section 7 (page 100) outlines the current status of the transmission and distribution system.
- Section 8 (page 102) details the DBIS generation reliability – no additional capacity.
- Section 9 (page 107) outlines the isolated power systems generation reliability – no additional capacity.
- Section 10 (page 112) details the committed firm and intermittent generation capacities – DBIS.
- Section 11 (page 118) highlights the planned firm and committed intermittent generation capacities – isolated power system.
- Section 12 (page 126) outlines the summary of firm and intermittent generation expansion projects.
- Section 13 (page 132) details the integrated utility service and net billing.
- Section 14 (page 134) outlines Long-term Expansion and International Grid Interconnection.
- Section 15 (page 136) details the Transmission, Distribution and Substation Upgrades and Expansions.
- Section 16 (page 145) describes the Guyana National Control Centre/Smart Grid.
- Section 17 (page 147) outlines the Network Maintenance Plan – 2023-2027.
- Section 18 (page 151) speaks to the Loss Reduction of GPL.
- Section 19 (page 154) details the Non-Technical Operations.
- Section 20 (page 157) summarises Divisional Plans.
- Section 21 (page 172) summarizes the Annual Expansion, Upgrades and Service Work Plan.
- Section 22 (page 187) outlines the Sales and Revenue Collection.
- Section 23 (page 188) details the Projected Capital Expenditure.
- Section 24 (page 192) details the impact of programme on Natural & Social Environment.
- Section 25 (page 193) defines the Major Risks and Contingencies.
- Section 26 (page 199) gives an overview on the Cost Benefit of Investment Projects.

3. Recent Major Achievements

3.1 Conventional Generation

With the aim of ensuring that the Company satisfies the growing demand reliably, GPL commenced a total of five (5) power generation expansion projects between year 2018 and 2020, seeking to increase its firm power generating capacity by 70.3 MW.

In year 2018, GPL commenced with Canefield, Anna Regina and Bartica power plants simultaneously. In Q4 of the following year, the Company commenced with the construction of the 46.5 MWs multi-fuel power generation plant at Garden of Eden and in year 2020, installed an aggregated total of 9.6 MWs of firm generation capacity.

The 9.6 MW comprised 6x1.6 MWs LFO-fired mobile generator units, which were distributed in blocks of 4.8 MWs at Sophia, Onverwagt and Canefield Substations, respectively.

3.1.1 Garden of Eden

In 2021, GPL commenced commercial operation of the 46.5 MWs multi-fuel power plant at Garden of Eden, boosting the total available generation capacity of the DBIS to 208.6 MWs. With the recorded peak demand of 135.7 MW, the 46.5 MW plant resulted in the capacity reserve margin of DBIS being 53.72%, which aided in achieving the LOLP planning target in year 2021.

During the year 2022, as expected, the electricity demand increased, depleting the DBIS capacity reserve margin here it averaged at 11.56 %. In that year, the maximum recorded capacity reserve margin was 28.7 %, which occurred in January and a minimum of 1.05% in July.

3.1.2 300 MW Gas-to-Energy Project, Wales

In 2021, while being cognisant of the forecast demand, the Government of Guyana, through the Gas-to-Energy Task Force and the Ministry of Natural Resources, commenced desktop works relative to the Gas to Energy Project. Among these works included the decision to construct the gas-fired and natural gas liquid plants - integrated facility, the publication of an Expression of Interest for the project, the identification of land for the integrated project, and pipeline survey works.

In 2022, technical and commercial developmental works relative to the Gas to Energy Project continued, which led to the pre-qualification of bidders and evaluation of EPC proposals for the integrated project. On November 10th, 2022, the Government of Guyana, via its Cabinet, officially announced the results of the evaluation of EPC proposals and outlined the next steps in support of the commencement and construction supervision of the integrated project.

The 300 MW Gas-to-Energy project is currently in progress and is expected to be completed per schedule.

Canefield

At Canefield, East Berbice Corentyne, GPL commissioned a 5.5 MW HFO-fired power plant in March 2019. However, with its commercial operation date on September 24th, 2018, it boosted the capacity reserve margin of the DBIS to 40%, in time for the peak demand period. This plant supported the Company's objective of satisfying the growing demand in the DBIS reliably and achieving its LOLP target for year 2018 and 2019, respectively.

In 2020, the power generation capacity at Canefield was bolstered by an additional 4.8 MW – 3x LFO-fired Mobile units, each having a firm capacity of 1.6 MW.

3.1.3 Columbia, Mahaicony

An EPC contract was awarded to APAN Energy Services Inc., in July of year 2023, for the installation of a turn-key 28.9 MW HFO-fired power plant project at Columbia, Mahaicony.

3.1.4 Anna Regina

In April 2019, GPL commissioned a 5.4 MW HFO-fired power plant at Anna Regina. This power plant replaced the aged, unreliable and derated 4 MW HFO-fired power plant. This new power plant resulted in a significant improvement in generation reliability relative to the demand on the Essequibo Coast.

The power plant was designed to accommodate additional power generation units, of similar dimensions, to assist in narrowing the supply-demand and bolster the capacity reserve margin to achieve the LOLP planning target.

3.1.5 Wakenaam

In 2020, GPL procured and installed 2x410 kW diesel-fired generators to augment the 750 kWp Solar PV Project with a 1,151 kW BESS UAE-CREF grant-funded project. The generator units were commissioned in the following year.

3.1.6 Leguan

In year 2014, GPL installed and commissioned a new 1.23 MW LFO-fired power generating plant, capable of supplying electricity 24hrs on the island. In year 2020, one of the units experienced technical challenges, however, in the following year the requisite repair works were completed and the unit became available for dispatch.

3.2 Non-Conventional Generation

Prior to and during 2021, in receipt of a Regional Technical Assistance (TA) programme funded by the German Federal Ministry for Economic Cooperation (BMZ) and the European Union under the 11th European Development Fund, GPL executed five (5) Integrated Utility Services (IUS) Model pilot projects.

In the general scheme the IUS Model pilot project provided GPL's customers with the option and the ability to procure affordable Renewable Energy (RE) and Energy Efficiency (EE)

systems from GPL. The structure of this model was primarily customer-focused, and it provided upfront financial assistance for the customers to acquire their desired energy-saving solutions.

In addition to the current electricity services, the primary reason for GPL pursing the IUS model is to expand its business model and become a multi-faceted utility company that provides its customers with sustainable energy solutions (Renewable Energy & Energy Efficiency Options).

In Q4 of 2021, GPL commissioned the five (5) IUS pilot projects successfully. A summary of the pilot projects is as follows:

1 OAS - 10.2kWp Grid Tied Solar PV System

2 IICA - 20.4kWp Grid Tied Solar PV System

3 GPL Middle Street - 13.26kWp Grid Connected Solar Photovoltaic System with 13.54 kWh Battery Energy Storage System.

4 GPL Main Street - 7.6kWp Grid Connected Solar Photovoltaic System with 25.39kWh Battery Energy Storage System.

5 GPL Sophia - 35.28kWp Grid Connected Solar Photovoltaic System with 110.4kWh Battery Energy Storage System.

3.2.1 Bartica

On 11th November 2020, the Government of Guyana/GEA signed the EPC Contract for the 1.5 MW Bartica Solar Farm plus 1.6 MW – 30 mins BESS. This project was funded through a loan from the IaDB and was commissioned on 31st March 2023.

3.2.2 Distributed Energy Resources (DER)

Within the GPL franchise areas, there is a total of 329 DER systems, where 223 are Government (68% of total) and 106 are privately owned (32% of total). Comparing with year 2022, the total number of DER systems increased by 12 units (reflecting a 3.8% increase), where majority of this growth stemmed from privately own DER systems. The total number of Government DER systems increased by 0.45% and privately owned, 11.58% from year 2022 to 2023.

The total growth in DER systems resulted in the aggregated capacity expanding from 7.51 MWac in year 2022 to 8.21 MWac in 2023. See Figure 1 for further information on annual growth of DER systems.

The total installed capacity represents 4.41% of the current available firm generation capacity and approximately 4.29% of the GPL aggregated non-coincidental system’s day peak demand.

Additionally, Table 1 below shows the number of DER systems installed per GPL power system and the estimated current penetration levels.

With the current Net Billing Programme, coupled with the falling price of equipment for solar energy systems, it is projected that the uptake of DER grid-tie solar PV systems will further

increase – see simple regression trend line for number of DERs in Figure 1. As a result, the percentage penetration level of DER systems in each power system will grow according to the points of interconnection.

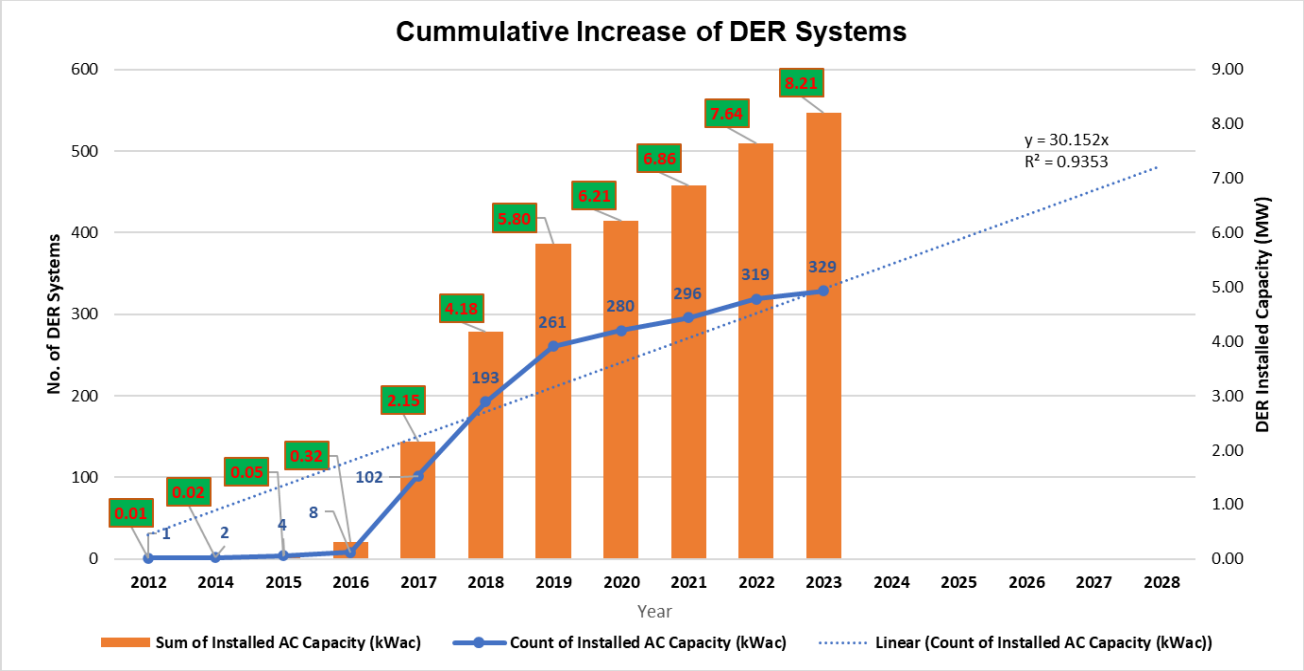

Figure 1: Cumulative Increase of No. of Grid-tie DER Systems

Table 1: DER installed capacity per GPL power system and estimated penetration level.

Power Systems	No. of DER Systems	Installed Capacity (kWac)	Estimated Annual Production (MWh)	2023 Load Demand (MWh)	Estimated Penetration Level (%)
DBIS	292	7,711	14,071.3	1,066,897	1.3%
Anna Regina	19	288	525.9	39,390	1.3%
Bartica	13	159	289.4	12,161	2.4%
Leguan	3	22	40.1	2,227	1.8%
Wakenaam	2	20	36.5	2,456	1.5%
Total	**329**	**8,200**	**14,963**	**1,123,132**	**1.3%**

3.3 Transmission and Distribution (T&D)

The transmission and distribution systems link the generating plants with customers across GPL franchise areas via common grid per power system.

The Company's current transmission and distribution networks evolved from a distribution network that commenced over 40 years ago and has since been progressively expanding to evacuate power from new power plants and deliver electricity to customers and unserved areas along the coastline of Guyana.

3.3.1 Transmission

The Transmission and Distribution Systems were improved substantially in 2014, having benefitted from the construction of seven (7) new substations, one hundred and thirty-seven

(137) kilometres of transmission lines and the interconnection of the Demerara and Berbice power systems. These network improvements positively influenced GPL customers' service reliability, and grid stability and contributed to the Company's technical loss reduction efforts.

Continued investments in T&D maintenance, refurbishment and expansion are in progress to improve service reliability further, meet and exceed customers' expectations and position the Company to move forward in becoming a World-class Utility.

While GPL forges ahead with current investments in T&D, the Company is cognisant that present high customer tariffs coupled with high generation costs currently limit its ability to self-finance critical projects. The financial situation is further exacerbated by commercial/non-technical losses. Notwithstanding the aforementioned, the Company intends to continue to pursue alternative funding sources to maintain its momentum of improving and expanding its power systems and reducing commercial/non-technical losses.

In 2021, the Government of Guyana/GPL commissioned the JICA grant funded 2x5 MVAr fixed capacitor banks at Canefield. These capacitor banks boost transmission voltage levels to be within the permissible steady-state level of +/- 5% of 69 kV and support the economic dispatch of generators to satisfy demand.

In 2022, GPL upgraded the transformer capacity at Edinburgh Substation from 10 MVA to 20 MVA. This upgrade facilitates the substation to dispatch more power to the feeders, thereby satisfying the growing demand and improving the quality and reliability of the electricity service on the West Coast of Demerara.

3.3.2 Distribution

In an effort to improve the reliability and efficiency of the primary distribution system, GPL installed and commissioned seven (7) auto recloser in 2023 in addition to the 83 auto reclosers that were commissioned during 2021-2022.

A summary of the auto recloser deployment is as follows:

1. T&D Area West: a total of 16 units; 6 units on the Vreed-en-Hoop feeders, 7 units on the Edinburgh Feeders, and 3 units on the Anna Regina feeders - 2021-2022.
2. T&D Area South: a total of 16 units; 7 units on the Golden Grove feeders, 7 units on the Garden of Eden feeders, and 2 on the New Georgetown feeders - 2021-2022.
3. T&D Area Central: a total of 10 units; 5 units each on the New Georgetown and Sophia feeders, respectively - 2021-2022.
4. T&D Area East: a total of 18 units; 11 units on the Good Hope Feeders, 5 units on the Sophia feeders, and 2 units on the Columbia F3 feeder - 2021-2022.
5. T&D Area West Berbice: a total of 4 units on the Columbia F1 feeder - 2021-2022.
6. T&D Area East Berbice: a total of 19 units; 13 units on the Canefield feeders, and 6 units on the No.53 feeders - 2021-2022.

7. T&D Area Central: a total of 7 units on the DP3 feeders - 2023.

In addition to the installation of auto reclosers, in 2023, GPL:

1. Improved the distribution protection relay coordination schemes.
2. Replace a total of 200 m of conductors on the primary distribution network.
3. Replace a total of 23.852 km of conductors on the secondary distribution network.
4. Replace a total of 2603.205 km of service conductors.
5. Upgraded a total of 235.64 km of conductors on the primary distribution feeders.
6. Upgrade a total of 70.385 km of conductors on the secondary distribution network.
7. Upgrade a total of 37.026 km of service conductors.
8. Upgraded a total of 58.22 MVA of pole-mounted transformers.
9. Upgraded a total of 1 MVA of pad-mounted transformers.
10. Completed and advanced sections of the JICA grant funded feeder upgrade works:
    a. No. 7 to Ithaca W.C.B Express Feeder - 40% completed to date. The project is to be 100% completed by Feb-2024.
    b. Golden Grove to Herstelling Feeder – 75% completed to date.

Further, Table 2 shows specific details of T&D planned and achievements, which are related to improving feeder reliability, efficiency, and quality of electricity service.

Table 2: T&D Achievements – Year to date 2023

TARGET INDICATORS		TOTAL OVERALL (2023) AMOUNT		
Activities	**Units**	**Plan**	**Ach**	**% Ach**
Retention Conductor	MV	265.677	280.628	106%
	LV	141.213	274.81	195%
Prepare & Erect Pole (Wallaba)	9m	1434	1261	88%
	11m	112	71	63%
	12m	599	607	101%
	14m	942	572	61%
	15m	56	21	38%
Erect Pole (Concrete)	9m	38	38	100%
	11m	1	0	0%
	12m	27	17	63%
	14m	56	92	164%
	15m	22	14	64%
	17m	1	0	0%

TARGET INDICATORS		TOTAL OVERALL (2023) AMOUNT		
Activities	**Units**	**Plan**	**Ach**	**% Ach**
Erect Pole (Fiberglass)	9m	0	0	0%
	11m	0	0	0%
	12m	0	0	0%
	14m	0	0	0%
	15m	0	0	0%
Construct H-Structure		45	7	16%
Treat Pole	MV	3272	1373	42%
	LV	5105	922	18%
Remove Old Pole	MV	1285	522	41%
	LV	1272	870	68%
Plumb Pole	MV	748	571	76%
	LV	539	495	92%
Stub Pole	MV	365	188	52%
	LV	274	130	47%
Shift Pole	MV	23	14	61%
	LV	40	19	48%
Install Auto Recloser		77	4	5%
Install GAB		76	4	5%
Install SPD		121	73	60%
Install RCO		282	490	174%
Install Fuse Holder		144	77	53%
Install Fuse Link		104	113	109%
Install Hot Line Clamp		230	205	89%
Install Bail Clamp		247	199	81%
Install Lightning Arrestor		194	533	275%
Install Planks		123	18	15%
Install Steel Planks		0	0	0%
Install Crossarm		0	0	0%
Install Concrete Crossarms		0	0	0%
Install Fiberglass Crossarm		1	0.808857809	81%
Install Runners		0	0	0%
Install Sleeper	Bottom	447	3	1%
	Top	571	36	6%
Install Guy - Helical	MV	216	33	15%
	LV	239	40	17%
Install Guy - Guy Block	MV	224	101	45%

TARGET INDICATORS		TOTAL OVERALL (2023) AMOUNT		
Activities	**Units**	**Plan**	**Ach**	**% Ach**
	LV	362	110	30%
Install Complete Guy Set		431	421	98%
Install Overhead Guy Set		23	50	217%
Install Fly Guy		9	23	256%
Install Pole Strut		91	7	8%
Transfer Guy Set	MV	0	0	0%
	LV	1	0	0%
Install Earth Set	MV	347	1067	307%
	LV	241	167	69%
Replace Auto Recloser		133	11	8%
Replace GAB		101	40	40%
Replace SPD		69	32	46%
Replace RCO		407	474	116%
Replace PMCO		212	38	18%
Replace Fuse Holder		195	22	11%
Replace Fuse Link		262	178	68%
Replace Lightning Arrestor		292	63	22%
Replace Earths		283	96	34%
Transfer Line Hardware	MV	0	0	0%
	LV	0	0	0%
Service Jumper	MV	1026	726	71%
	LV	812	935	115%
Replace Jumper	MV	2797	3425	122%
	LV	3067	3246	106%
Replace Conductor Lug		482	579	120%
Replace Insulator	MV	2689	1943	72%
	LV	2370	2385	101%
Replace Cross Arm		1220.3	1010	83%
Replace Pole Top Pin		300.2	322	107%
Replace Insulator Pin		326.7	489	150%
Replace Cross Arm Brace		243.1	382	157%
Replace Anchor		90	60	67%
Replace Guy - Helical		100	42	42%
Replace Pole Strut		3	2	67%
Replace Conductor (km)	MV	24	0.2	1%

TARGET INDICATORS		TOTAL OVERALL (2023) AMOUNT		
Activities	**Units**	**Plan**	**Ach**	**% Ach**
	LV	52.06	23.852	46%
	Service	3881.64	2603.205	67%
Upgrade Conductor (km)	MV	42.5	235.64	554%
	LV	221.794	70.385	32%
	Service	19.019	37.026	195%
Upgrade Transformer	Pole-mounted	59.5	58.22	98%
	Pad-mounted	85	1	1%
Upgrade Jumper	MV	222.03	163	73%
	LV	125	42.009	34%
Install Transformer	Pole-mounted	197	249	126%
	Pad-mounted	123	29	24%
Relocate Transformer		37	28.5	77%
Retention Conductor	MV	0	0	0%
	LV	0	0	0%
Network Extension	MV	20.0393	48.0033	240%
	LV	409.8383	383.9643	94%
Network Relocation	MV	44.002	18.863	43%
	LV	48.4408	12.102	25%
Crimp/Renew connections on Auto Recloser		19.12	18.12	95%
Crimp/Renew connections on GAB		26.092	28.492	109%
Crimp/Renew connections on SPD		208	108	52%
Crimp/Renew connections on RCO		183	269	147%
Crimp/Renew connections on Voltage Regulator		0	0	0%
Crimp/Renew Connections on Capacitor Banks		12	20	167%
Service connections on Auto Recloser		174	2	1%
Service connections on GAB		79	1	1%
Service connections on SPD		117	21	18%
Service connections on RCO		347	306	88%
Service connections on Capacitor Bank		10	7	70%
Service Connections on Voltage Regulator		63	37	59%
Service Connection	Pigtail	5732	3333.5	58%
	Pole	5919	4103.5	69%
Maintain Auto Recloser		55	90	164%
Maintain Transformer		1190	1282	108%

TARGET INDICATORS		TOTAL OVERALL (2023) AMOUNT		
Activities	**Units**	**Plan**	**Ach**	**% Ach**
Maintain Capacitor Bank		15	5	33%
Maintain Voltage Regulator		60	32	53%
Transfer Line Hardware	MV	1123	695	62%
	LV	1050	1301	124%
Data Capture (Network Points)		71.2	17.5	25%
Phase Switch - Transformers		27	16	59%
Phase Switch - Spur		23	32	139%
Vegetation Management (MV)		0	0	0%
Heavy Vegetation Pole Spans		42.12	199.48	474%
Light Vegetation Pole Spans		63.87	110.631	173%
Small Trees		22	44	200%
Large Trees		79	60	76%
Branches/ Limbs		240	375.56	156%
Vines		354	532	150%
Vegetation Management (LV)		0	0	0%
Heavy Vegetation Pole Spans		66	24	36%
Light Vegetation Pole Spans		168.31	93.16	55%
Small Trees		62	63	102%
Large Trees		22	23	105%
Branches/ Limbs		274	339	124%
Vines		454	583.08	128%
Remove Pole Top		84	143.43	171%
Site Visit		131	619	473%
Overhead Inspection (km)	MV	709	1368.683	193%
	LV	653.3	206.715	32%
Pole Inspection (km)	MV	2022.27	2122.239	105%
	LV	861.32	1049.18	122%
Aerial Inspection (km)	MV	0	0.07	0%
	LV	0	0	0%
Thermal Inspection (km)	MV	0	0.001	0%
	LV	0	0	0%
Night Inspection (km)	MV	216.6	328.2	152%
	LV	16	4.2	26%
Switching		108	1090.75	1010%
Reclaim Line Hardware		0	0	0%

TARGET INDICATORS		TOTAL OVERALL (2023) AMOUNT		
Activities	**Units**	**Plan**	**Ach**	**% Ach**
Reclaim Poles (Wallaba)		0	0	0%
Reclaim Conductor	MV	0	0	0%
	LV	0	0	0%
Transportation of Poles (km)		673.02	1165.559	173%
Transportation of Materials (km)		0	0	0%
Training (hrs)		0	0	0%
Assistance (hrs)		0	0	0%
C.E.O. F		608	598	98%

In addition to the above achievements, GPL also:

1. Installed and commissioned 13 Automatic Power Factor Correction (APFC) capacitor banks in 2022.
2. Maintained 15 Automatic Power Factor Correction (APFC) capacitor banks in 2023.

The following summarises the deployment of the APFC capacitor banks in 2022:

1. T&D Area West: a total of 2 units on the Edinburgh F2 feeder.
2. T&D Area South: a total of 2 units on the Golden Grove feeders.
3. T&D Area Central: a total of 2 units on the Sophia F2 feeder.
4. T&D Area East: 1 unit on the Columbia F3 feeder.
5. T&D Area West Berbice: 1 unit on the Onverwagt F2 feeder.
6. T&D Area East Berbice: a total of 4 units; 3 units on the Canefield F3 feeder and 1 unit on the No. 53 F3 feeder.

Notwithstanding the scope of achievements show in Table 2, the reliability indices and their improvement rates are still to reach their respective targets. However, it must be noted that the transmission and distribution infrastructure have not been expanded and configured at the required rate and manner to address the new electricity demand portfolio – opening of new housing schemes, commercial and industrial zones, and increase in energy intensity per household. As a result, the present transmission and distribution systems are thermally stressed, resulting reduced power quality and reliability.

4. Current Major Developments

The Company continues to invest in capacity building and equipping its planning and research department with the requisite tools and skillsets to develop robust, resilient, and cost-effective expansion plans. These steps amongst other taken at the corporate level are critical to

addressing the Company's current issues and challenges, in pursuit of transforming it progressively into a World-Class Utility.

4.1 Power Generation

Guyana Power and Light Inc. is the largest producer and distributer of electricity services in Guyana, having an estimated current grid coverage of 99.7 % within its franchise area on the Coastal Plain and Bartica. The power system is currently powered by GPL using 100% liquid fossil fuel: heavy and light fuel oils. Notwithstanding the current primary source of energy, several options are being explored to harness Guyana's natural resources to generate electricity in substantial quantities to satisfy the current and future electricity demands reliably and sustainably.

GPL recognizes the importance and urgent need for additional firm power generation capacity to be installed in its power systems. To ensure the DBIS continues to operate reliably, it is recommended to ramp up its firm power generation capacity to approximately 618 MWs during the life span of this Development and Expansion Programme (see Table 45 on page 114).

The immediate need for new dispatchable generation capacity does not negate the Company's current endorsement of Guyana's Energy Policy, Low Carbon Development Strategies (LCDSs), Sustainable Development Goals (SDGs), and other National Energy Priorities that seek to reduce the Country's net carbon footprint and the electricity tariffs, while satisfying the demand reliably and sustainably.

As Guyana realizes its much-anticipated economic benefits of commercial crude oil and gas productions, which also has positive ripple impact on the other economic sectors, the Company projects that Guyana's electricity demand would rise above the traditional levels by almost 380% within the next 5- years.

HFO-fired Power Plant

GPL, through an EPC Contract with APAN Energy Services, is currently installing 17x1.7 MW generator units at Columbia, Mahaicony. The total 28.9 MW HFO-fired power plant will be dispatched into the DBIS through its electrical interconnection with the Columbia Substation.

This project is scheduled for completion by mid-December 2023.

4.1.1 Natural Gas

The growing Oil and Gas sector has presented the opportunity to use natural gas as the primary energy resource of electricity generation in Guyana. With the natural gas an indigenous resource it also presents the opportunity of lowering generation cost, and by extension, electricity tariffs.

Through the Guyana Power & Gas Inc, GPL will purchase majority of the electricity generated to service the current and future demands of its customer's base.

The migration towards using natural gas will certainly propel Guyana towards realising its national objective relative to energy security and reaffirms its position on global Climate Change commitments such as the Sustainable Development Goals (SDGs) and Conference of Parties (COP).

Natural gas consists typically of 70%-90% of methane, and it is considered the cleanest of all fossil fuels because it produces lower emissions of CO_2, NO_x SO_x and particulate matter compared to HFO and LFO.

It is an energy resource well suited to complement renewable resources such as solar, wind, biomass, and hydropower. As a result, it is currently coined as a transitioning fuel towards increasing the use of renewable energy resources.

The Government of Guyana has engaged the EPC Contractor – LNDCH4 to design, supply, construct, start-up, commission, and handover of a fully functional and complete natural gas integrated facility. The EPC Contractor is currently being supervised by the Project Management Consulting firm Engineers India Limited (EIL).

The integrated facility will comprise a 300 MWe Combine Cycle Gas Turbine (CCGT) Power Plant and a Natural Gas Liquids Fractionation Plant (NGLFP). This integrated facility will be located within the Heavy Industrial Area of the Wales Development Zone, West Bank Demerara.

The Power Plant will have the following main facilities:

1. 300 MWe gas turbine combined cycle power plant with configuration 2(2+1), comprising Siemens 4x STG-800 and 2x SST-400 units.
2. A 30 MW – 1hr Battery Energy Storage System (BESS) to provide ancillary services to the grid relative to voltage and frequency.

The Combined Cycle Gas Turbines (CCGT) will offer many advantages over the continued use of Reciprocating Internal Combustion Engines (RICE). These advantages include but are not limited to higher combustion efficiency, lower emissions, allow for higher renewable energy penetrations, providing higher load ramping rates which would improve grid stability, and use of future flexible fuels such as hydrogen. These advantages, while outweighing the benefits of using RICE, are well aligned with the Low Carbon Development Strategies (LCDSs), Sustainable Development Goals (SDGs) and Guyana's commitment to the COP.

The primary fuel to the 300 MW power generating facility will be supplied by the onsite NGLFP. The NGLFP will be supplied with pipeline-quality natural gas via a 220 km, 12-inch diameter pipeline, connecting to the Floating Production Storage and Offloading vessels (Liza Phase 1 and 2 FSPOs), located in the Atlantic Ocean.

While initial gas flow is average at 50 mmscfd, it will be ramped up to 120 mmscfd as offshore productions increase.

Construction works for the pipeline is in progress and is expected to be completed on schedule for the power plant.

The commercial operation dates for the 300 MW GTE Power Plant are phased in accordance with the expected completion timeline of works relative to the Simple Cycle and Combine Cycle. Phase 1 – Simple Cycle is expected to be commissioned and placed into commercial operation by Q3 of year 2025 and Phase 2 – Combined Cycle, by December 2025.

The project is expected to have an economic lifespan of 25 years from the Commercial Operation Date (COD).

4.1.1.1 Possibility of Converting Existing HFO-fired Power Plants to Dual Fuel-fired Plants – DBIS

To further add value to the use of indigenous natural gas, the existing power plants at Garden of Eden Wärtsilä (DP1), Kingston I (DP2), Kingston II (DP3) and Vreed-en-Hoop (DP4) can be converted to combust natural gas as the primary fuel and HFO as the contingency fuel.

The conversion of these power plants has the potential to reduce significantly the present operating costs (Table 3) and extend the economic operational life by 12 to 15 years for DP1 and DP2, and 20 years for DP3 and DP4.

These power plants will continue to serve the DBIS, ensuring grid reliability and stability are maintained during contingent events relative to either the 300 MW CCGT power plant or critical transmission lines.

Table 3: Summary of Benefits - Conversion to Natural Gas of existing HFO-fired Power Plants.

Key Parameters	DP1& DP2	DP3 - W16V	DP3 - W18V	DP4
Output (kW)	-0.02%	-3.74%	-4.55%	-8.56%
Heat rate (BTU/kWh) - 100% Loading	-8.63%	0.11%	0.24%	4.94%
Fixed O&M Cost $/kW/yr)	-33.50%	-66.29%	-66.29%	-42.93%
Variable O&M Cost ($/kWh)	-59.25%	-65.86%	-68.79%	-64.35%
Maintenance Rate	-13.04%	-13.04%	-13.04%	-13.04%
Mean Time to Repair – Top Overhaul	1.19%	1.19%	1.19%	1.19%
Mean Time to Repair – Major Overhaul	-45.44%	-45.44%	-45.44%	-45.44%
Mean Time to Repair – FOR	-71.43%	-71.43%	-71.43%	-71.43%
Forced Outage Rate	-49.15%	-3.23%	-3.23%	-18.92%

4.1.2 Renewable Energy

4.1.2.1 Solar

The abundant use of solar energy confirms to be an attractive source of sustainable production of electricity to mitigate risks associated with imported fuel costs volatility and carbon emissions. However, the intermittent nature of this renewable energy resource, concomitant with

significantly high levels of penetration, will present considerable technical challenges to the stability of the current grid.

Albeit renewable energy is globally attractive, electricity generation from wind and solar energy systems will only displace the electricity generated by fossil fuel-fired generators and not their firm capacity. As a result, GPL plans to incrementally introduce and integrate intermittent renewable energy systems prudently to ensure that power system reliability and stability are not adversely impacted.

A. GuySOL Project

GPL is currently engaged with the IaDB in the implementation of a total of 33 MWp of Solar PV capacity through non-reimbursable investment financing of up to US$83.3 million - the GUYSOL Project.

Besides the total 10 MWp of Solar PV capacity to be installed in Berbice, this project will also deliver 8 MWp of Solar PV capacity and 12 MWh Battery Energy Storage Systems (BESS) in Anna Regina, 15 MWp of Solar PV capacity and 15 MWh BESS in Linden by June 2025.

In addition to the delivery of energy infrastructure, the project is also equipped with pertinent capacity building scope for GPL engineers. The capacity building scope includes for all technical and non-technical works related to composing a renewable energy project document for procurement application and administering project execution.

It is anticipated that the GUYSOL project would displace a total of approximately 75,277 tCO_2eq of emissions from the aggregated DBIS, Anna Regina and Linden power systems per annum.

Resulting from the anticipated avoided cost of generation using imported liquid fossil fuels, the estimated savings is approximately US$5.53 million per annum.

Considering the current total DER capacity of 7.711 MWp, with the aggregated 10 MWp added to the DBIS in year 2025, Solar energy penetration would be 1.5% from the perspective of total annual generation. In year 2025, aggregated installed Solar PV capacity would represent a minimum of 2.9% of total installed firm generation capacity and 8.3% of the forecast day peak demand.

As the number and aggregated installed capacity of DER increases, the increasing solar PV penetration level result in stability issues that must be addressed frontally. This Development and Expansion Programme includes BESS capacity to mitigate grid stability risks arising from the increasing penetration levels of intermittent renewable energy resources.

B. Wakenaam UAE-CREF Grant Funded Project

The Solar PV plus BESS – Diesel hybrid energy system in Wakenaam is a US$3million UAE-CREF grant fund project, geared towards decarbonising the Wakenaam power system, as well as reducing the cost of electricity generation and fossil fuel dependency.

The project comprises three (3) key components: (1) 750 kWp solar PV power plant, (2) 1,151 kWh Battery Energy Storage System with grid-forming inverters (BESS), and (3) an upgraded diesel generation plant.

Along with this grant financing, the Guyana Power and Light Inc. will undertake investments to upgrade the Wakenaam Power Plant to ensure seamless integration and operation of the Solar PV system.

The grant-funded project execution scope also includes for operations training to be provided to the local utility technicians and relevant government employees. The plant design and installation will incorporate principles of gender equality, utilizing staff and subcontractors who actively seek out gender equality in their selection of technicians and engineers.

The Project is currently being executed and it is expected to enter commercial operation during Q1 of 2025.

C. Leguan Solar Farm Project

The Government of Guyana, through the GEA, will fund the construction of a 600 kWp Solar PV farm, supported by an 600kWh/600kW firm capacity BESS. This project aims at reducing the risks associated with fuel price volatility and supply, while reducing the production cost of electricity in Leguan. It is estimated that this renewable energy project would reduce carbon emissions up to 800 tons annually.

The scope of work of the project also includes for the construction of a 13.8 kV solar farm-grid interconnection line, upgrading the generator step-up transformers at the LFO-fired power plant and facilitate upgrading of the present distribution voltage level from 4.16 kV to 13.8 kV – replacement of customer pole-mounted transformers. This project is expected to be completed by June of year 2025.

A. KIAT Grant Fund – Solar PV and Battery Energy Storage System

KIAT - Korea Institute for Advancement of Technology, approached the Government of Guyana/GPL through the IaDB with the opportunity to grant fund a Solar PV and BESS project.

Preliminary field reconnaissance works, and feasibility studies are currently in progress.

This project is earmarked to be located on the Essequibo Coast, which is aimed at bolstering the aggregated 8 MWp of Solar PV capacity and 12 MWh Battery Energy Storage Systems (BESS) from the GUYSOL Project, to further reduce fossil fuel dependency and reducing production cost of electricity on the Essequibo Coast.

4.1.2.2 Net Billing Programme (Feed-in Tariff)

A Feed-in Tariff (FIT) can be considered a significant revenue stream for present and future grid-tie customers. At present, GPL Net Billing customers are being credited at a rate of 90% of the current electricity tariff for electricity exported to the grid. This current rate should provide

prosumers with an adequate return on investment and promote the expansion of distributed renewable energy system - DER.

To be a participant in the Net Billing Programme, the grid tied customer, also known as the prosumer, is required to sign a Standard Offer Contract (SOC). The SOC is a contract that lists the standard terms and conditions between the customer and GPL during the duration of the programme. The SOC allows the customer to be compensated for the total amount of electricity exported to the grid within the billing cycle period. The standard arrangement for billing a Net Billing customer is as follows:

1. If during the billing period, the received energy charge is greater than the delivered energy charge then the received energy credit is applied to the 'Energy Credits Bank' for application to future bills with net Energy Charges to the Prosumer
2. If the delivered energy charge is greater than the received energy charge, then appropriate credits (if available) can be withdrawn from the 'Energy Credits' Bank to reduce or liquidate the net Energy Charge. Subject to the deduction of monies owed to the Company, any unused credit remaining at the end of a twelve (12) month period will be paid to the Prosumer at a rate of 90% of the tariff at the time.

See Section 13 on page 132 for further details.

4.1.2.3 Hydropower and Biomass

Firm and dispatchable electricity from renewable resources such as hydropower and biomass remain as attractive alternative energy supply options. Besides the benefits of these resources being indigenous, their lower unit generation costs are extremely attractive for sustainable economic development. However, their current capital costs are considerably high.

With the Skeldon co-generation facility in operation, GPL purchases electricity from Skeldon Energy Inc. at approximately 10 US cents per kWh. In the case of hydropower, it is projected that the unit cost of electricity from the Amaila Falls Hydroelectric Power Project would not exceed 7.737 US cents per kWh (Guyana Chronicle, November 2021).

Hydropower

Guyana, the land of many water, has thirty-three (33) potential hydropower sites, totalling 8.5 Gigawatt (GW). Among the top five (5) potential hydropower sites, Amaila Falls ranks highest on the techno-economic and environmental-social preference indices. As a result, the 165 MW Amaila Falls is an optimal hydropower site for satisfying Guyana's projected electricity and peak demands (Norconsult, NORAD, 2016).

Invariably, the Amaila Falls Hydropower Project is a flagship project of Guyana's Low Carbon Development Strategy (LCDS). Among the numerous benefits this project is expected to bring to the electricity sector, GPL customers would benefit from sustained tariff reduction and significant improvement in power quality, grid stability and reliability.

On 18th October 2023, the Government announced the re-opening of the tender for the construction of the 165 MW Amaila Falls Hydropower Project (AFHP). The AFHP project is expected to have an annual production of 1,047 GWh.

With the site identified and availability of base information, it would be reasonable to assume a project duration of 46-50 months[1]. Assuming Commercial Operation Date in year 2029, the estimated annual production of the plant represents 35% of year 2029 forecast Net Export of the DBIS and Linden.

The project will aid in further reduction of Guyana's dependency on imported fossil fuel – Heavy and Light Fuel Oils, and a significant decrease in carbon emissions from the electricity sector (GRIF, 2011).

To maintain Guyana's Carbon footprint in a steady state and to ensure Guyana's continuous long-term commitment to mitigating the effects and risks of Climate Change, it is anticipated that the Government will build three (3) hydropower plants over the next 20 years: Amaila Falls by 2029 and an additional 205 MW in 2035 and 150 MW by year 2040. The latter two sites for the total additional 355 MW are to be finalised.

Biomass

There is potential to using biomass to generate electricity. The stockfeed includes bagasse, rice husk and Napier grass.

There is a 30 MW biomass-fired power generation facility at Skeldon. Over the years, this facility depended on the continuous operation of the Skeldon sugar factory and other sugar factories within its vicinity for feedstock – bagasse. However, between year 2016 and 2017, the closure of Skeldon and Rose Hall sugar factories adversely affected the continuous availability of bagasse, which hindered the operation of the power generation facility at Skeldon. Due to the prolong period of being out of operation, the boilers developed technical issues. At this time, the boilers are required to be replaced.

SEI secured approximately 3,000 acres of land for the cultivation of Napier grass. Phase 1 saw the cultivation of 207 acres of Napier grass. However, this pilot project was later hindered in year 2021 due to flooding in the East Canje area. The entire phase 1 crop was destroyed.

Studies have shown that with Napier grass, annual production of the plant would have been 6.2 GWh.

However, during the period 2016 – 2018, Skeldon Energy Inc. (SEI) attempted to maintain the 30 MW biomass-fired power generation facility in operation by diverting attention to using Napier grass as an alternative feedstock. In addition to investments in the cultivation of Napier grass, SEI also invested in equipment to expand its substation to allow for increased power

[1] Dabar hydroelectric power plant in the Republic of Srpska.

export to the DBIS. However, due to the significant investment required to resuscitate the boilers and complete requisite overhauls/maintenance, the plant is currently out of operation.

4.2 Transmission and Distribution

The target is to ensure there is consistent reduction in the Company's SAIFI, SAIDI and CAIDI indices in order to satisfy and supersede the requirements of the transforming economy of Guyana's landscape. With the rapid rate of developments within the oil and gas and other significant economic sectors, such as the commercial, industrial and tourism sectors, the Government of Guyana and GPL are cognisant of the dire need for robust, resilient, and efficient transmission and distribution infrastructure to serve customers' increasing demand for reliable and quality electric services. As a result, this Development and Expansion Programme contains several upgrade and expansion projects for the transmission and distribution systems.

4.2.1 Transmission and Sub-transmission

4.2.1.1 System Voltage Levels

As mentioned in sections 4.1.2.3 and 14 on pages 53 and 134, respectively, a higher transmission voltage level to transfer larger blocks of power efficiently due to having larger power generation facilities located at a considerable distance away from load centres will be required.

The 300 MW Gas to Energy and Amaila Falls Hydroelectric Projects certainly justify the need for having a bulk power transmission system operating at 230 kV. Further, it is intended for Guyana to be integrated into the Arco Norte Project via 230 kV double circuit transmission lines. As such, the current 230 kV transmission plans are in perfect alignment for future power generation expansions and cross-border interconnections with Brazil and Suriname. With the 230 kV introduced into the DBIS, the current 69 kV will invariably be classified as sub-transmission voltage level.

4.2.1.2 System Configuration

Besides the plan to utilise 230 kV to transfer larger blocks of power and cross-border interconnections, it is also intended to utilise this voltage level to interconnect critical load centres that are located at the extreme ends of the power system's coverage.

In the current expansion programme, the architecture of the grid will transform the larger blocks of power from the 230 kV level to the 69 kV level. At the 69 kV level, power would be distributed among a group of load centres. The load centres forming this group will be selected smartly to optimize voltage levels and reduce technical losses.

Technically, while such a configuration at the sub-transmission level is necessary to mitigate widespread outages, there will be 69 kV lines installed to interconnect these substations to address contingent events automatically at the sub-transmission level via Smart Grid.

4.2.1.3 Expanding with Resilient Mitigation Measures

In an effort to build resilience into the transmission and sub-transmission systems, GPL intends to standardise critical construction attributes of the 230 kV and 69 kV lines as follows:

1. 230 kV Transmission Lines – lattice steel structures supported by a reinforced concrete base, buttressed by drilled concrete pier.
2. 69 kV Sub-transmission lines – tubular steel poles supported, anchored by a reinforced concrete base, which will be buttressed by either drilled concrete pier or a driven pile.

4.2.1.4 Improving System Performance - Conductor Type

Concerning conductor type, AAAC and ACSR conductors have been serving GPL for well over fifty-two (52) years. In view of the Company's experience with these conductor types and the need to ensure the critical transmission and sub-transmission lines are well reinforced, while optimising on life cycle cost, the position has been taken to utilise ACCC conductor type in all new 230 kV and 69 kV lines.

While the initial capital cost of AAAC and ACSR are more competitive to ACCC, this does not transcend to the life cycle cost of projects having the latter conductor type. Below is a high-level summary of the benefits of using ACCC conductors:

1. **Shape of Strand and Aluminium Area:** the trapezoidal shape of each strand of the ACCC conductor results in a more compact conductor than ACSR and AAAC, where the strands are circular in shape. As a result, the total area of aluminium in the ACCC is greater than in the ACSR and AAAC. Such attributes of the ACCC give rise to lower unit resistance per length and cross-sectional area compared to ACSR and AAAC conductors and by extension lower technical losses.

   With lower technical losses, this translates to savings on the supply side from the perspectives of fuel and reducing carbon footprint.

   Additionally, the compact trapezoidal shape of each strand does not allow for the accumulation of foreign materials that will adversely affect the conductor's properties of absorptivity and emissivity. As such, the design ampacity of the conductor is readily available for power dispatch.

2. **Rated Strength:** The ACCC has a carbon composite core while the ACSR and AAAC, have steel and aluminium, respectively. As a result of the structural composition of the conductor strands and the core, the ACCC has higher rated strength than ACSR and AAAC. With such a competing characteristic, using the ACCC conductor would result in lesser line sags and mitigate the adverse impacts of loading due to wind gusts.
3. **Thermal Loading:** The combined characteristic benefits of the Aluminium Area and Rated Strength result in the ACCC conductor being able to operate at nominal ampacity of 180 deg. C – Rating A. The emergency rating of this type of conductor, Rating B,

operates at the maximum temperature of 200 deg. C for a total of 10,000 hrs over its lifetime, having minimum impact on the line sag.

Within the family of ACCC conductor types, there are several sizes, and each is assigned a code name, and technical properties that include but not limited to ampacity, tensile strength, weight, and resistances. In the current expansion programme, the selection of the appropriate conductor size is premised on the results of a techno-economic assessment of the various sizes over the expected life of a transmission line – a minimum of 30 years.

4.2.1.5 Major Transmission and Sub-Transmission Projects

The 300 MW Gas to Energy Project will be integrated into the DBIS via 230 kV and 69 kV lines, respectively. Below is a summary of the power evacuation project scope in support of the 300 MW GTE Project:

C. New Transmission Lines and Line Upgrades

1. 24.79 km of Double circuit 230 kV transmission lines 300 MW GTE Project Site to Goedverwagting Substation
2. 0.58 km of Three single-circuit 69 kV transmission lines from the 300 MW GTE Project Site to Wales Industrial Substation, located close to the 300 MW GTE Project Site.
3. 9.14 km of Double circuit 69 kV transmission lines from Wales Industrial Substation to Wales Commercial / Residential Substation
4. 17.54 km of 69 kV transmission line from Wales Residential/ Commercial Substation to Vreed-en-Hoop Substation (East route)
5. 21.88 km of 69 kV transmission line from Wales Residential/ Commercial Substation to Vreed-en-Hoop Substation (West route)
6. Total of 33.9 km of upgrade to the existing 69 kV transmission line from Golden Grove Substation to Sophia Substation
7. 230 kV Double-circuit transmission lines to interconnect Amaila Falls Hydropower Project with Linden at Bamia and Goedverwagting Substation.

D. New Substations and Expansions

1. 2x300 MVA 230/69 kV and 2x60 MVA 69/13.8 kV Substation at Goedverwagting for major integration into the DBIS.
2. 69 kV Wales Industrial Substation located at 300 MW GTE Project Site ending at 13.8 kV take-off structure.
3. 3x35 MVA 69/13.8 kV Wales Residential/ Commercial Substation.
4. Bay expansion at Vreed-en-Hoop for partial integration of the 300 MW GTE Project into the Western Section of the DBIS at 69 kV.

5. Construction of a new 20 MVA, 69/13.8 kV substation at No. 53 Village, Corentyne Berbice.
6. 69/13.8 kV Substation transformer upgrade at Good Hope Substation.
7. Upgrade to Old Sophia 69/13.8 kV Substation.
8. Procurement of one 35 MVA, 69/13.8 kV, fully equipped mobile substation.

E. Sub-transmission Reinforcement

GPL plans to install a total of 55 MVAr fixed, detuned capacitor banks across the DBIS at 69 kV. The interconnection sites and capacities are as follows:

1. New Sophia Switching Substation – 15 MVAr
2. Edinburgh Substation – 10 MVAr
3. Columbia Substation – 15 MVAr
4. No. 53 Substation – 15 MVAr

With these capacitor banks installed in the DBIS, GPL would have the technical capacity to dispatch the available power generation capacity economically to satisfy the demand, without having to dispatch generators to the correct voltage level in the grid. Additionally, these capacitor banks will assist in improving the power factor of the grid, reducing technical losses, and mitigating steady-state voltage instability.

4.2.2 Distribution System

The current expansion works are planned contextually to address the distribution network deficiencies and to satisfy the growing requirements of the industrial, commercial, and residential customers across GPL's franchise areas. Further, these works are in support of delivering reliable and quality electricity service to customers with the objective to bolster Guyana's economic and socio-economic development plans.

The new substations listed in section 4.2.1.5 on page 5757 will be equipped with feeders to deliver electricity to customers to satisfy the planning targets and to set the foundation for Smart grid at the distribution system. The number of planned feeders for the new substations currently in construction is as follows:

1. **Goedverwagting Substation** – 6 feeders and 2 spares; to drive the increasing industrial, commercial, and residential developments along the corridor of East Bank Demerara, providing relief to and redundancy to the New Georgetown and Golden Grove Substations.
2. **Wales Industrial** – 6 feeders and 2 spares; to serve the planned industrial development within the Wales Development Zone and provide relief to and redundancy to the planned Wales Residential/Commercial substation, in preparation for planned economic activities.

3. **Wales Residential/Commercial** – 12 feeders and 3 spares; to serve the planned residential, commercial, administrative, and mixed areas of the Wales Development Zone, and provide relief to and redundancy to the existing Vreed-en-Hoop substation and planned Wales Industrial Substation, in preparation for planned economic activities.

4.3 Guyana National Control Centre/Smart Grid

As stated in section 2.1 on page 3030, besides the lack of sufficient generation capacity, it has been a challenge for GPL to dispatch six (6) HFO-fired power plants and maintain the required spinning reserve. In an effort to mitigate frequency excursions, besides the application of primary response (machine inertia and governor), the secondary response is also required from the generators should there be a need to further address the contingency event. The Operation Code of the National Grid Code requires for Secondary Response to be triggered within 30 seconds from the commencement time of a frequency excursion. Presently, there is no automatic control system in place to provide such a timely response.

While the operators at the Control Centre monitor the power system's frequency, they are unable to react at the required speed and simultaneously ascertain the generator unit(s) that need(s) to provide the secondary response and the magnitude of the said response. The situation is further exacerbated by the current method of communication between the operators at the Control Centre and the power plants - radio communication. As a result, frequency excursions that stem from an N-G-1 or N-1 usually resulted in cascaded system shutdowns.

In view of the above, GPL has recognised the importance of timely secondary responses to attenuate frequency excursions, especially for a well-run utility in a modern economy. With Guyana moving into a new economic era, the current system control modus operandi, communication mechanism, and performance of the electric power system cannot sustain the present and future planned developments as outlined in the Low Carbon Development Strategy (LCDS) – 2030 and other National Energy Priorities.

It has also been a challenge for GPL to take absolute control of the transmission and distribution reliability indices, SAIFI and SAIDI. The situation would certainly exacerbate as the transmission and distribution coverage expands to support economic growth.

In the event of a fault on a transmission line that is currently not connected to SCADA, it takes a longer time for the operator at the Control Centre to ascertain the nature of the fault and to advise the T&D personnel on responding and restoring the line to service. Given the length and the total number of primary and secondary distribution feeders, diagnosing a fault can be challenging. The T&D personnel are required to patrol the lines manually to search for the fault evidence and perform the necessary repairs. These field exercises take time and, as a result, have direct adverse impacts on SAIDI.

Transmission and Distribution reliability have a direct and adverse impact on power demand and the public image of the power utility company. Additionally, reliability issues coupled with

power quality resulted in having an approximate total installed capacity of about 100 MW of self-generating clients.

As the power system continues to expand, continuous data analysis will certainly become a critical cornerstone for grid operation efficiency and aligning the electricity sector with LCDS-2030 and other National Energy Priorities.

In view of the forecasted electricity and peak demands for the DBIS, coupled with the expansion plans to address these demands, a modern and properly equipped Control Centre is certainly required to supervise and manage the power grid.

The Government of Guyana/GPL plans to construct a new Control Centre on the East Bank of Demerara – Guyana National Control Centre. The new Guyana National Control Centre/Smart Grid (GNCC/SG) comprises two (2) Control Centres:

1. Guyana Transmission and Generation Control Centre (GTGCC); and
2. Guyana Distribution Control Centre (GDCC).

The architecture of the GNCC/SG includes a modern state-of-the-art SCADA as the intelligence core of the power system that would have extended capabilities to integrate a host of devices across Generation, Transmission and Distribution. See Figure 2 for more information.

The construction of the GNCC/SG will be executed in two (2) phases:

1. Phase 1 – Guyana Transmission and Generation Control Centre (GTGCC). Phase 1 must be completed and commissioned before December 2024 to efficiently manage and dispatch power from the 300-Megawatt (MW) Gas-fired Power Plant to load centres served by the Demerara-Berbice Interconnected System (DBIS).
2. Phase 2 – Guyana Distribution Control Centre (GDCC). The completion of this phase, between 2025 to 2034, will realize the full implementation of SCADA in the DBIS and Isolated Power Systems – at the Distribution levels, Automated Metering Infrastructure (AMI) and Transmission and Distribution (T&D) Network Supervision and Automation – Smart Grid.

The completion of Phase 1 – GNCC/SG is a prerequisite for the successful integration and efficient dispatch of the 300 MW Gas-fired Power Plant into the DBIS. Additionally, Phase 1 will allow GPL to supervise and control the new 230 kV transmission system and the existing and expanded 69 kV sub-transmission system.

The scope of works relative to Phase 1 - GNCC/Smart Grid are:

1. Supply and Installation of a SCADA system to support the specified EMS-GMS[2] required for the GTGCC and sized to later integrate seamlessly the OMS-DMS functionalities.

[2] GMS includes Automatic Generation Control (AGC)

2. Integration of the existing transmission substations currently monitored by the SCADA in the New Sophia station with the GTGCC.
3. Gateway configuration and integration of eight (8) generating plants.
4. RTU installation and commissioning in transmission substations that currently do not have remote supervision and control.

In the current DBIS, eight (8) power plants and five (5) substations are not integrated with the present SCADA. Currently, data from these locations are manually recorded by Operators at the Control Centre. Installing RTUs at these local stations will facilitate smooth interconnection with the Guyana National Control Centre (GNCC). It will enable Operators to effectively monitor and efficiently dispatch generators remotely. Also, it will aid in the Sequence of Events (SOE) of the devices at each location, assisting Operators to identify faulted areas of the network, quickly arriving at solutions to restore the power system. With the RTU project, all required data from the respective power plants and substations will be acquired by the RTU and transferred to the Control Centre via fibre optic communication medium.

Overall, the integration of these power plants and substations to the Guyana National Control Centre (GNCC) will undoubtedly improve the operation and reliability of the DBIS. With the successful completion of this project, data acquisition and processing, time synchronization, Sequence of Events (SOE) processing, supervisory control, fault reports and trending are some of the key features that will become readily accessible.

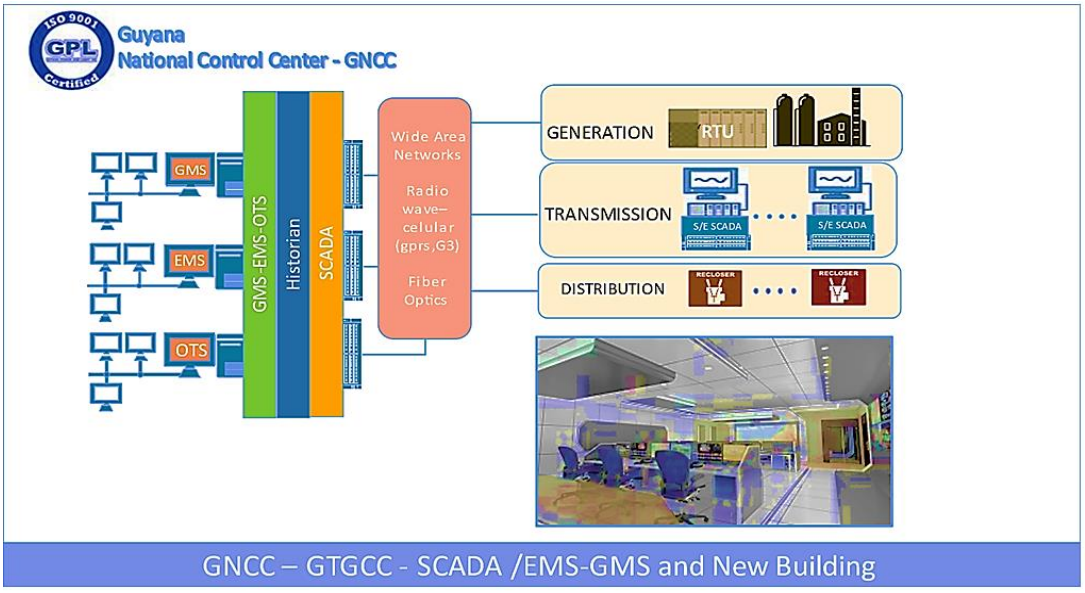

Figure 2: GNCC Real-Time Monitoring and Control Overview

In addition to the modern SCADA and the different management systems, the critical components in forming the Smart Grid include AMI meters, Auto-Reclosers, Sectionalizers, Scada-mate switching systems, Fault Current Indicators (FCIs) and Smart Inverters – allowing for Distributed Energy Resources. See Figure 3 below.

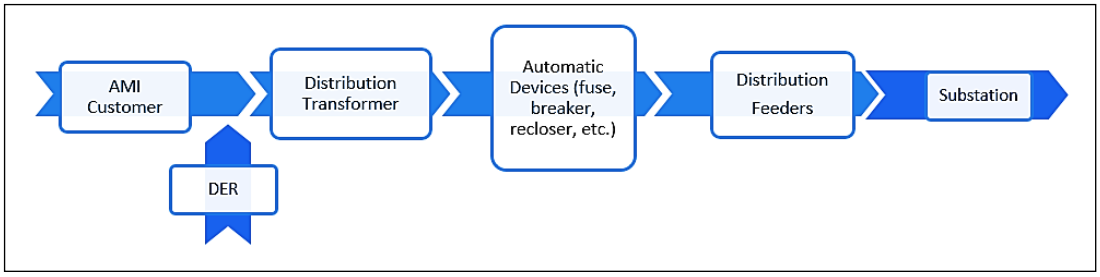

Figure 3: Proposed Smart Grid Architecture

To further improve the intelligence and self-healing capabilities of the Smart Grid, all Capacitor Banks, Voltage Regulators and Electric Vehicles (future application) would be integrated into SCADA.

The application of a Smart Grid means that all control, communication and switching mechanisms within DBIS would be automated, controlled (locally and remotely) and supervised by a modern SCADA.

The Smart Grid would support the Government's plans for economic and socio-economic developments and its Climate Change Commitments on a national level. This will be achieved by utilizing the Smart Grid to optimise the power system in real-time, for example, through generator economic dispatch, transmission, and distribution load management.

From a control's perspective, the Smart Grid will provide the grid with fast response capability to mitigate variations of grid operation parameters emanating from grid-connected intermittent renewable energy resources. As a result, the Smart Grid will allow for increasing renewable energy penetration and for Integrated Utility Service (IUS) to play an integral role in improving power system efficiency, reliability, and demand-side management.

Given that the GNCC/SG is all-inclusive, this Development and Expansion Programme seeks to ensure there are no weak links in the proposed projects that will eventually and severely limit the advantages and expected benefits to be derived from the total capital project investment.

4.4 Fibre Optic Communication Infrastructure

In GPL's automation system, each local SCADA-monitored substation is interconnected to Master SCADA at the Control Centre via OPGW (Optical Ground Wire) or ADSS (All-Dielectric Self-Supporting) fibre optic cable, each having 12 cores.

The topology of the fibre communication infrastructure follows the 69 kV transmission line. As such, it has an equally radial topology, and any contingency event will result in significant disruption of the day-to-day management and supervision of the DBIS.

With the current project scope relative to the construction of new 69 kV and 230 kV transmission lines, new 48 cores OPGW fibre cables will be installed. Given the topology of the new 69 kV and 230 kV lines, a major section of the fibre optic communication infrastructure will have redundancy.

4.5 System Losses

The progressive and sustained reduction in System Losses remains a corporate priority. Considering the 12% growth in net export from 2022 to 2023, total losses reduced from 24.92% in 2022 to 23.43% (estimated) in 2023. The projected total 5-year system losses for the aggregated GPL power system is estimated to be 9.96 % in year 2028. With Linden connected to the DBIS, total losses are estimated to be 7.48% in the year 2028.

Further reductions in system losses, especially non-technical/commercial losses, will improve the Company's revenue stream and reducing current financial burdens. The reduction of non-technical losses will certainly bolster the Company's financial position, off-setting dire needed capital investments to benefit all consumers.

The major contributors to the Company's non-technical losses are:

1. Unmetered supplies,
2. Tampered meters,
3. Illegal Street lighting, and
4. Electricity theft.

The major contributors to the Company's technical losses are:

1. Aged and long feeders (medium and low voltage),
2. Heavy-loaded feeders (medium and low voltage),
3. Customer Service Transformers with high losses; and
4. Poor power factor of maximum demand customers.

The planned total loss reduction from 23.43 % in 2023 to 9.96 % in 2028 is premised on the combination of Development and Expansion projects, which include but not limited to the construction of new feeders, feeder conductor upgrades, transformer right-sizing, meter replacements, installation of Advanced Meter Infrastructure (AMI), installation of energy-efficient streetlamps, reactive power compensation at both transmission and primary distribution levels, and low voltage service installation upgrades.

To achieve the projected loss reduction, the 2024-2028 Development and Expansion Programme will require significant and timely capital investments. Given the current revenue constraint due to high commercial losses and fuel prices, the Company will prudently pursue, through the Government of Guyana, concessional funding sources to intensify its loss reduction efforts.

4.6 Tariffs

The reduction of tariffs remains a priority for the Government of Guyana and GPL. Whilst the Company's operating license provides a tariff mechanism to adjust rates to ensure profitability

and self-sustainability, GPL will continue to adopt prudent operating practices to reduce losses and improve generation efficiency in its efforts to sustain lowered tariffs to all customers.

During 2015 and 2016, when world market fuel prices declined, the Company applied a fuel rebate of five percent (5%) and ten percent (10%) respectively. In addition, tariffs were reduced by five percent (5%) in year 2016. The aggregated effect was a twenty percent (20%) reduction in tariffs over year 2014. During the year 2021, the fifteen (15%) fuel rebates were removed and concurrently the headline tariffs were reduced by the same amount thus concretising the reduction in rates.

Despite steady increases in world market fuel prices from year 2015, when prices were below US$40 a barrel at the end of that year to more than US$90 a barrel currently, an increase of over 125% the Company has not applied any fuel surcharge or tariff increases as provided for under its license.

Whilst lowered and sustained tariffs are among the Company's primary objectives, GPL remains challenged to fund network and generation improvement projects without debt financing and grants from multi-lateral concessional lending agencies.

The following factors have a major influence on GPL's ability to lower Tariffs from the current level of approximately US$ 23 cents per kWh. A review of the projected financial performance for the period to Year 2028 highlights the following:

i) Growth in Sales Demand

The significant growth in demand (increase of approximately 145%) over the five (5) year period is projected to have a favourable impact on the generation of profits and operating cash flows. The projections have included a 50% reduction in tariffs from the beginning of year 2026[3].

The 50% tariff reduction stems from the reduced cost of electricity generation using native natural gas and efficient power generation systems, which is in keeping with Government's projections of improving the affordability of energy to boost economic growth, directly benefiting citizens and businesses.

ii) Losses (Technical and Commercial losses)

Losses are projected to decline from 23.43% to 9.96%. Further reductions in losses will have a positive impact on the financial performance and would improve the ability of the company to lower tariffs even further.

iii) Cost of Generation

By year 2025, generation using natural gas supplied by way of the planned gas pipeline is projected to provide more than 80% of the required generation. The price

[3] Assumed timeline pending the definitive Commercial Operation Date of the 300 MW Gas-to-Energy Project and Government's formal directive on tariff reduction – % reduction and commencement date.

at which the electricity is sold to GPL is therefore extremely important and will have the most impact on the ability of the company to lower tariffs by 2025. These projections assume a rate of US five (5) cents per kWh at which GPL will purchase the electricity from the Independent Power Producer.

iv) GPL's Debt Burden

The projections indicate that by the end of 2028, GPL's Related Parties Non-Current Liabilities consisting mainly of loans from the Government of Guyana would increase from approximately G$100 billion to more than G$384 billion.

GPL has negotiated with the Ministry of Finance, the extension of the moratorium on servicing the majority of the current outstanding debt until the year 2026. Discussions are ongoing to extend this moratorium to all of the remaining debt.

Converting this debt to equity, would strengthen GPL's financial position and better position the company to continue to reduce tariffs while at the same time improve its capacity to deliver a stable and high-quality electricity supply to the Nation.

5. Mandates, Planning Criteria, KPIs, Targets and Assumptions

The Government and GPL remain cognizant that access to clean, reliable, affordable, and sustainable energy is pivotal to sustaining the socio-economic development of Guyana. The aim of the current Development and Expansion Programme is to support the Low Carbon Development Strategy (LCDS) - 2030, other National Energy Priorities and specifically, the Sustainable Development Goal (SDG) No.7. In support of this aim, the objectives of this Programme are as follows:

1. Increase access to reliable and modern electricity services.
2. Improve Network Reliability and quality of electricity services.
3. Increase the renewable energy share in the grid.
4. Reduce technical and non-technical losses.
5. Enhance international cooperation to facilitate objective no.1.
6. Expand infrastructure and implementation of modern technology to support objective no.1.

As of August 2023, GPL recorded a total of 224,267 customers. It is projected that by the end of year 2023, the total number of customers would be 265,014. The key drivers of customer growth include but not limited to the vibrant Oil & Gas Sector, tourism, improvement and expansion of public infrastructure, housing, and commercial activities. Currently, the total

number of unserved customers within GPL franchise areas is 589. As such, access to electricity within GPL franchise areas stands at 99.7% - an increase of 2.2% from year 2022.

Per customer-base projection, the content of this Development and Expansion Programme is strategically structured to support an estimated total of 265,014 customers by year 2028. As the number of customers increases within the life of this Programme, the Company remains committed to ensuring all residents within its franchise areas have access to reliable, affordable, and clean electricity.

5.1 Mandates

The Engineering Service Division has the responsibility for planning new electricity supply sources, generation capacity, transmission and distribution infrastructure, and other ancillary grid requirements to satisfy the demand forecast reliably.

The Company has recognized that the emerging sources of renewable energy are becoming more competitive in terms of their affordability, supporting Government and Utilities to achieve their Climate targets, and as an enabler of Demand-Side Management (DSM) to ease the thermal stress and need of urgent capital to upgrade the power grid. In Guyana's case, the expanse of infrastructural developments relative to the housing programmes, commercial and industrial sectors to sustain the Oil & Gas sector, and the other critical economic sectors, the current power systems are considered inadequate to meeting the required reliability and service quality targets to support economic development sustainably.

Through the Company's Corporate Strategic Plan, the Engineering Service Division remains committed to supporting Governments emission reduction target of 70% by year 2030. As such, in the current continuously evolving economic environment, it is paramount to ensure that the planning process and its results are maintained relevant to supporting the aim of this Development and Expansion Programme. In doing so, the Division intends to adapt the philosophy of Integrated Resource and Resilience Planning (IRRP) progressively.

5.1.1 Increase access to reliably and modern electricity services.

Ensuring universal access to affordable, reliable, and modern electricity services is one of the top priorities of the SDG No. 7. Tracing the Company's performance on this target, from 2021 to 2023, access to electricity has progressively increased from 96.70% to 99.73%.

Amid the current customer-base expansion due to Guyana's rapid economic growth within its franchise areas, the Company stands resolute to improve further customers' access to reliable and modern electricity services.

Regarding other currently unserved areas that are considered remote to GPL's power systems, the Company remains committed to assisting the other utilities as deem necessary and within its capabilities to ensure that Guyana achieves SDG target No. 7.1.

5.1.2 Improving network reliability and quality of electricity services

The transmission and distribution systems are the essential components that connect the customers to the electricity generation sources. The growing customer-base in Guyana comprises a modern multifaceted society that depends on the reliable and economic delivery of electricity. To become further aligned with SDG target No. 7.1, the Government and GPL are aware that the reliability of the transmission and distribution system **must** be improved.

Further to the need of being aligned with SDG target No.7.1, it must be underscored that reliable transmission and distribution systems are critical to the Government, GPL, and Customers to realise the true benefits of the current massive investment in Guyana's Electricity Sector. As such, through this Development and Expansion Programme, GPL remains committed to improving progressively the reliability indices of its transmission and distribution systems.

5.1.3 Increasing the renewable energy share in the grid.

SDG target No. 7.2 outlines the required substantial increase of renewable energy share in the global energy mix. The beckoning call to increasing the renewable energy share in the energy sector is global, where every country has its specific role and time-based target.

The Government remains committed to reducing Guyana's net carbon emissions at least by 70% by year 2030. The Low Carbon Development Strategy (LCDS) outlines the Government's roadmap to achieving this target, which includes increasing the renewable energy share on the grid.

GPL remains committed in supporting Government's carbon reduction through its Net Billing Programme (Feed-in Tariff) and improving the efficiency of the Company's power generation, transmission, and distribution systems. In this regard, the Company aims to launch a customer-friendly online tool on or before mid-2024 to further its Net Billing Programme and Government's energy initiatives.

It must also be emphasized that the Government and GPL are cognisant of the technical requirements of the grid to facilitate the increasing hosting capacity of intermittent renewable energy resource. The Government and GPL will continue to embrace these requirements, ensuring that they are addressed in a timely manner.

5.1.4 Reducing Technical and Non-Technical Losses

SDG No. 7 also has an efficiency objective – Target No.7.3, which requires a doubling of the global rate of improvement in energy efficiency to aid global carbon emission's reduction. In this regard, GPL remains resolute to reducing its current technical and non-technical losses. Progressively, total losses of the Company have been decreasing from 30.9% in year 2013 to 24.92% in year 2022. It is estimated that year 2023 total losses would close at 23.43%, signalling a 7.47% reduction in a fast-paced growing economy within the last 10 years.

While non-technical/commercial losses are aligned with revenue loss, it certainly presents a hard constraint on the Company's financial ability to offset efficiently and effectively capital

expenditures to reduce technical losses in a timely manner. GPL will continue to persevere in its endeavour of enforcing the recourse actions outlined in the Electricity Sector Reform Act 1999 (ESRA) to reduce the current non-technical/commercial losses, which will certainly strengthen the Company's revenue stream.

In this Development and Expansion Programme, specific focus is being placed on technical loss reduction to complement the non-technical loss reduction strategies towards improving the energy efficiency of GPL power systems.

5.1.5 Enhance International Cooperation to facilitate objective No.1

In view of the required scope and capital expenditures to achieve SDG No.7 targets, this objective remains a top priority to the Government and GPL. In this regard, GPL has been liaising with the IaDB, European Union, GGGI, IRENA, KIAT etc. through the Government of Guyana, to realise the objectives outlined in the previous and current Development and Expansion Programmes.

5.1.6 Expand Infrastructure and Upgrade Technology to support objective no.1.

This Development and Expansion Programme outlines the Government and GPL's plans to ensure that the Company's power systems are entuned to support the Low Carbon Development Strategy (LCDS) and Sustainable Development Goals (SDGs), specifically goal no.7.

5.2 Technical Planning Criteria

GPL has identified two significant planning constraints to power system development and expansion: reliability and availability of capital investments.

Prior to 2019, the planning criterion that drove the expansion plans was capacity reserve. Although capacity reserve provides a practical indication of the health status of the power generation system, probability-based power generation reliability metrics such as Loss of Load Probability (LOLP) or Loss of Load Expectation (LOLE) provide more accurate details on the ability of the installed power generation capacity to satisfy the current and future electricity demands.

The LOLP is a probabilistic metric that indicates the probability of the total available firm generation capacity unable to satisfy the forecast electricity demand. This generation reliability metric is also expressed as the equivalent number of day(s) per year as Loss of Load Expectation (LOLE) or hour(s) per year as Loss of Load Hour (LOLH). This can also be understood as the equivalent total number of days in a year that the total available firm generation capacity will not be able to satisfy the demand. As a result of a high probability, there would be a corresponding high Expected Energy Not Served (EENS). Additionally, Unserved Served Energy (USE) indicates the demand that could not be met due to a shortage in generation and/or transmission capacity due to transmission congestion.

The planning LOLH/LOLE/LOLP varies globally and depends on the country's economic status quo and projection. Table 4 below shows the planning LOLP/LOLE targets of several section of the global economy.

Table 4: Typical planning LOLP/LOLE targets

Item No.	Location	LOLH or LOLE	LOLP
1	North America	LOLE ≤ 0.1 days per year	LOLP ≤ 0.02% per year
2	Belgium, France, Great Britain, and Poland	LOLH ≤ 3 hr per year or LOLE ≤ 0.125 days per year	LOLP ≤ 0.034% per year
3	Netherlands	LOLH ≤ 4 hr per year or LOLE ≤ 0.167 days per year	LOLP ≤ 0.046% per year
4	Spain	LOLE ≤ 1 day in 10 years (Island grid)	LOLP ≤ 0.027% per year
5	Oman	LOLH ≤ 24 hr per year or LOLE ≤ 1 day per year	LOLP ≤ 0.27% per year
6	Jamaica	LOLE ≤ 2 days per year	LOLP ≤ 0.55% per year

The transmission system also has planning targets, and these are detailed in section 2.6 of the Planning Code of the National Grid Code.

5.2.1 GPL Expansion Planning Criteria

GPL seeks to expand and develop its power systems in alignment with the vision of the Low Carbon Development Strategy (LCDS) – 2030 and other National Energy Priorities to improve the quality and reliability of electric service to customers, and to support national developments. Further, in accordance with the Company's Corporate Strategic Plan, GPL aims to be a world-class utility service provider as seen by its SUCCESS in exceeding its stakeholder's expectations.

In view of the above, the Company has defined a set of critical planning criteria for Generation and Transmission and Distribution (T&D) expansions to ensure there is an adequate balance of the investment allocation for Generation, Transmission and Distribution. These planning criteria are:

1. LOLP ≤ 0.27% per year (LOLE ≤ 1 day/year).
2. Compliance with section 2.6 of the Planning Code for Transmission Reliability Criteria.
3. Compliance with section 2.7 of the Planning Code for Voltage Regulation Standards.
4. Compliance with section 2.8 of the Planning Code for Voltage Swing Criteria.
5. Compliance with section 2.9 of the Planning Code for Voltage Stability Criteria.
6. Compliance with section 2.10 of the Planning Code for Damping.
7. Compliance with section 2.11 of the Planning Code for Frequency Deviations.

8. Configure primary distribution feeders to achieve a thermal loading and total backbone length by at least 50%, respectively; and
9. Provide backup circuits to mitigate contingencies at the primary distribution level, where applicable and not constrained by the geographic layout of the customer base.

As a result of the above planning criteria, the Company has developed a menu of expansion projects at addressing the aim of this Development and Expansion Programme. See section 12, 15 and 27 on pages 126, 136 and 200 respectively for further details.

5.2.2 Operation Planning Criteria

The annual contingency capacity of the DBIS, which is premised on the forecast peak demand, required spinning reserve and available firm generation capacity, remains critical to ensuring there is adequate firm generation capacity to support grid stability and mitigation of the N-G-1 criterion.

5.2.2.1 Grid Frequency Management

Regarding frequency management for the DBIS and Isolated Systems, there are two spinning reserve requirements: (1) spinning up reserve and (2) spinning down reserve. The following description relating to spinning reserve is relative to the current DBIS. In view of the generation expansion plan, the governing concept/principle is expected to remain, however, tailored to specific generator units under the technical guidance of Automatic Generation Control (AGC).

Installation of AGC is a subcomponent of the Phase 1-GNCC/Smart Grid project. See section 4.3 on page 59 for more details on this project.

Spinning up reserve is an extra generation capacity available by **increasing** the power output of grid-connected generators. This available MW of spinning reserve is used to respond to short-term variations in demand, generator unit forced outages or variations in the output of intermittent renewable energy systems. For Guyana, GPL adopted the rule of thumb by NYISO (NYISO, 2020) and PJM (NREL, 2011), which states that the spinning reserve shall be 150% of the single largest contingency. In the case of the DBIS, the single largest contingency is presently equivalent to an N-G-1. With the 46.5 MW plant at Garden of Eden commissioned, the required spinning reserve for secondary response is 13.95 MW – ancillary service.

Spinning down reserve is an extra generation capacity available by **decreasing** the power output of grid-connected generators. This available MW of spinning reserve is used to respond to short-term variations in demand, generator unit forced outages or variations in the output of intermittent renewable energy systems.

The spinning down reserve is half of the spinning up reserve – 6.8 MW.

Under-frequency events result when the aggregated generation capacity is less than the total demand. Such an event can be due to:

1. An N-G-1 event – loss/trip of a generator unit.

2. Energization of a large load; or
3. N-1 on the transmission line(s) that result(s) in the loss of generation MW on the grid.

As per section 4.5.5 of the National Grid Code (page 150) – Reserve Margins, there are three (3) main frequency control/correction mechanisms:

1. **Primary** – automatic response from Generator Unit Governor, fully available within 5 seconds the time of a frequency excursion.
2. **Secondary** – automatic (AGC)/manual response in the adjustment of generation dispatch, fully available within 30 seconds of the time of a frequency excursion. Additionally, automatic load-shedding to mitigate high-frequency excursion events.
3. **Tertiary** – Instruction to synchronize and/or dispatch other generation units as well as Economic Dispatch of Generator unit(s).

With the Vreed-en-Hoop power plant (DP4) operating in Isochronous mode, it acts as the swing/slack bus to correct/normalise power system frequency within 1 second of a frequency deviation from the setpoint value of 60 Hz. As such, DP4 generator units need to be dispatched at such loading value that it can provide the DBIS with the required spinning reserve, while not exceeding the required minimum stable loading.

The minimum dispatch of each available generator unit at DP4 is 75% of the generator unit's nominal rating. This loading corresponds to each unit being loaded at 6.525 MW and 2.175 MW is allocated as spinning reserve. The aggregated output from DP4, when all units are available is 19.575 MW, and total spinning reserve at 6.525 MW.

To achieve the total required reserve of 13.95 MW (1.5*9.3 MW), generator units in Speed Droop mode shall be loaded, such that, the balance of 7.425 MW of spinning reserve can be provided. This is achieved with more units in Speed Droop mode, such as from the generator units at DP1, DP2, DP3, DP5, C/field – Hyundai and SEI HFO units.

In the event one or two units are unavailable at DP4, the available unit(s) is/are dispatched at 75%. The balance spinning reserve is obtained from the other units in Speed Droop Mode to achieve the total 13.95 MW spinning reserve.

The permitted Spinning Reserve margin is ±5% of 13.95 MW – Permitted Range: 13.25 MW-14.65 MW.

Only in the event of a worst-case scenario in generation available capacity at DP1, DP2, DP3, DP4 & DP5, the critical minimum total spinning reserve is considered to be 9.3 MW.

5.2.2.2 DBIS Automatic Under Frequency Loadshedding (AUFL) Scheme

The objective of the AUFL scheme is to shed load automatically at various substations after the exhaustion of the primary response.

Definition of Generator Engine Control Modes:

True kW: engine speed is only used for safety purposes. The generator unit outputs the operator setpoint value and does not actively support system frequency.

Speed Droop: a load-sharing mode when operating generators in parallel. Generator engines in this mode share their load by decreasing their internal speed reference proportionally to an increase in the engine load. Generator unit frequency and loading are related to each other via the droop characteristics. This mode aid in frequency control as described below (see Figure 4):

- 3% droop means that for every 1% change in the generator speed reference, its output will change by 33.33%. Also, the generator unit frequency will change by 4% when its loading change from 100% to 0% - no load frequency would be 61.8 Hz.
- 4% droop means that for every 1% change in the generator speed reference, its output will change by 25%. Also, the generator unit frequency will change by 4% when its loading change from 100% to 0% - no load frequency would be 62.4 Hz.
- 5% droop means that for every 1% change in the generator speed reference, its output will change by 20%. Also, the generator unit frequency will change by 5% when its loading change from 100% to 0% - no load frequency would be 63 Hz.

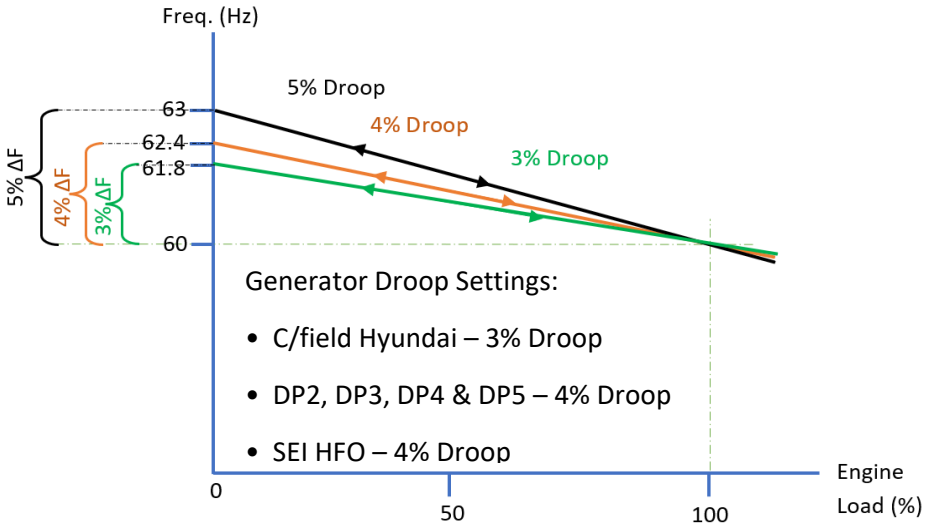

Figure 4: Speed Droop characteristics

Isochronous: a load-sharing mode where the engine speed will be regulated to the speed reference (frequency setpoint – 60 Hz) regardless of the load of the generator units (Figure 5). As such, the frequency is kept constant and not load-dependent.

As per section 2.11 of the National Grid Code:

- Frequency shall not drop below 57.7 Hz.
- Frequency shall not exceed 63 Hz.

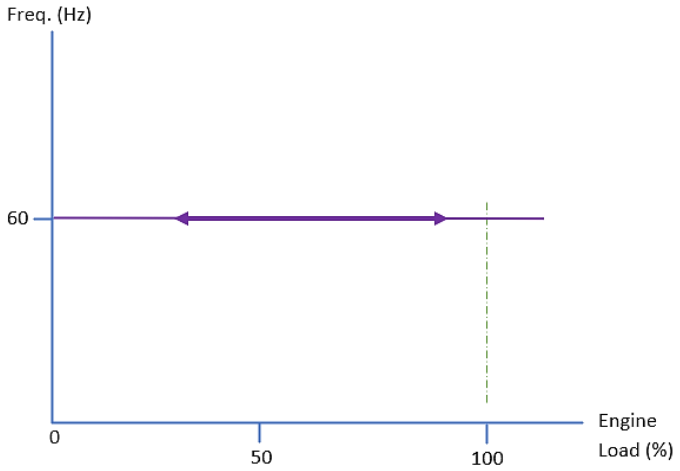

Figure 5: Isochronous characteristic

5.2.2.3 Spinning Reserve with Intermittent Renewables

With grid-connected Solar PV and Wind energy systems, the power systems must be supported with additional spinning reserve capacity to mitigate the effects of output volatility and variability.

Research has indicated the need for an additional reserve capacity equivalent to 30% of installed Solar PV and/or Wind capacities. In the case of both Solar PV and Wind connected to the grid, 30% of installed Wind capacity during the night and the day, 30% of Solar PV and Wind capacities. The additional 30% of installed intermittent renewable energy capacities apply to both spinning up and spinning down reserves.

In the DBIS, the three (3) power plants capable of providing spinning reserve are Kingston II - DP3, Vreed-en-Hoop - DP4 and Garden of Eden - DP5. Simulation results have indicated that 27% of DP3 (9.86 MW) and DP4 (7.1 MW) installed capacity, respectively, can provide spinning reserve. The aggregated spinning reserve would be 16.96 MW.

In consideration of the largest Solar PV capacity, the DBIS would have a total of 10 MWp and Linden, 15 MWp. Until Linden is connected to the DBIS in 2026, the additional required spinning reserve for the Solar PV system would be 3 MW by 2024. With Linden connected to the DBIS in 2026, the total additional required spinning reserve would be 7.5 MW.

As a result of the Isolated Systems operating with only a few small diesel generator units, the spinning reserve is provided by the generator unit's technical minimum to maximum capacity – full operating range.

As power generation expansion continues, especially using larger generator units, the required spinning reserve would increase. Additionally, the spinning reserve requirement from conventional generators would increase as the penetration level of intermittent renewable energy in the grid increases.

With Battery Energy Storage Systems (BESS), the dependency on conventional generators to provide spinning reserves will be reduced.

5.2.2.4 Transmission and Distribution

Each transmission line has its own derated capacity rating based on conductor age and frequency of maintenance. These derating influencing factors are modelled via the properties of conductor emissivity and absorptivity. As a result, each single-circuit transmission line is loaded up to 75% of its derated capacity.

For double-circuit transmission lines, each line is loaded to 37.5%, such that, in the event of N-1 contingency, the remaining energised line would be loaded at 75%. However, for such a contingent event, the energised line is permitted to operate up to 100^0C for a total duration of 330 seconds. Such an overload duration constraint is applied to transmission lines with ASCR and AAAC conductors only. In the case of ACCC conductor type, the transmission line is permitted to operate up to 200^0C for an aggregated total hour of 10,000 hours over its entire service life.

5.3 Corporate Key Performance Indicators and Targets

GPL has identified Key Performance Indicators (KPIs) for its main objectives, and these have been drilled down to Divisional levels, as reflected in the Divisional Plans (see section 20, page 157 for Divisional Plans details). The KPIs are consistent with the Company's mission and vision and cover areas relating to the Company's drive towards '**SUCCESS'**:

- **S**ervice quality.
- **U**ptime/ reliability of systems.
- **C**overage / access to service.
- **C**ompliance with applicable regulations and standards.
- **E**fficiency in all activities.
- **S**afety and security. and
- **S**ustainability.

To achieve **SUCCESS**, the KPIs have been disaggregated into OS&PT, CSS, and Additional Corporate Indicators. See Table 5 for all relevant details and projections relative to the defined KPIs.

Table 5: Corporate Key Performance Indicators (KPIs)

	Unit of Measure	Target 2024	Target 2025	Target 2026	Target 2027	Target 2028
Operating Standards and Performance Targets						
1. Issuance of bills after meter reading	days					
- MD	days	7	7	7	7	7
- Non-MDs	days	10	10	10	10	10
2. Meters Read						
- MD	%	97	98	98	98	98
- Non-MDs	%	90	90	90	90	90
3. Accounts Receivable	days	30	30	30	30	30
4. Accounts Payable	days	26	26	26	26	26
5. Losses (update using losses trend)	%	22.2	20.47	17.32	12.09	9.96
6. Average Availability	%	80	80	80	80	80
7. Customer Interruptions- System Average Interruption Frequency Index (SAIFI)		85	80	75	70	70

	Unit of Measure	Target 2024	Target 2025	Target 2026	Target 2027	Target 2028
8. Customer Interruptions- System Average Interruption Duration Index (SAIDI)		80	71	63	53	43
9. Voltage Regulation	%	95within 25 days	95 within 25 days	95 within 23 days	95 within 21 days	95 within 20 days
Customer Services Standards						
1. New Service installation- Non-Capital (Days)						
- Commercial	days	6	3	3	3	3
- Residential	days	6	3	3	3	3
2. New Service installation – Capital						
- Commercial	days	40	30	30	30	30
- Residential	days	30	30	30	30	30
3. Response to queries (Billing, service, complaints, and inquiries)						
- Acknowledge only	days	~~3~~	2	2	2	2
- Inquiries – written, OTC or telephone	days	~~5~~	3	3	3	3
- Billing inquiries – No Site Visit	days	~~5 d~~	3	3	3	3
- Legal inquiries – No Site Visit	%	~~100 In 21 days~~	100 in 15 days	100 in 15 days	100 in 15 days	100 in 15 days
- All inquiries – Site	days	~~28~~	21	21	21	21
4. Reconnections service and meter in place						
- In Georgetown	days	1	1	1	1	1
- Elsewhere	days	2	2	2	2	2
5. Reponses to repair calls						
- Commercial	days	~~1~~	1	1	1	1
- Residential	days	~~1~~	1	1	1	1 day
6. Reconnections service and meter NOT in place						
- Commercial	days	~~7~~	3	3	3	3
- Residential	days	~~7~~	3	3	3 days	3
7. Response to a written notice from customer where a meter may be improperly registering						
- Time to respond to written notice	days	~~5~~	2	2	2	2

	Unit of Measure	Target 2024	Target 2025	Target 2026	Target 2027	Target 2028
- Time to complete test	days	~~9~~	7	7	7	7
8. Replacement of an improperly registering meter after the improper registration has been confirmed						
- Commercial	days	~~50~~	15	10	10	10
- Residential	days	~~50 days~~	15	10	10	10
Additional Corporate KPIs						
1. New Service application processing time	days	1	1	1	1	1
2. Straight connections corrected in 1 day	%	100	100	100	100	100
3. Call Centre Response	%	96	97	98	99	100
4. Collection Rate (Average)	%	96	97	98	99	100
5. Response to Repair Calls Within 24 Hours	%		100	100	100	100
6. Percentage of Households with access to electricity	%	97.5	98.5	99	99.5	99.
7. Required Reports Submitted on time	%	100	100	100	100	100
8. Environmental Requirements Met	%	100	100	100	100	100
9. Collection Rate (Average)	%	95	96	97	98	99
10. Generation Plant Efficiency – HFO	IG/MWh	50.4	50	50	50	50
11. Generation Plant Efficiency – LFO	IG/MWh	61.6	60	60	60	60
12. Overtime/Basic Pay	%	38%	35%	30%	25%	20%
13. Percentage of Projects Completed on Time, while meeting quality and performance requirements	%	87%	87%	90%	92%	94%
14. Percentage of Projects Completed on Budget while meeting quality and performance requirements	%	87	87	90	92	94
15. Number of reportable safety incidents	No.	19	10	0	0	0
16. Person-hours lost due to safety incidents		0	0	0	0	0
17. Renewable Energy as % of Energy Generated	%	2.9	6.2	7.4	5.7	8.0
18. Liquidity Ratio	%	1.31	1.36	1.41	1.46	1.51
19. EBITDA/Revenue	%	22	22	22	22	22
20. Debt/Equity Ratio	%	84	84	84	84	84
21. Staff vacancies adequately filled within 45 days	%	85	86	88	90	92
22. PMS Reviews completed on time	%	90	92	94	96	98
23. Required staff training and development programs implemented as per PMS	%	85	86	88	90	92

5.4 Customer Growth and Demand Forecasts

Access to reliable and affordable electricity is a critical indicator of social and economic development. Moreover, energy is one of the fundamental cornerstones for industrial production, development of local commercial markets and improving the livelihood of citizens. As such, forecasting energy consumption is paramount for macro-planning.

The aim of the energy forecast is to inform the required expansion projects to ensure there is a consistent balance between the supply and demand of energy reliably.

It is important to highlight that forecasting errors can lead to unbalance supply-demand, which would adversely affect operational cost, network efficiency, and the quality of the electricity supply. Underestimation of electricity demand can lead to power outage, which can be harmful to both the economy and the daily life of society. On the other hand, overestimation of energy demand may lead to having stranded assets, wasting valuable financial resources.

5.4.1 GPL Power Systems

The aggressive increase in the demand for electricity is premised on unprecedented growth in the number of customers and increased energy intensity per customer. Certainly, the fundamental basis of this aggressive demand increase is subject to the current steep growth of Guyana's economic sectors.

Historical data for the period 2011-2022 revealed that GPL power systems (DBIS & Isolated group of Power Systems) experienced escalating electricity demand. Gross generation has been increasing at an average annual rate of 4.9% or by 41.72 GWh per annum, moving from 653.4 GWh in 2011 to an estimated 1,154 GWh by the end of year 2023. The historical average 5-year gross generation increased by 7%, that is, from 876.83 GWh in 2019 to an estimated 1,154 GWh in 2023. Comparing year 2022 gross generation with 2023, the increase is estimated at 12%, that is, from 1,030 GWh in 2022 to an estimated 1,154 GWh by the end of 2023. See Figure 6 – All GPL Power Systems, for graphical details.

The non-coincidental peak demand of the aggregated GPL power systems experienced an annual average growth of 6.7% or 8.54 MW per annum, that is, from 90.1 MW in 2011 to 191.6 MW (suppressed peak demand) in 2023. In the recent 5 years, the aggregated GPL power system experience a 9.1% growth rate in its non-coincidental peak demand, that is, from 126.8 MW in 2019 to 191.6 MW in 2023. Comparing 2022 peak demand with 2023, the increase is estimated at 17.9%, that is, from 162.6 MW in 2022 to 191.6 MW in 2023. See Figure 6 for graphical details.

On 27th September 2023, the DBIS recorded a peak demand of 172.9 MW. An estimated 8.4 MW of loads were shed to maintain grid stability. As such, the DBIS estimated peak demand for year 2023 was 181.3 MW. In year 2022, the forecasted peak demand for year 2023 was 186.6 MW. With the unsuppressed peak demand at 181.3 MW and the total available generation capacity currently ranging between 175 MW and 171.9 MW, the supply-demand gap for year 2023 can be estimated to be between 6.3 MW and 9.4 MW.

One of the first and immediate steps taken by the Government to address supply-demand gap is based on the concept of demand responses – specifically, Time of use Tariff. The approach from the Government essentially placed a 14% VAT only on maximum demand customers (commercial and industrial tariffs). However, to date, GPL continues to experience high peak demands relative to available generation capacity, which can result in temporary disconnection of maximum demand customers and shedding any additional required load to satisfy the available generation capacity. While this is a temporary solution, it is certainly not business-friendly for the Company's valued customers, and by extension, the economy.

In consideration of all economic activities currently unfolding on a national scale and increased ambient temperature, assuming unconstrained available generation capacity, it is estimated that the DBIS the peak demand would have surpassed the forecasted 186.6 MW, approaching approximately 200 MW in year 2023.

While the average load factor for the aggregated GPL Power Systems has been decreasing at 1.4% per annum for the period 2011 to 2023, the average value for this period has been 0.77 pu. The progressive decrease in the power systems load factor is mainly due to the rapidly increasing peak demand, which is a result the rapidly increasing number of residential customers across Guyana. See Figure 6 for graphical details.

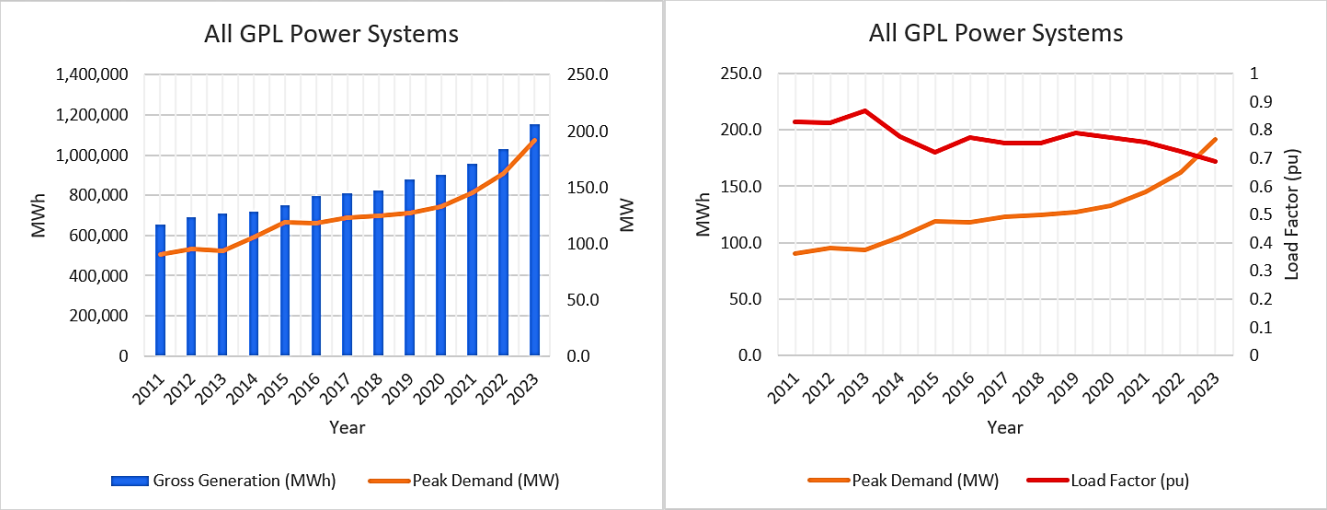

Figure 6: All GPL Power Systems Historical Electricity Demand and Load Factor Records

5.4.2 Linden Power System

Linden's historical data exhibited significant electricity demand growth in the recent years. For the entire period of 2011-2023, the average annual percentage increase is 3.7% or by an annual average of 2.1 GWh, that is, from 46.5 GWh in 2011 to an estimated 71.6 GWh in 2023. The recent average 5-year period gross generation increased by 5.5%, that is, from 57.5 GWh in 2019 to an estimated 71.5 GWh in 2023. Comparing 2022 gross generation with 2023, the increase is estimated at 7.4%, that is, from 66.6 GWh in 2022 to an estimated 71.5 GWh in 2023. See Figure 7 - Linden Power System for graphical details.

The peak demand for Linden power system experienced an annual average growth of 3.1%, that is, from 7.8 MW in 2011 to 11.1 MW (estimated) in 2023. In the recent 5 years, the Linden power system experienced a 5.1% growth rate in its peak demand, that is, from 8.6 MW in 2019 to 11.1 MW in 2023. Comparing 2022 peak demand with 2023, the increase is estimated at 12.1%, that is, from 9.9 MW in 2022 to 11.1 MW in 2023. See Figure 7 – Linden Power System for graphical details.

While Linden Power System currently has generation capacity, the continuous upward trend of gross generation indicates that the town has experienced economic development (improved standard-of-living). As the demand for electricity continues to grow, Linden will certainly need to bolster its generation capacity in a timely manner.

Linden's actual peak demand increased, on average, by 1.8%, moving from 7.8 MW in 2011 to 9.4 MW in 2021, and the power system load factor ratio increased, on average, by 0.8%, moving from 0.68 pu in 2011 to 0.75 pu in 2021, indicating improvements in capacity generation, where supply closely followed demand.

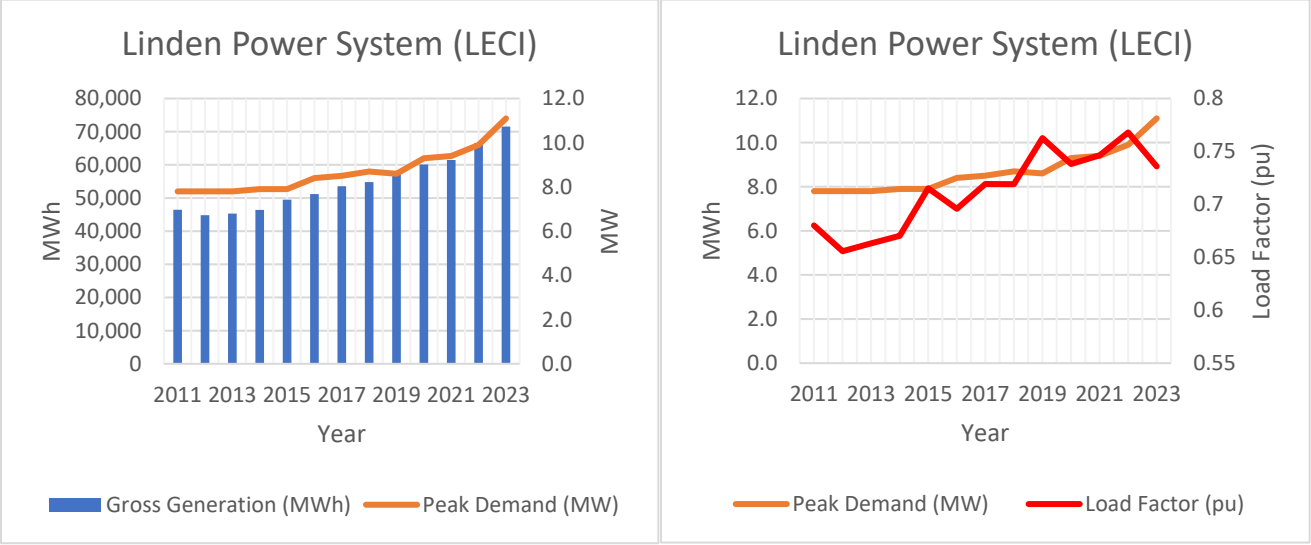

Figure 7: Linden Historical Electricity Demand and Load Factor Records

Progressively, the load factor of the Linden Power System has been on the increase, that is, from 0.68 pu in 2011 to 0.74 pu in 2023. While the peak demand has been increasing, the coincidental increase of the load factor is an indication of increase in electricity demand from customers within the commercial tariff bracket.

5.4.3 Forecasts

Per GPL practice relative to planning, medium-term is defined as a ten (10) year period and long-term, fifteen (15) years. Albeit this Development and Expansion Programme comprises a 5-year planning period, medium and long term demand forecasts were developed and considered in the expansion model to ensure there is synergy in the year-to-year investment

plan to support the Government's prospects of National Development. See Appendix 1 on page 200 for further information on medium to long term forecasting.

This Development and Expansion Programme is primarily premised on Base Case demand forecast, which provides critical insights on required gross generation, net grid export, sales (customer demand) and losses (technical and non-technical).

It is important to highlight that year 2022 demand forecast was developed using established econometric modelling techniques, having a top-down approach, while for year 2023, the results are based on the application of simple regression using a bottom-down approach.

5.4.4 Data Collection – Demand Forecast

The forecast is driven mainly by the economic activities relative to planned infrastructural development projects located within the GPL franchise areas of Region Nos. 2, 3, 4, 5, 6 and 7 (Figure 8), which stemmed from Guyana's Oil & Gas and other vital economic sectors.

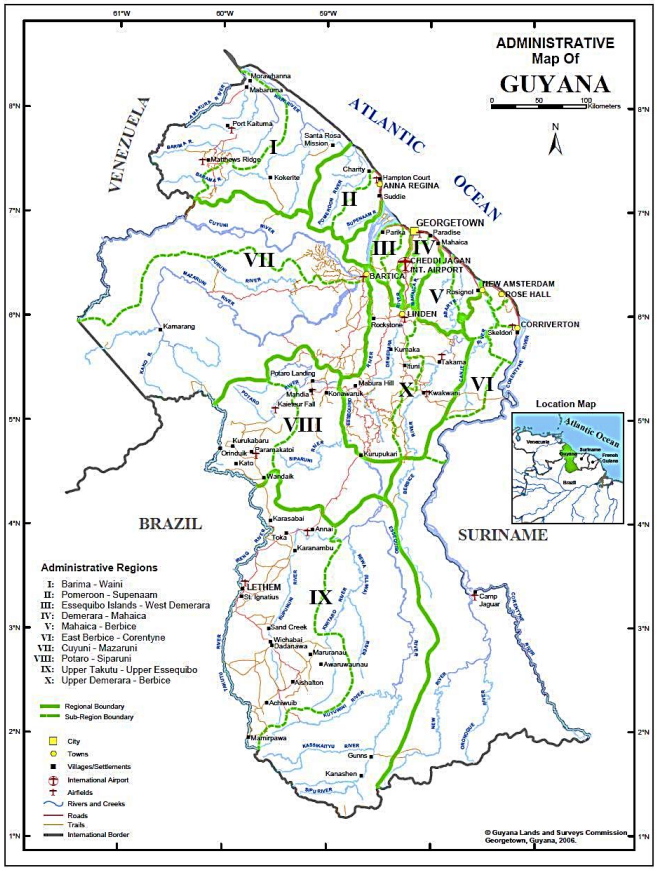

Figure 8: Map of Guyana showing Regional Boundaries

Over the past year, GPL has been collecting data on all planned infrastructural development projects. These projects include works from the Central Housing and Planning Authority (CH&PA), construction of schools, hospitals, hotels/apartment complex, and the establishment of commercial and industrial facilities/businesses. Additionally, the customer growth accounts for currently documented unserved customers within the GPL franchise areas.

The dataset indicates that planned infrastructural development projects would add approximately 23,611 customers to GPL. This additional number of customers represents an estimated 120 MW to be added to the total GPL power system by year 2028. See Table 6 for relevant breakdown details of planned infrastructural development projects.

Table 6: Breakdown of Planned Infrastructural Development Project.

Load Demand Components Planned Infrastructural Developments (PID)	Total No. of Projects	Estimated No. of Customers - GPL Only	Estimated No. of Customers - GPL & Linden	Estimated PID & UsA Demand by 2028 (MW) - GPL Only	Estimated PID & UsA Demand by 2028 (MW) - GPL & Linden
CH&PA Housing Projects	69	23,536	25,617	76	77.5
School/Educational Development	28	28	28	4	4.0
Hospitals/Health care Improvements	18	18	18	12.1	12.1
Hotels/Apartment Complex	14	14	14	16	15.6
Commercial and Industrial Projects	16	15	17	12	12.2
sub-total PID	**145**	**23,611**	**25,694**	**119.2**	**121.4**
Unserved Areas (UsA) - No. of Customers	**N/A**	**589**	**589**	**0.8**	**0.8**
Total		**24,200**	**26,283**	**120.0**	**122.2**

At the regional level, the breakdown of the number of customers relative to planned infrastructural development projects and unserved customers are shown in Table 7.

Table 7: Breakdown of Number of Customers per Region relative to Planned Infrastructural Development and Unserved Areas

Region No.	No. of New Potential Customers by		Utility Company
	Planned Infrastructural Development	Unserved Areas	
2	1,552	38	GPL
3	6,651	25	
4	12,458	221	
5	1,977	236	
6	466	56	
7	507	13	
sub-total GPL Only	**23,611**	**589**	
10	2,083	2,695	LECI (Linden)
Total	**25,694**	**3,284**	

In addition to the above, an additional estimated total of 15,812 customers are considered in the current GPL customer growth projection for the current planning period. This total represents the number of customers resulting from a combination of the estimated 109 active self-generating clients, the experience of current customers subletting/converting a section of their property to business endeavours, which can include small shops, supermarkets and apartment(s), public illumination for highways/roadways and streets, drainage pump stations, potable water supply stations for existing and new housing schemes and electric vehicles (EVs).

GPL initiated a survey exercise to better understand the details relative to the self-generating clients. While GPL continues with this survey, the response rate to date stands at 35%. One of the major benefits to date of this exercise is the output a refined list of self-generating clients. This list indicates that the total active number of self-generating clients is 109, where 95 is within the coverage of the DBIS and the remaining 14[4] are located within the group of Isolated Power Systems. Albeit GPL is not in receipt of feedback from the total list of self-generating clients, examination of the dataset indicates that more than 95% of the total number corresponds to GPL's industrial tariff, and the balance, commercial.

Further, the estimated total installed generation capacity is circa 75 MVA, which can correspond to 65 MW. From a qualitative perspective, it is estimated that approximately 30% to 35% of the total self-generating clients are prepared to become grid connected clients as soon as possible. As a result, the remaining 65% to 70% of self-generating clients are estimated to be grid connected clients within the currently planning period.

It is assumed that the average load factor of all self-generating clients is 0.65. Considering at minimum a 25% of total number of self-generation client connected to the grid by the end of year 2024, this represents approximately 10.6 MW. The remaining 54.4 MW is spread across the period 2025 to 2028 – approximately 13.6 MW per annum.

Over the past nine (9) years, electric vehicles (EVs) have introduced a new and efficient mode of transport in Guyana. To date, there are approximately 116 EVs in service. Given the presence of this new transportation technology, the Guyana Energy Agency (GEA) is taking the lead, with assistance from REVAMP and IaDB, on two (2) critical initiatives to ensure there is sustainable growth of EVs in Guyana. These initiatives are related to establishing charging stations and capacity building for mechanics and auto electricians. As a pilot project, the GEA installed six (6) EV charging stations; four (4) in region no.4, and one (1) each in region nos. 3 and 6, respectively. Each charging station has a rated demand of 27 kVA.

As the number of EVs in Guyana increases, it is expected that additional charging stations would be deployed across the country. However, it must be highlighted that the projection of EVs in Guyana is based on many critical external factors and sustainable energy policies.

5.4.4.1 Demand Side Management (DSM) and Energy Efficiency (EE)

Demand Side Management (DMS) is a strategic way of managing the shape of load profiles to match the most economical generation capacity dispatch and mitigating technical losses. Load shape management strategy includes peak clipping, conservation, load building, valley filling, flexible load shape and load shifting. In addition to reducing electricity demand, several reasons have been put forward to promoting or undertaking DSM. These include, but are not limited to electricity cost reduction, reducing dependency on expensive importation of fossil fuel,

[4] 100% Rice Mills and excludes Bartica. Bartica has no self-generator client.

environmental and social improvements, addressing reliability and network issues, and ensuring electricity supply security.

5.4.4.2 Demand Side Management from Utility Perspective

The load-shape management strategy can be achieved by non-technical and technical interventions.

Non-technical interventions include activities or programmes that promote electric energy efficiency or conservation, or more efficient management of electricity consumption through the media, social platforms, public outreaches, and application of Time of Use tariff.

GPL continues to signal its endorsement of Demand Side Measurement by crafting information dissemination initiatives aimed at different target groups. GPL's efforts are supported by the EU/IDB-funded Social Management Programme within the Power Utility Upgrade Programme (PUUP). The consolidated efforts of the Company's Public Relations Officers and the EU/IDB funded Social Management Specialists resulted in year 2018/19 Community Outreach Meetings in 70 Project Areas with 3200 participants in regions 3,4,5 and 6 with simulative informational, interactive engagements with residents.

In addition, for the year 2019/2020 period, the Social Management focused on project areas of Lot A and B with interventions, inclusive of Community Outreach and direct dialogue and consultation with the local democratic organs and customer base in 87 project areas with approximately 2500 participants. Efforts were augmented with information dissemination via print and electronic media. These activities will be reviewed to achieve maximum penetration and will continue over and beyond the life of this plan.

Some of the initiatives deployed were:

- ✓ The Importance of Energy Conservation/Energy Efficiency/Demand Side Management.
- ✓ Benefits of Energy Conservation/Energy Efficiency/Demand Side Management. and
- ✓ Practical saving tips and industry-standard best practices.

These initiatives were developed to deliver an improved appreciation of the benefits of effective Demand Side Management (DSM) and their positive effects on:

- ✓ Customers' electricity consumption and by extension electricity bills
- ✓ Reduced cost of generation

The Company continues leveraging its corporate website to consistently disseminate DSM information within the framework of:

- ✓ Cost reduction (GPL and electricity bills)
- ✓ Reduced CO_2 emissions

Technical interventions involve the application of Smart Grid (includes Advance Metering Infrastructure (AMI) and Automatic Generation Control (AGC)), Battery Energy Storage Systems (BESS), Combine Heat and Power, medium to large scale renewable energy systems, Capacitor Banks, Voltage Regulators, Prepaid meters, and optimised transmission, and distribution conductor size.

In this Development and Expansion Programme, the characteristics of the planned projects for the horizon year 2027 are testimonies of the Company's commitment towards implementing technical interventions to promote DMS, improving grid efficiency and reducing grid operation costs.

5.4.4.3 Demand Side Management from a Customer Perspective

Demand Side Management extends to all customer sectors, which includes the Industrial, commercial, and residential since these typically contribute to having two (2) peak periods- a daytime peak attributed to the commercial activity and an evening peak period attributed to the residential sector.

In the case of GPL being a relatively small utility, residential activity is predominant, hence the system's peak period is frequently in the evenings. As a result, DSM activities have been focused primarily on the residential sector. Recently, the Government of Guyana and GPL have implemented Time of Use Tariffs.

In addition to GPL's various ongoing outreach and public relation programs, there are various strategies customers (residential, commercial, and industrial) can undertake on their behalf to help manage their consumption during peak demand periods. These strategies include the use of energy-efficient equipment and the practice of energy conservation.

5.4.4.4 Energy Efficiency and Energy Conservation

While DMS is a strategic way of synchronising the load profile with generation capacity, it strives to improve the efficiency of energy consumption without reducing the services that the energy provides for development.

With the practice of energy conservation added to the equation, it helps to further improve energy efficiency and emission reductions through the curtailment of non-essential services.

The Guyana Energy Agency (GEA) has the national mandate to advise and make national recommendations to the responsible Minister for Energy/Electricity regarding any measures necessary to secure the efficient management of energy. As such, GPL will continue to work closely with the Guyana Energy Agency for maximum penetration in the countrywide deployment of energy efficiency and energy conservation initiatives.

5.4.5 GPL 5-Year Customer Growth Projection

At the end of year 2022, the total number of customers served by GPL was 218,922. As of August 2023, the total number of customers served by GPL was 224,267. Using August to December of year 2022 to establish the monthly customer growth rates as a reference, it is

estimated that by the end of year 2023, GPL would have a total of 225,002 customers. This represents a growth in the total number of customers of 2.78% or 6,080 customers from year 2022 to year 2023. See Table 8 for more information.

Table 8: GPL Percentage growth of customer-base per tariff.

Year (GPL ONLY)	2022	2023	2024	2025	2026	2027	2028
Annual Actual Customer-base Growth		6,080	6,623	7,059	7,756	8,648	9,926
Residential - Annual % Growth		2.78%	2.93%	3.04%	3.24%	3.49%	3.88%
Commercial - Annual % Growth		2.60%	2.83%	2.91%	3.14%	3.39%	3.76%
Industrial - Annual % Growth		6.84%	7.18%	7.49%	7.92%	8.45%	8.94%
Total - Annual % Growth		2.78%	2.94%	3.05%	3.25%	3.51%	3.89%

Delving into further details, the breakdown per tariff category indicates that the total number of Residential customers was 91.3%, Commercial 8.3% and Industrial 0.4% for year 2022. See Table *9*. Similar analysis done for year 2023 customer dataset indicates that the above percentage share per tariff is remains constant.

Table 9: GPL Percentage share of number of customers per tariff

Year (GPL ONLY)	2022	2023	2024	2025	2026	2027	2028
% Share - Residential Customers	91.28274%	91.28137%	91.27333%	91.26628%	91.25523%	91.24250%	91.22893%
% Share - Commerical Customers	8.32306%	8.30885%	8.30002%	8.28866%	8.27958%	8.27010%	8.25998%
% Share - Industrial Customers	0.39420%	0.40978%	0.42666%	0.44506%	0.46520%	0.48740%	0.51109%

Assuming similar percentage share among the tariff groups (Table 10) and referencing the total number of potential customers resulting from Planned Infrastructural Development, addressing unserved areas, and the estimated additional customers of 15,812, the projected total number of customers for the aggregated GPL power system in year 2028 is 265,014 – an increase of 40,012 relative to year 2023. See Table 10 for annual breakout details on project total number of customers for GPL.

Table 10: Breakdown of GPL customer projection

Year (GPL ONLY)	2022	2023	2024	2025	2026	2027	2028
No.of Residential Services	199,838	205,385	211,412	217,838	224,889	232,749	241,769
No.of Commerical Services	18,221	18,695	19,225	19,784	20,404	21,096	21,890
No.of Industrial Services	863	922	988	1,062	1,146	1,243	1,354
Total No. of Services	**218,922**	**225,002**	**231,625**	**238,684**	**246,440**	**255,088**	**265,014**

5.4.6 GPL 5-Year Electricity Sales/Demand Projection

Year 2023 sales is estimated to increase by 14.2% relative to year 2022 (Table 11). It must be noted that sales are currently constrained by significant shortfall in power generation capacity and the request for maximum customers to switch off the grid during peak demand hours. Assuming the presence of unconstrained generation and T&D infrastructural capacity, sales for the current planning period are premised on comparing year 2022 and 2023 monthly energy consumption per customer and estimating the monthly energy consumption per customer per

tariff category. This estimate (Table 12) is based on the current average monthly energy consumption per customer per tariff category in Linden, mainly because of the lower tariff rates provided by LECI, which prompts users to consume more electricity compared to those on the DBIS. Coupled with the projected number of customers per tariff category, Table 11 shows the projected sales for the current planning period for GPL.

Table 11: GPL projected sales/demand for current planning period

Annual Sales (GPL ONLY)	2022	2023	2024	2025	2026	2027	2028
Residential Sales (MWh)	394,229	438,866	580,721	777,885	947,616	1,082,285	1,236,655
Commercial Sales (MWh)	116,254	128,126	171,787	212,136	240,668	273,545	312,035
Industrial Sales (MWh)	242,567	292,940	404,992	522,402	620,165	773,444	926,863
Total Sales (MWh)	**753,050**	**859,932**	**1,157,500**	**1,512,423**	**1,808,449**	**2,129,273**	**2,475,553**

Table 12: Estimated average monthly energy consumption per GPL customer.

GPL ONLY Average Monthly Energy Consumption per Customer							
Year (GPL ONLY)	2022	2023	2024	2025	2026	2027	2028
Residential Consumption (kWh)	164.40	178.07	228.91	297.58	351.14	387.50	426.25
Commercial Consumption (kWh)	531.68	571.12	744.64	893.56	982.92	1,080.55	1,187.89
Industrial Consumption (kWh)	23,422.87	26,476.55	34,150.91	40,981.09	45,079.20	51,841.08	57,025.18

5.4.7 GPL 5-Year Losses, Net Grid Export and Gross Generation Projections

Total losses for year 2022 were reported as 24.92%. For year 2023, it is estimated that total losses would be 23.43% - a 1.49% reduction from previous year. In consideration of the planned T&D, metering projects, which are essentially geared towards ensuring GPL achieves its operational and planning targets, and specific strategic approach to curb commercial losses, total losses are projected to be 9.96% in year 2028 - an estimated 13.48% reduction relative to year 2023.

While it can be recognised that reducing commercial losses in a fast-paced growing economy remains a challenge. Nevertheless, the Company's loss reduction targets are primarily premised on the combination of planned T&D, AMI, and Smart Grid projects. See Table 14 for further details.

Table 13: GPL Project losses breakdown for 2024-2028.

Year	2023	2024	2025	2026	2027	2028
Total Losses factor (%)	23.43%	22.20%	20.47%	17.32%	12.09%	9.96%
Technical loss factor (%)	*9.52%*	*9.31%*	*9.11%*	*8.88%*	*7.48%*	*6.88%*
Non-Technical loss factor (%)	*13.92%*	*12.89%*	*11.36%*	*8.43%*	*4.61%*	*3.08%*

Given the projected sales and losses, and accounting for power plants' auxiliary demand, the projected required gross generation to satisfy the projected sales/demand for the current planning period is shown in Table 14.

Table 14: GPL Projected Net grid export and Gross Generation for 2024-2028.

Year	2023	2024	2025	2026	2027	2028
Gross Generation (GWh)	1,154.0	1,529.1	1,952.8	2,244.7	2,489.4	2,825.4
Aux Demand (GWh)	30.9	41.3	51.1	57.4	67.2	76.1
Aux Demand (% of Gross Gen.)	2.68%	2.70%	2.62%	2.56%	2.70%	2.69%
Net Grid Export (GWh)	1,123.1	1,487.8	1,901.7	2,187.2	2,422.2	2,749.3
Total Losses (GWh)	263.2	330.3	389.3	378.8	292.9	273.8
Sales (GWh)	859.9	1,157.5	1,512.4	1,808.4	2,129.3	2,475.6

5.4.8 GPL 5-Year Demand Forecast per Power System

The aggregated GPL power system comprises the Demerara-Berbice Interconnected System (DBIS), Anna Regina, Bartica, Leguan and Wakenaam. The boundaries of each power system are as follows (see Figure 8 for reference details):

1. DBIS – Parika on the East Bank of Essequibo to Moleson Creek, East Corentyne, Berbice to Yarrowkabara on the Soesdyke Highway, encompassing Region Nos. 3, 4, 5 and 6.
2. Anna Regina – from Charity, bordering the eastern bank of the Pomeroon River, to Supernaam, Region No.2.
3. Bartica – from the confluence of the Cuyuni and Mazaruni Rivers to 5-miles in Bartica, Region No.7.
4. Leguan – entire island, located in the Essequibo River, Region No.3.
5. Wakenaam - entire island, located in the Essequibo River, Region No.3.

The breakout of the total GPL forecast is premised on the historical gross generation trend of its individual power system. The historical gross generation of the GPL power system is shown in Table 15 below.

Table 15: Historical gross generation of GPL power systems

Gross Generation (GWh)											
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total GPL	711.0	717.1	750.3	798.9	809.4	823.9	876.8	902.6	958.8	1,030.3	1,154.0
DBIS	674.2	678.9	710.8	757.3	767.7	780.8	828.7	851.1	905.0	974.2	1,094.4
Anna Regina	23.9	25.1	25.5	27.1	27.9	29.3	33.4	36.0	37.9	39.7	42.8
Bartica	10.3	10.5	11.3	11.3	10.5	10.6	11.1	11.6	11.8	11.9	12.2
Leguan	1.3	1.2	1.4	1.6	1.7	1.7	1.8	1.9	2.0	2.1	2.2
Wakenaam	1.3	1.4	1.3	1.6	1.6	1.7	1.8	1.9	2.0	2.3	2.5

The per unit share of the historical gross generation for individual power system relative to the aggregated value is shown in

Table *16*.

Table 16: Per unit share of historical gross generation of GPL power systems.

Gross Generation Share (pu)											
Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
DBIS	0.9483	0.9467	0.9474	0.9479	0.9485	0.9476	0.9452	0.9429	0.9439	0.9456	0.9450
Anna Regina	0.0337	0.0350	0.0339	0.0340	0.0344	0.0355	0.0381	0.0399	0.0395	0.0385	0.0383
Bartica	0.0144	0.0147	0.0151	0.0142	0.0130	0.0128	0.0127	0.0129	0.0123	0.0116	0.0125
Leguan	0.0018	0.0017	0.0019	0.0020	0.0020	0.0020	0.0021	0.0021	0.0021	0.0021	0.0021
Wakenaam	0.0018	0.0019	0.0017	0.0020	0.0020	0.0020	0.0020	0.0021	0.0021	0.0022	0.0021

Progressively, the 5-year average per unit share of each power system was used to obtain the estimated annual share of individual power systems. See Table 17.

Table 17: Projected per unit share of individual power system's gross generation.

	Gross Generation Share (pu)				
Year	**2024**	**2025**	**2026**	**2027**	**2028**
DBIS	0.9445	0.9444	0.9447	0.9449	0.9447
Anna Regina	0.0389	0.0390	0.0389	0.0387	0.0388
Bartica	0.0124	0.0123	0.0122	0.0122	0.0123
Leguan	0.0021	0.0021	0.0021	0.0021	0.0021
Wakenaam	0.0021	0.0021	0.0021	0.0021	0.0021

Referencing the aggregated GPL gross generation (Table 14) and the projected per unit share of gross generation for individual power systems (Table 17), the breakout demand forecast for each power system is shown as follows:

- Table 18 - DBIS
- Table 19 - Anna Regina
- Table 20 – Bartica
- Table 21 – Leguan
- Table 22 – Wakenaam
- Table 23 – Total GPL (excludes Linden)

In addition to the above, the peak demand forecast of each power system is premised on the estimated load factor profile for the current planning period, which is based on the Company's expectation relative to historical trends. As development continues to unfold, the load factor will vary in accordance with the activities associated with each power system. The load factor narrative of each power system is as follows:

1. DBIS – trend indicates insignificant increase.

2. Anna Regina – trend indicates a gentle increase.
3. Bartica - trend indicates a steep increase.
4. Leguan – trend indicates a moderate increase.
5. Wakenaam – trend indicates a moderate increase.

In addition to the above qualitative description of the load factor trends, the projected values are shown in the tables below, inclusive of the forecast peak demand of each power system.

Table 18: DBIS 10-year demand forecast

DBIS	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Gross Generation (GWh)	1,094.38	1,444.28	1,844.23	2,120.53	2,352.07	2,669.17	2,879.86	3,111.25	3,204.71	3,300.56	3,443.64
Aux Demand (GWh)	27.48	36.07	46.54	53.83	62.30	70.70	76.28	82.41	84.88	87.42	91.21
Net Export (GWh)	1,066.90	1,408.20	1,797.69	2,066.69	2,289.77	2,598.47	2,803.58	3,028.84	3,119.82	3,213.14	3,352.42
Total Losses (%)	23.55%	22.37%	20.64%	17.48%	12.23%	10.08%	9.07%	8.47%	7.88%	7.28%	6.68%
Technical Losses (%)	9.56%	9.48%	9.27%	9.04%	7.62%	7.00%	6.49%	6.39%	6.29%	6.20%	6.10%
Non-Technical Losses (%)	13.98%	12.89%	11.36%	8.43%	4.61%	3.08%	2.58%	2.08%	1.58%	1.08%	0.58%
Total Losses (GWh)	251.21	314.98	370.96	361.22	279.97	261.98	254.19	256.58	245.70	233.91	224.08
Sales (GWh)	815.69	1,093.23	1,426.73	1,705.48	2,009.80	2,336.49	2,549.38	2,772.26	2,874.12	2,979.23	3,128.35
Load Factor (pu)	0.69	0.71	0.74	0.74	0.74	0.76	0.76	0.77	0.76	0.76	0.76
Peak Demand (MW)	181.30	232.21	284.50	327.12	362.84	400.92	432.57	461.25	481.36	495.76	517.25

With the role of the DBIS relative to total GPL power system, it is paramount to compare demand projects developed in year 2022 and 2023. Without performing any statistical correlations, Figure 9 clearly shows there is strong statistical correlation between the forecast results of the DBIS developed in year 2022 and 2023. As such, it can be assumed that the projected GWh and MW for the DBIS have a high probability of realisation.

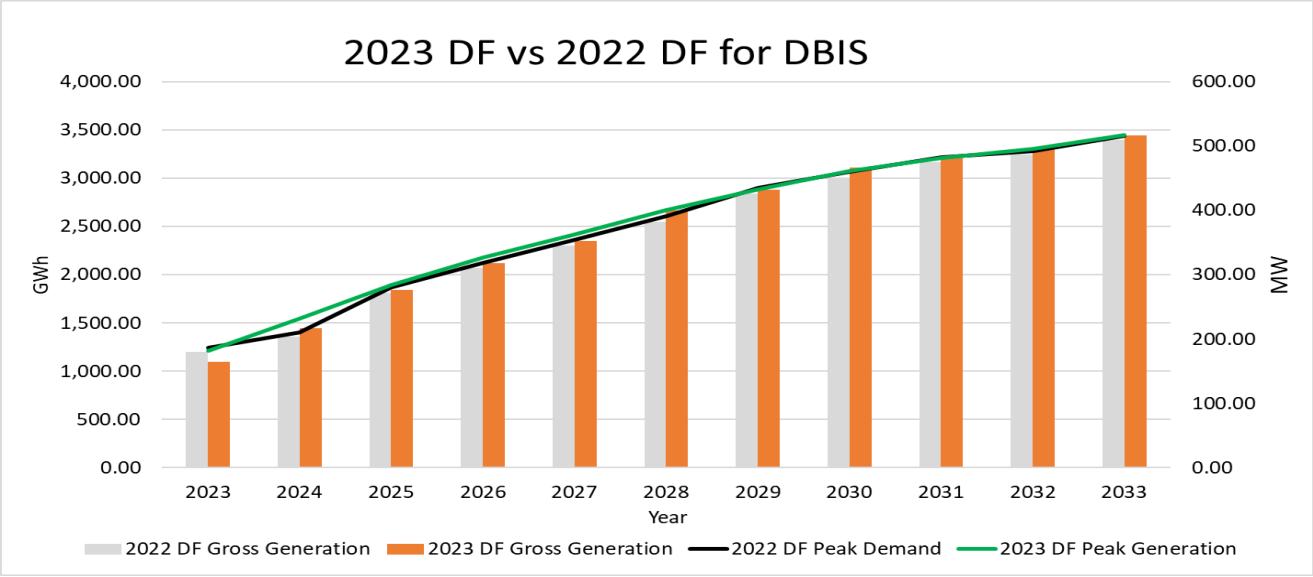

Figure 9: Comparison of DBIS Demand Forecasts: Year 2022 vs Year 2023

Table 19: Anna Regina 10-year demand forecast

Anna Regina	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Gross Generation (GWh)	42.76	59.47	76.25	87.25	96.43	109.56	118.48	127.98	131.69	135.60	141.53
Aux Demand (GWh)	3.37	4.69	6.01	6.88	7.60	8.63	9.34	10.09	10.38	10.69	11.16
Net Export (GWh)	39.39	54.78	70.24	80.37	88.83	100.92	109.14	117.89	121.31	124.91	130.38
Total Losses (%)	21.68%	19.44%	17.93%	15.18%	10.61%	8.74%	8.22%	7.69%	7.17%	6.64%	6.12%
Technical Losses (%)	8.80%	8.19%	8.01%	7.82%	6.59%	6.05%	5.96%	5.88%	5.79%	5.70%	5.61%
Non-Technical Losses (%)	12.87%	11.25%	9.92%	7.36%	4.02%	2.69%	2.25%	1.82%	1.38%	0.94%	0.51%
Total Losses (GWh)	8.54	10.65	12.59	12.20	9.42	8.82	8.97	9.07	8.69	8.30	7.98
Sales (GWh)	30.85	44.13	57.65	68.17	79.41	92.10	100.18	108.83	112.62	116.61	122.40
Load Factor (pu)	0.66	0.70	0.71	0.72	0.74	0.74	0.75	0.75	0.75	0.75	0.75
Peak Demand (MW)	7.37	9.70	12.26	13.83	14.88	16.90	18.03	19.48	20.04	20.64	21.54

Table 20: Bartica 10-year demand forecast

Bartica	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Gross Generation (GWh)	12.17	18.94	24.08	27.44	30.37	34.81	37.47	40.42	41.59	42.86	44.78
Aux Demand (GWh)	0.01	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05
Net Export (GWh)	12.16	18.92	24.06	27.41	30.34	34.77	37.43	40.38	41.55	42.82	44.73
Total Losses (%)	22.57%	20.18%	18.61%	15.75%	11.00%	9.06%	8.51%	7.97%	7.42%	6.88%	6.33%
Technical Losses (%)	9.17%	8.47%	8.29%	8.08%	6.81%	6.26%	6.17%	6.08%	5.98%	5.89%	5.80%
Non-Technical Losses (%)	13.40%	11.71%	10.33%	7.67%	4.19%	2.80%	2.35%	1.89%	1.44%	0.98%	0.53%
Total Losses (GWh)	2.74	3.82	4.48	4.32	3.34	3.15	3.19	3.22	3.08	2.94	2.83
Sales (GWh)	9.42	15.10	19.58	23.09	27.00	31.62	34.25	37.16	38.47	39.88	41.90
Load Factor (pu)	0.66	0.65	0.68	0.71	0.73	0.76	0.76	0.84	0.85	0.85	0.85
Peak Demand (MW)	2.10	3.33	4.04	4.41	4.75	5.23	5.63	5.49	5.59	5.76	6.01

Table 21:Leguan 10-year demand forecast

Leguan	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Gross Generation (GWh)	2.24	3.21	4.10	4.69	5.19	5.91	6.38	6.89	7.09	7.31	7.63
Aux Demand (GWh)	0.01	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05
Net Export (GWh)	2.23	3.19	4.08	4.67	5.16	5.87	6.34	6.85	7.05	7.26	7.58
Total Losses (%)	17.22%	15.39%	14.20%	12.01%	8.39%	6.91%	6.49%	6.07%	5.66%	5.24%	4.83%
Technical Losses (%)	6.99%	6.46%	6.32%	6.16%	5.19%	4.77%	4.70%	4.63%	4.56%	4.49%	4.42%
Non-Technical Losses (%)	10.23%	8.94%	7.88%	5.85%	3.20%	2.14%	1.79%	1.44%	1.10%	0.75%	0.40%
Total Losses (GWh)	0.38	0.49	0.58	0.56	0.43	0.41	0.41	0.42	0.40	0.38	0.37
Sales (GWh)	1.84	2.70	3.50	4.11	4.73	5.47	5.93	6.43	6.65	6.88	7.21
Load Factor (pu)	0.67	0.69	0.71	0.73	0.76	0.77	0.77	0.77	0.77	0.77	0.77
Peak Demand (MW)	0.38	0.53	0.66	0.73	0.78	0.88	0.95	1.02	1.05	1.08	1.13

Table 22: Wakenaam 10-year demand forecast

Wakenaam	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Gross Generation (GWh)	2.48	3.21	4.13	4.75	5.30	5.96	6.44	6.97	7.18	7.40	7.71
Aux Demand (GWh)	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.07	0.07	0.08	0.08
Net Export (GWh)	2.46	3.17	4.09	4.70	5.24	5.90	6.38	6.90	7.11	7.32	7.63
Total Losses (%)	13.23%	11.83%	10.91%	9.23%	6.44%	5.31%	4.99%	4.67%	4.35%	4.03%	3.71%
Technical Losses (%)	5.37%	4.96%	4.85%	4.73%	3.99%	3.66%	3.61%	3.56%	3.50%	3.45%	3.40%
Non-Technical Losses (%)	7.86%	6.87%	6.05%	4.49%	2.46%	1.64%	1.38%	1.11%	0.84%	0.58%	0.31%
Total Losses (GWh)	0.33	0.38	0.45	0.43	0.34	0.31	0.32	0.32	0.31	0.29	0.28
Sales (GWh)	2.13	2.80	3.65	4.27	4.91	5.58	6.06	6.58	6.80	7.02	7.35
Load Factor (pu)	0.66	0.68	0.72	0.73	0.75	0.75	0.75	0.76	0.76	0.76	0.76
Peak Demand (MW)	0.43	0.54	0.66	0.74	0.81	0.91	0.98	1.05	1.08	1.11	1.16

Table 23: Total GPL 10-year demand forecast (excludes Linden)

Total GPL Power Systems	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Gross Generation (GWh)	1,154.03	1,529.10	1,952.80	2,244.66	2,489.35	2,825.41	3,048.64	3,293.51	3,392.27	3,493.73	3,645.28
Aux Demand (GWh)	30.90	40.83	52.64	60.81	70.01	79.47	85.76	92.65	95.43	98.28	102.54
Net Export (GWh)	1,123.13	1,488.27	1,900.16	2,183.85	2,419.34	2,745.94	2,962.88	3,200.86	3,296.84	3,395.45	3,542.74
Total Losses (%)	23.43%	22.20%	20.47%	17.32%	12.09%	9.96%	9.36%	8.76%	8.16%	7.56%	6.96%
Technical Losses (%)	9.52%	9.31%	9.11%	8.88%	7.48%	6.88%	6.78%	6.68%	6.58%	6.48%	6.38%
Non-Technical Losses (%)	13.92%	12.89%	11.36%	8.43%	4.61%	3.08%	2.58%	2.08%	1.58%	1.08%	0.58%
Total Losses (GWh)	263.20	330.31	389.05	378.73	293.50	274.67	267.08	269.60	258.18	245.82	235.53
Sales (GWh)	859.93	1,157.96	1,511.10	1,805.12	2,125.83	2,471.27	2,695.80	2,931.26	3,038.66	3,149.62	3,307.20
Sales (GWh)	859.93	1,157.96	1,511.10	1,805.12	2,125.83	2,471.27	2,695.80	2,931.26	3,038.66	3,149.62	3,307.20
Load Factor (pu)	0.69	0.71	0.74	0.74	0.74	0.76	0.76	0.77	0.76	0.76	0.76
Peak Demand (MW)	191.15	245.77	301.46	346.10	383.24	423.93	457.18	487.25	508.04	523.24	545.93

5.4.9 Linden 5-Year Customer Growth Projection

At the end of year 2022, Linden reported having a total of 11,986 customers and as of July 31st, 2023, Linden reported having a total of 12,235 customers. Applying the same method as done for the DBIS, it is estimated that at the end of year 2023, Linden would have an estimated total of 12,313 customers. This represents an estimated customer growth of 2.73% between year 2022 and 2023. See Table 24 for more information.

Table 24: Linden Percentage growth of customer-base per tariff.

Year (Linden ONLY)	2022	2023	2024	2025	2026	2027	2028
Annual Actual Customer-base Growth		327	816	971	1,072	1,197	1,204
Residential - Annual % Growth		2.51%	6.95%	7.73%	7.58%	7.86%	7.15%
Commercial - Annual % Growth		4.09%	4.69%	5.33%	7.76%	8.05%	8.63%
Total - Annual % Growth		**2.73%**	**6.63%**	**7.40%**	**7.60%**	**7.89%**	**7.36%**

Linden has three (3) tariffs, which are Residential, Commercial and Pensioner. The customer projection for the current planning period considered Pensioner to be included in the Residential group of customers. In year 2022, the percentage share of Residential customers was 86.1% and Commercial, 13.9%. In consideration of the current commercial developments in Linden, the percentage share of Residential customers would be 85.9% and Commercial, 14.1% by the end of year 2023. See Table 25.

In consideration of planned infrastructural development projects for Linden and unserved customers, it is expected that this undertaking would add an estimated total of 5,523 customers (2,083 from planned infrastructural development and 2,695 unserved customers). See Table 26 for more details. The total additional 5,523 customers for Linden are spread across the current planning period, resulting in the planned percentage share of customers as shown in Table 25.

Table 25: Linden Percentage share of number of customers per tariff

Year (Linden ONLY)	2022	2023	2024	2025	2026	2027	2028
% Share - Residential Customers	86.1%	85.9%	86.1%	86.4%	86.4%	86.3%	86.2%
% Share - Commerical Customers	13.9%	14.1%	13.9%	13.6%	13.6%	13.7%	13.8%

Table 26: Breakdown of Linden customer-base projection

Year (Linden ONLY)	2022	2023	2024	2025	2026	2027	2028
No.of Residential Services	10,314	10,573	11,307	12,181	13,104	14,134	15,146
No.of Commerical Services	1,672	1,740	1,822	1,919	2,068	2,235	2,427
Total No. of Services	**11,986**	**12,313**	**13,129**	**14,100**	**15,172**	**16,369**	**17,573**

5.4.10 Linden 5-Year Electricity Sales Projection

From year 2022 to 2023, Table 27 shows a 2% increase in the average monthly energy consumption Residential customers and 8% for Commercial. For the current planning period, a moderate increase is estimated for both tariffs relative to the planned developments for Linden – mining town.

Table 27:Estimated average monthly energy consumption per Linden customer.

LINDEN ONLY Average Monthyl Energy Consumption per Customer							
Year (Linden ONLY)	2022	2023	2024	2025	2026	2027	2028
Residential Consumption (kWh)	321	329	330	329	353	388	436
Commercial Consumption (kWh)	777	840	938	1,033	1,113	1,193	1,307

Give the above and applying similar concept as for the GPL power systems, the projected sales for Linden is shown in Table 28.

Table 28:Linden projected sales for current planning period.

Annual Sales (LINDEN ONLY)	2022	2023	2024	2025	2026	2027	2028
Residential Sales (MWh)	39,724	41,696	44,828	48,163	55,473	65,857	79,235
Commercial Sales (MWh)	15,582	17,552	20,513	23,782	27,631	31,980	38,070
Total Sales (MWh)	**55,306**	**59,248**	**65,341**	**71,945**	**83,104**	**97,837**	**117,304**

5.4.11 Linden 5-Year Losses, Net Grid Export and Gross Generation Projections

Following similar procedure as done for the GPL power systems relative to total projected losses (Table 29) and auxiliary demand, the gross generation forecast for Linden is shown in Table 30.

Table 29:Linden Project losses breakdown for 2024-2028

Year	2023	2024	2025	2026	2027	2028
Total Losses factor (%)	14.90%	14.65%	14.40%	14.15%	13.90%	13.65%
Technical loss factor (%)	*5.70%*	*5.60%*	*5.50%*	*5.40%*	*5.30%*	*5.20%*
Non-Technical loss factor (%)	*9.20%*	*9.05%*	*8.90%*	*8.75%*	*8.60%*	*8.45%*

Table 30:Linden Projected Net grid export and Gross Generation for 2024-2028

Year	2023	2024	2025	2026	2027	2028
Gross Generation (GWh)	71.5	78.8	86.4	99.1	116.3	138.6
Aux Demand (GWh)	1.9	2.3	2.4	2.3	2.7	2.7
Aux Demand (% of Gross Gen.)	2.70%	2.91%	2.76%	2.36%	2.33%	1.96%
Net Grid Export (GWh)	69.6	76.6	84.0	96.8	113.6	135.8
Total Losses (GWh)	10.4	11.2	12.1	13.7	15.8	18.5
Sales (GWh)	59.25	65.34	71.94	83.10	97.84	117.30

6. Current Status of Power Generation Capacity

With the GOE II 46.5 MW power plant – DP5, in commercial operation, the total number of power plants within GPL's remit currently stands at 13, and totals 206.3 MW of firm available generation capacity. The DBIS aggregated available capacity of 186.3 MW comprises nine (9) power plants and the isolated group of power systems, 20 MW resulting from four (4) power plants. The isolated group of power systems comprise Anna Regina, Wakenaam, Leguan and Bartica – one power plant in each power system.

6.1 Demerara-Berbice Interconnected System (DBIS)

In the DBIS, HFO-fired generator units account for 90.6% and LFO-fired, 9.4% of the total available capacity. For the Isolated Systems, 21% of the total capacity is HFO-fired and 79% is LFO-fired. See Table 31 for numerical details.

Table 31: Breakdown of GPL's Total Firm Available Generation Capacity by fuel type.

Fuel Type	Demerara	Berbice	Total DBIS	Anna Regina	Wakenaam	Leguan	Bartica	Total Isolated	Total GPL
MWs of HFO	151.0	17.8	**168.8**	4.5	0.0	0.0	0.0	**4.5**	**173.3**
MWs of LFO	3.4	14.1	**17.5**	9.9	1.1	1.2	4.7	**17.0**	**34.5**
Total Available Capacity (MW)	**154.4**	**31.9**	**186.3**	**14.4**	**1.1**	**1.2**	**4.7**	**21.5**	**207.8**
Fuel Type	**Demerara**	**Berbice**	**Total DBIS**	**Anna Regina**	**Wakenaam**	**Leguan**	**Bartica**	**Total Isolated**	**Total GPL**
% of HFO	97.8%	55.8%	**90.6%**	31.3%	0.0%	0.0%	0.0%	**21.0%**	**83.4%**
% of LFO	2.2%	44.2%	**9.4%**	68.8%	100.0%	100.0%	100.0%	**79.0%**	**16.6%**

With scheduled maintenances and efficient operations, reciprocating internal combustion engine-generator units generally have a maximum operational life of 25 years. In most instances, their economic life is taken as 20 years. Surpassing 20 years, these units are usually mothballed and classified as Cold Reserve. However, in the event of need of addressing supply-demand gap, these units are actively dispatched as required.

In the DBIS, 12 generator units totalling 53.1 MW are classified aged units. These units have surpassed their maximum operational life of 25 years. The age-specifics of these generator units are shown in Table 32.

These generator units have been and continue to be well maintained, which has resulted in an average annual availability circa 85%. Due to the current increasing shortfall in generation capacity reserve, these units are being dispatched as baseload units. As a result, there is an accompanied elevated risk of major mechanical failure, which can be due to failure of

components that have not been replaced, for example, counterweight bolts. In the year 2020, as a result of failed counterweight bolts, which precipitated a series of other major mechanical failures, one (1) engine was destroyed completely.

Major overhauls are usually carried out at each operation tranche of 24,000 hours, which approximates to three (3) calendar years of operation (based on total running hours). The total cost for a major overhaul is approximately 80% of the cost of a factory-refurbished generator unit. After major overhauls, it is currently a challenge to recuperate the performance of highspeed generator units or anywhere close to a factory-refurbished unit. As such, the balance of 20% additional capital cost is considered negligible when considering the increased performance efficiency, reliability, and availability of a factory-refurbished unit. For the mobile LFO units in the Isolated Power Systems, GPL has realised over the years that it is considered cost-effective to replace high-speed generator units with factory-refurbished generator units instead of performing a major overhaul.

Table 32: Aged generator units in the DBIS

Generator Units	Commissioned Dates	Age of Unit (Years)	Installed Capacity (MW)	Available Capacity (MW)
Garden of	**Subtotal**		**11.00**	**3.40**
# 5 Niigata	1991	32	5.50	-
# 6 Niigata	1996	27	5.50	3.40
Garden of Eden - DP1	**Subtotal**		**22.00**	**20.60**
# 1 Wärtsilä	1996	27	5.50	5.50
# 2 Wärtsilä	1996	27	5.50	5.50
# 3 Wärtsilä	1996	27	5.50	4.50
# 4 Wärtsilä	1996	27	5.50	5.10
Kingston I - DP2	**Subtotal**		**22.00**	**21.50**
# 1 Wärtsilä	1997	26	5.50	5.50
#2 Wärtsilä	1997	26	5.50	5.50
# 3 Wärtsilä	1997	26	5.50	5.50
# 4 Wärtsilä	1997	26	5.50	5.00
Canefield	**Subtotal**		**5.50**	**3.00**
#3DA - Mirrlees	1996	27	5.50	3.00
Onverwagt	**Subtotal**		**5.00**	**4.60**
#5 GM	1981	42	2.50	2.30
#7 GM	1981	42	2.50	2.30
Grand Total			**65.50**	**53.10**

Table 33 shows the annual Total Available Capacity, Reliable Capacity, Unreliable/Suspect Capacity, and Cold Reserve Capacity for the current planning period. For the majority of year 2023, the average total available capacity is 186.3 MW.

Although the aged units are included in the Unreliable Capacity, they are considered dispatchable. Therefore, their available capacity is included in the Total Available Capacity within the current planning period. LFO-fired units that require a major overhaul after year 2025, and within the current planning period, would be mothballed and classified as Cold Reserve Capacity.

Table 33: Summary of existing power generation profile: 2023-2028 (DBIS)

DBIS	Year	2023	2024	2025	2026	2027	2028
Demerara	Total Available Capacity (MW)	154.4	154.4	154.4	154.4	154.4	154.4
	Reliable Capacity (MW)	108.9	108.9	108.9	108.9	108.9	108.9
	Unreliable Capacity (MW)	45.5	45.5	45.5	45.5	45.5	45.5
	Cold Reserve Capacity (MW)	-	-	-	-	-	-
	Accumulated Cold Reserve (MW)	-	-	-	-	-	-
Berbice	Total Available Capacity (MW)	31.9	31.9	31.9	23.8	23.8	14.8
	Reliable Capacity (MW)	14.8	14.8	14.8	14.8	14.8	14.8
	Unreliable Capacity (MW)	17.1	17.1	17.1	9.0	9.0	-
	Cold Reserve Capacity (MW)	-	-	-	8.1	-	9.0
	Accumulated Cold Reserve (MW)	-	-	-	8.1	8.1	17.1
DBIS Total	Total Available Capacity (MW)	186.3	186.3	186.3	178.2	178.2	178.2
	Reliable Capacity (MW)	123.7	123.7	123.7	123.7	123.7	123.7
	Unreliable Capacity (MW)	62.6	62.6	62.6	54.5	54.5	54.5
	Cold Reserve Capacity (MW)	-	-	-	8.1	-	9.0
	Accumulated Cold Reserve (MW)	-	-	-	8.1	8.1	17.1

In year 2023, the DBIS recorded peak demand of 172.9 MW was sustained by an available generation capacity of 176.9 MW[5]. The relationship between the peak demand and available generation capacity resulted in the DBIS having a capacity reserve margin of 4 MW or 2.3%. See Table 34.

In consideration of the largest generator unit capacity in the DBIS to be 9.3 MW, Table 34 indicates that in the event of the loss of one of these units (N-G-1 contingent event), there will be unserved energy (ENS). The outcome of an ENS event can take the form of either load shedding or a total system shutdown, depending on the response of the automatic load shedding schemes to the rate at which frequency would be falling. To address this situation, year 2023 required an additional minimum of 10 MW firm generation capacity.

[5] Available firm generation capacity at time of peak demand - 27th September 2023.

For this planning period and beyond, referencing Government's position and commitment on the projected economic and socio-economic developments, Table 34 indicates that it is mandatory to invest significantly in increasing the firm power generation capacity of the DBIS.

The following results are premised on the scenario of no increase in firm installed generation capacity and do not include the committed generation expansion projects. The aim of these results is to demonstrate the minimum required firm generation capacity for the current planning period of 2024-2028.

In year 2024, with an additional 9.4 MW available on the grid (in 2023 the relevant units were offline due to maintenance), the total available capacity would be 186.3 MW. However, in consideration of the forecast peak demand, capacity reserve margin will be negative, which will invariably require significant load shedding. Deterministically, Table 34 illustrates that a total of almost 60 MW is required to address the supply-demand gap and to ensure that the grid remains firm and stable in the event on an N-G-1.

Progressively, as the forecast peak demand increases, Table 34 informs of the required annual additional capacity to firm-up the stability and security of the DBIS. The additional capacity increases in year 2025 to 112 MW and further increases to 229 MW in year 2028.

Table 34: Deterministic results of current status and required firm generation capacity - DBIS.

Year	2023	2024	2025	2026	2027	2028
Current State						
Peak Demand (MW)	181.3	232.2	284.5	327.1	362.8	400.9
Avail. Gen. Capacity (MW)	176.9	186.3	186.3	186.3	186.3	186.3
Capacity Reserve (MW)	**-4.4**	**-45.9**	**-98.2**	**-140.8**	**-176.5**	**-214.6**
CRM (%)	**-2.4%**	**-19.8%**	**-34.5%**	**-43.0%**	**-48.7%**	**-53.5%**
Largest Generator Unit (MW)	9.3	9.3	9.3	9.3	9.3	9.3
Impact Factor: N-G-1	**-0.5**	**-4.9**	**-10.6**	**-15.1**	**-19.0**	**-23.1**
Outcome of an N-G-1 Event	**ENS**	**ENS**	**ENS**	**ENS**	**ENS**	**ENS**
Min. Required MW to Satisfy Spinning Reserve Capacity						
Spinning Reserve - Min.	150%	150%	150%	150%	150%	150%
Spinning Reserve (MW)	13.95	13.95	13.95	13.95	13.95	13.95
Additional Capacity (MW)	**18.4**	**59.9**	**112.1**	**154.8**	**190.5**	**228.6**
Total DBIS Available Capacity (MW)	**195.3**	**246.2**	**298.4**	**341.1**	**376.8**	**414.9**
Capacity Reserve (MW)	13.95	13.95	13.95	13.95	13.95	13.95
Impact Factor: N-G-1	1.5	1.5	1.5	1.5	1.5	1.5
Outcome of an N-G-1 Event	**NI**	**NI**	**NI**	**NI**	**NI**	**NI**

6.2 Isolated Power Systems (Anna Regina, Bartica, Leguan and Wakenaam)

Similarly, the isolated group of power systems in the Essequibo region presently have a combination of aged, inefficient, and unreliable high-speed mobile generator units. Where applicable and necessary, GPL would continue performing minor and major overhauls, as specified by the manufacturer of these generator units, to ensure that customers are provided with reliable electricity. In cases where engine efficiency, availability and reliability are in dire

need of improvement, the cost benefits of unit replacement would become significantly competitive relative to performing a major overhaul.

As the expansion programme draws closer to the planned commissioning timeline of the Amaila Falls Hydroelectric Project, it is intended to interconnect the isolated group of power systems with the DBIS circa 2030. After the interconnection, the generator units within the isolated group of power systems would be mothballed and classified as Cold Reserve as a mean of mitigating transmission line contingencies. On account of the aforementioned, the customers of the Isolated Power Systems are expected to benefit from cheaper, cleaner, and reliable electricity service from a blend of new energy resources, which includes natural gas, hydro, and solar energy.

Having interconnection with the DBIS, the operation of the isolated group of power systems would be independent of the local power generation facilities and by extension, fuel price volatility, fuel transportation risks and other fuel-associated risks that can adversely impact plant availability, and by extension, electricity generation reliability and electricity supply security.

Anna Regina

GPL intends to reduce the dispatch of LFO-fired generator units in Anna Regina due to the volatile market price of LFO, coupled with the dire need to improve power generation efficiency and reducing production cost. In this vane, GPL replaced the 5 MW HFO-fired power plant that was commissioned in year 1995 with a new plant of similar technology in 2019.

Due to the improvement of power generation reliability, the rapid increase in electricity demand resulted in GPL having to revert to the use of LFO-fired units, to halt the widening of the supply-demand gap. The LFO-fired units at the Anna Regina Power Plant are currently in good working conditions, as they were commissioned in 2020.

On the account of the above, GPL currently has a total available capacity of 14.4 MW at the Anna Regina Power Plant. A total of 9.9 MW belongs to the group of high-speed LFO-fired capacity, which is unreliable from the perspective of the planning targets of this 5-year Programme. The balance 4.5 MW, which is HFO-fired, is considered reliable capacity.

For the latter part of year 2023, the two of the three HFO-fired generator units were offline due to major overhaul. However, in 2024, these units are expected to be returned to service. Further, with no generator units at this location surpassing its economic lifespan, there will be no Cold Reserve Capacity during this planning period. See Table 35 for further details.

Wakenaam

The first utility scale power plant in Wakenaam was commissioned circa 1997 with an installed LFO-fired capacity of 0.975 MW – 3x 0.325 MW units. While these generator units served and supported developments on the island successfully, with consistent prudent maintenance practice for 25 years, GPL has been able to maximise the use of 2x 0.325 MW generators.

Though Wakenaam was equipped with 0.975 MW since 1997 and the electricity demand was less than 20% of the installed capacity for majority of the years, electricity service supply was not 24 hours per day. However, in year 2014, the power plant with 2x 0.325 MW generators was re-conditioned and recommissioned to supply 24 hours of electricity service.

In view of the UAE-CREF grant fund project, and GPL's commitment, the Company has already procured, installed, and commissioned 2x 410 kW LFO-fired generator units. The remaining work to further upgrade the power plant, which include but not limited to new switchgear at 480 V and 13.8 kV, are currently in progress and will be completed in a timely manner to facilitate the integration of the Solar PV farm plus BESS in the year 2025.

Albeit a technical constraint that existed with one of the 25-year-old units is resolved, its reliability is not on par with another similar unit. As a result, the Company intends to mothball this unit in 2023 upon the commercial operation of the hybrid energy system in Wakenaam.

On account of the above, this Development and Expansion Programme considers that the total minimum available firm capacity for the period 2024-2028 would be 1.15 MW for Wakenaam. See Table 35 for further details.

Leguan

Similarly, in 1997, the Leguan power plant was commissioned with one 0.325 MW LFO-fired generator unit that did not operate 24 hours per day. In 2014, the 0.325 MW unit was replaced with three (3) new 410 kW LFO-fired generator units. The power plant was re-conditioned, reconfigured, and re-commissioned to generate electricity 24 hours per day. To date, the 410 kW generator units continue to support the energy-based activities on the Island.

Considering the fixed dates for major overhauls of the 410 kW LFO-fired generator units, the total of 1.23 MW is considered to be the total available firm capacity for the current planning period. Further, with no generator units at this location surpassing its economic lifespan, there will be no Cold Reserve Capacity during this planning period. See Table 35 for further details.

Bartica

In 2019, GPL took determined steps to construct a new and efficient 3.36 MW LFO-fired power plant at Dagg Point, Bartica. As a result of power generation reliability improvement, electricity demand increased rapidly, which resulted in GPL having to revert to the use of 1.4 MW LFO-fired mobile generator units to bolster the power plant's firm capacity.

With a loan from the IaDB, the Guyana Energy Agency (GEA) commissioned a 1.5 MW Solar PV farm with a Battery Energy Storage System (BESS) on 31st March 2023. The Solar + BESS + Diesel hybrid system continues to support the energy-based activities in Bartica.

In light of the dates for major overhauls, the total 4.7 MW is considered to be the total minimum available firm capacity from 2024 to 2028. In 2025, it is intended to classify the 1.4 MW LFO-fired mobile generator unit as Cold Reserve Capacity. See Table 35 for further details.

Table 35: Summary of power generation profile: 2023-2028 (isolated group of power systems).

ISOLATED SYSTEMS	Year	2022	2023	2024	2025	2026	2027	2028
Anna Regina	Total Available Capacity (MW)	14.4	11.4	12.9	14.4	14.4	14.4	14.4
	Reliable Capacity (MW)	4.5	1.5	3.0	4.5	4.5	4.5	4.5
	Unreliable Capacity (MW)	5.6	5.6	5.6	5.6	5.6	5.6	5.6
	Cold Reserve Capacity (MW)	-	-	-	-	-	-	-
	Accumulated Cold Reserve (MW)	-	-	-	-	-	-	-
Wakenaam	Total Available Capacity (MW)	1.15	1.15	1.15	1.15	1.15	1.15	1.15
	Reliable Capacity (MW)	0.82	0.82	0.82	0.82	0.82	0.82	0.82
	Unreliable Capacity (MW)	0.33	0.33	0.33	0.33	0.33	0.33	0.33
	Cold Reserve Capacity (MW)	-	-	-	-	-	-	-
	Accumulated Cold Reserve (MW)	-	-	-	-	-	-	-
Leguan	Total Available Capacity (MW)	1.23	1.23	1.23	1.23	1.23	1.23	1.23
	Reliable Capacity (MW)	-	-	-	-	-	-	-
	Unreliable Capacity (MW)	1.23	1.23	1.23	1.23	1.23	1.23	1.23
	Cold Reserve Capacity (MW)	-	-	-	-	-	-	-
	Accumulated Cold Reserve (MW)	-	-	-	-	-	-	-
Bartica	Total Available Capacity (MW)	4.7	4.7	4.7	3.3	3.3	3.3	3.3
	Reliable Capacity (MW)	3.3	3.3	3.3	3.3	3.3	3.3	3.3
	Unreliable Capacity (MW)	1.4	1.4	1.4	-	-	-	-
	Cold Reserve Capacity (MW)	-	-	-	1.4	-	-	-
	Accumulated Cold Reserve (MW)	-	-	-	1.40	1.40	1.40	1.40
Isolated System	Total Available Capacity (MW)	21.5	18.5	20.0	20.1	20.1	20.1	20.1
	Reliable Capacity (MW)	8.6	5.6	7.1	8.6	8.6	8.6	8.6
	Unreliable Capacity (MW)	8.6	8.6	8.6	7.2	7.2	7.2	7.2
	Cold Reserve Capacity (MW)	-	-	-	1.40	-	-	-
	Accumulated Cold Reserve (MW)	-	-	-	1.40	1.40	1.40	1.40

7. Current Status of Transmission and Distribution Systems

GPL's transmission and distribution systems currently constitute three main voltage levels: 69 kV for bulk power transfer, 13.8 kV for primary power distribution and lower utilisation voltage (480 V,440 V,415 V, 240 V and 120 V) for customer-specific applications.

The present transmission and distribution systems provide electricity supply coverage to approximately 99.73% of the total number of households on the Coastland, inclusive of Bartica.

The characteristics of the transmission and distribution systems include the following attributes:

1. The transmission voltage level of 69 kV is only present in the DBIS, and the 16 transmission lines result in a total length of 276 km[6], whereas per conductor type:
    a. 119.74 km is Canton.
    b. 156.07 km is Partridge.
    c. 2.18 km is XLPE Submarine Cable.
2. A total of 39 active primary distribution feeders in the DBIS have an aggregated estimated length of approximately 921 km. Total line length extension in 2023 amounted to 48 km.
3. With regards to the automatic load-shedding scheme in the DBIS, 29 feeders have this scheme activated and 10 do not have the functionality for mitigating low frequency excursions.

Within the total GPL power system, majority of the network-related challenges are experienced in the DBIS. A summary of the critical issues currently experienced, and which the Company is aggressively working to address within the shortest possible time frame, are as follows:

1. Reduced life span of pole structures due to poor poles and cross-arms material quality.
2. Impassable access to pole structures located in remote terrains, largely for the transmission lines and to some extent, sections of primary distribution lines.
3. Frequent line trips due to vegetation encroachments on open conductors.
4. Minimal redundancy in the transmission system frequently results in delayed scheduled maintenance, which usually result in the failure of line hardware components.
5. High voltage drops due to a combination of long feeder lengths, high electricity demands, and low power factor presented primarily by maximum demand customers.
6. Widespread outages due to fault clearing by protection relay scheme at substation level for feeders without Auto reclosers.

[6] The updated transmission line lengths are premised on recent data collection campaigns to improve transmission line protection and coordination.

7. A large number of and duration of outages to facilitate line maintenance and emergency switching.
8. Poor operation visibility and the absence of remote control and supervision for sections of primary distribution feeders result in a high dependency on customer fault reports.
9. Poor line construction and maintenance works.
10. Lack of adequate and timely availability of T&D resources.
11. Absence of standards and specifications that are related to T&D line hardware materials and workmanship.
12. Lack of proper monitoring of condition and performance of T&D networks; and
13. Delayed implementation of upgrades and other corrective actions, which includes vegetation management.

For the isolated system, Table 36 provides a breakdown of the primary and secondary distribution line details.

Table 36: Breakdown of distribution feeders' lengths in Isolated Systems

Location	Feeders	Primary (MV) km	Secondary (LV) km
Anna Regina	North	28.64	214.87
	South	35.54	
	West	17.6	
	CRM	0.27	
Total		**82.05**	
Leguan	West	8.8	24.04
	East	8.8	
	North	11.2	
Total		**28.8**	
Wakenaam	North	10.6	21
	South	10.59	
Total		**21.19**	
Bartica	F1	3.2	24.26
	F2	6.44	
	F3	8	
	F4	2.2	
Total		**19.84**	

7.1 T&D SAIFI and SAIDI

Figure 10 shows monthly T&D SAIFI and SAIDI indices for individual power system and total GPL. Albeit there are month-to-month variations relative to each power systems, there have

been concurrent reduction of 36% in SAIFI and 24 % in SAIDI, respectively, in year 2023 relative to year 2022.

These improvements are attested to GPL's continuous commitment to improving T&D reliability. It is the Company's desire to further improve SAIFI and SAIDI performances, which unwaveringly is in alignment with of projection of the national economy. However, in light of the current high non-technical losses, revenue is currently the impeding factor to proceed in this direction. For this reason, this D&E aims to address reducing non-technical losses aggressively in accordance with the Electricity Sector Reform Act.

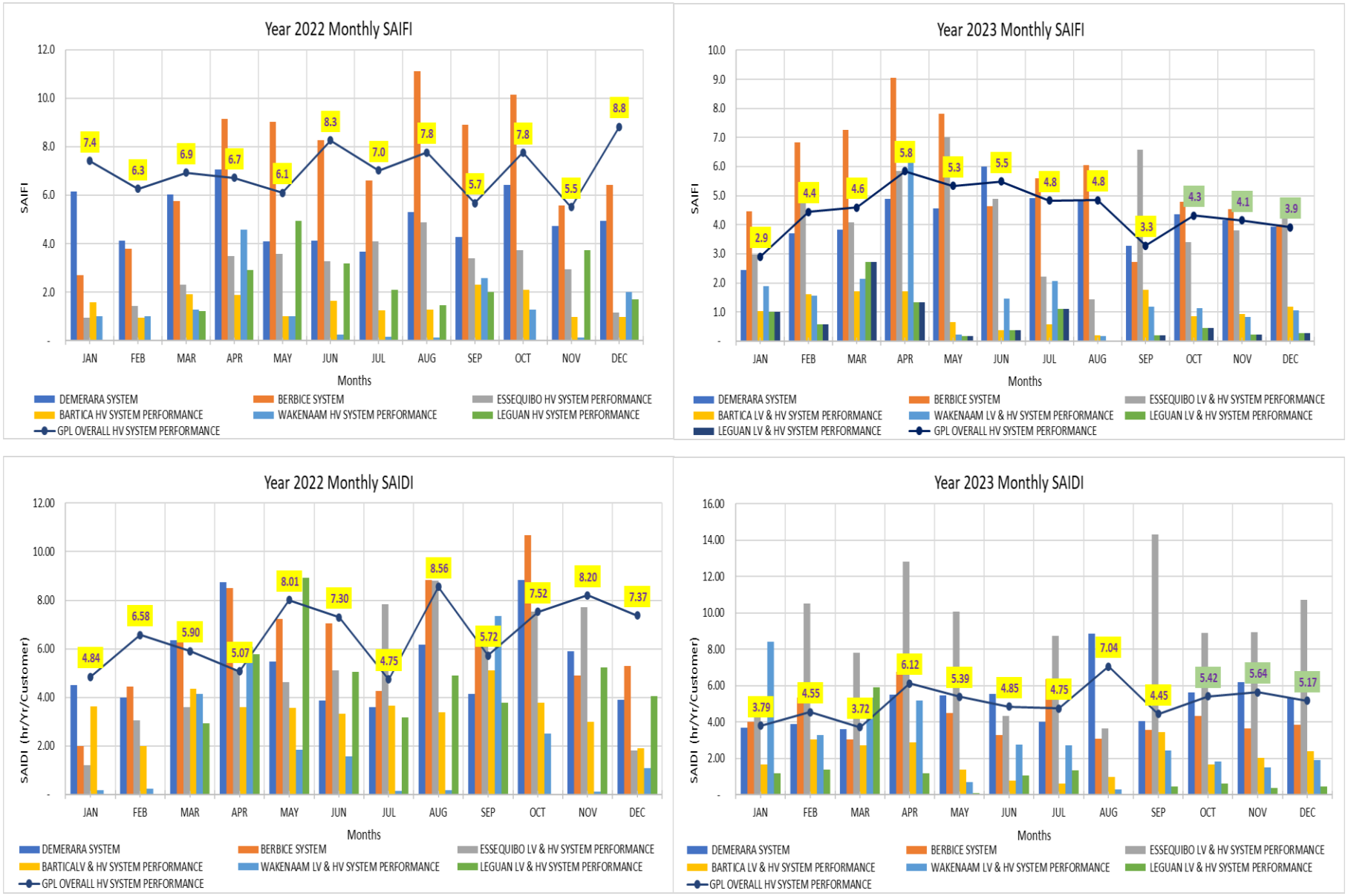

Figure 10: Monthly SAIFI and SAIDI

In addition to revenue constraints, historically, SAIFI and SAIDI indices have not been able to further reduce as a result of the following challenges:

1. Absence of alternative feeder to execute planned maintenance schedules.
2. Thorough inspection of poles structures and line hardware.
3. Availability of line hardware materials to complete schedule maintenance works.
4. Effects of Climate Change impacts – increase ambient temperatures and dust particles.
5. Effects of Weather impacts – heavy rainfall and wind gusts.
6. Vehicular accidents, inclusive of excavators.
7. Prudent vegetation management.

GPL remains cognizant of the adverse effects of the above on sustainable economic development and remains committed to improving the SAIFI and SAIDI indicators of each power system.

This Development and Expansion Programme contains projects to mitigate the impacts of above list of challenges on T&D SAIFI and SAIDI. The mitigatory measures include, but are not limited to new and upgrade feeders, installation of auto-reclosers and sectionalisers, fault current indicators, AMI, and other Smart grid related technologies to be supervised by the new Guyana National Control Centre.

8. DBIS Generation Reliability – Existing & Committed Generation Projects

The simulations performed in this scenario are primarily to evaluate the Loss of Load Probability (LOLP) of the DBIS against the backdrop of the demand forecast and assuming no addition of new power generation capacity other than the already committed generation expansion projects. See Table 38 for details relative to the list committed generation projects and their expected commissioning timelines.

Table 37 reveals that in 2023, there is currently a violation of the LOLP target, which has led to significant Expected Energy Not Served (EENS). This high EENS, which stems from the high LOLP, indicates that there will be periods when there is insufficient available generation capacity to meet demand reliably, invariably leading to generation shortfall. Load shedding is the immediate next step taken to preserve the stability of the power system.

It must be noted that with the total committed generation capacity, LOLP violation is likely to occur until year 2025. See Table 37 for the relevant details. More specifically, the results as shown in Table 37 indicate that:

1. The Loss of Load Probability (LOLP) is violated in 2023 and will be severely violated in years 2024 and 2025, respectively. This means that almost every three-day of year 2024 and 2025 there will be loadshedding unless additional firm generation capacity is incorporated into the DBIS.

2. With the addition of 28.9 MWs of committed generation capacity by mid-December 2023, capacity reserve will increase from the annual average of 5.0 MW to 33.9 MW – referencing the 2023 unsuppressed peak demand. However, as a result of the in-service year of this project, coupled with unexpected high forced outages, the LOLP target has been violated.
3. A comparable situation is expected to occur in year 2025, where a total of 325 MW of committed firm generation capacity would be added to the grid between Q2 and Q4. More specifically, phase-1 of the GTE 300 MW natural gas power plant is expected to be in service in between Q1 and Q2 of 2025, while phase-2 is scheduled to be in service between Q3 and Q4 of 2025. As such, the prior to phase-1 being in service, the estimated capacity reserves would be -69.3 MW, resulting in LOLP violation.

Table 37: DBIS Scenario No.1 Generation Reliability Results for 2023-2028

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Committed Capacity (MW)
2023	1094.38	181.30	222.92	215.20	33.90	6367.20	9.55	28.9
2024	1444.28	232.21	222.92	215.20	-17.01	40246.81	31.53	0.00
2025	1850.91	284.50	557.92	540.20	255.70	133766.06	43.72	325.0
2026	2135.94	327.12	549.82	532.10	204.98	41.29	0.01	0.00
2027	2531.87	380.31	579.82	547.10	166.79	70.06	0.03	15.0
2028	2844.32	421.73	570.82	538.10	116.37	478.54	0.21	0.00

Further, in order for the DBIS to operate reliably, the results shown in Table 37 are testimony to the dire need to further increase the firm power generation capacity aggressively in the DBIS for years 2024 and 2025.

From an operation's perspective of generator dispatch to satisfy the forecast annual peak demand, Table 38 shows that in years 2023, 2024 and 2025, with the existing available and committed generation capacities, the DBIS would not have the requisite contingency capacity. It paramount to note that the actual in-service date/timeline of firm generation capacity has significant impact on generation capacity reserve and by extension, the LOLP. As such, values shown in Table 38 are relative to the annual peak demand, total available capacity, and accounting for the required spinning reserve.

Table 38: Scenario No.1- Available Contingency Capacity Forecast– DBIS.

Existing Capacity + Committed, MW	2023	2024	2025	2026	2027	2028
DEMERARA						
Garden of Eden Power Station	3.4	3.4	3.4	3.4	3.4	3.4
Garden of Eden 46.5 MW	46.5	46.5	46.5	46.5	46.5	46.5
Demerara Power (Kingston 1)	21.5	21.5	21.5	21.5	21.5	21.5
Demerara Power, (Kingston 11)	36.3	36.3	36.3	36.3	36.3	36.3
Demerara Power 1 (GoE)	20.6	20.6	20.6	20.6	20.6	20.6

Existing Capacity + Committed, MW	2023	2024	2025	2026	2027	2028
Vreed en Hoop Power Station	26.1	26.1	26.1	26.1	26.1	26.1
Total Demerara	**154.4**	**154.4**	**154.4**	**154.4**	**154.4**	**154.4**
BERBICE						
Canefield						
Hyundai	5.2	5.2	5.2	5.2	5.2	5.2
No. 4 Mirrlees Blackstone	3.0	3.0	3.0	3.0	3.0	0.0
Mobile Sets	6.5	6.5	6.5	0.0	0.0	0.0
Sub-total	**14.7**	**14.7**	**14.7**	**8.2**	**8.2**	**5.2**
Onverwagt						
No. 5 General Motor	2.3	2.3	2.3	2.3	2.3	0
No. 7 General Motor	2.3	2.3	2.3	2.3	2.3	0
Mobile Sets	3	3	3	1.4	1.4	0
Sub-total	**7.6**	**7.6**	**7.6**	**6**	**6**	**0**
Skeldon						
SEI	9.6	9.6	9.6	9.6	9.6	9.6
Sub-total	**9.6**	**9.6**	**9.6**	**9.6**	**9.6**	**9.6**
Total Berbice	**31.9**	**31.9**	**31.9**	**23.8**	**23.8**	**14.8**
DBIS Solar-DER	**7.7**	**7.7**	**7.7**	**7.7**	**7.7**	**7.7**
Total Existing DBIS	**194.02**	**194.02**	**194.02**	**185.92**	**185.92**	**176.92**
Total Existing Firm Capacity	**186.3**	**186.3**	**186.3**	**178.2**	**178.2**	**169.2**
Committed Generation						
28.9 MW EPC- Columbia (APAN)	28.90	28.90	28.90	28.90	28.90	28.90
300 MW GTE - Simple Cycle	-	-	183.00	183.00	183.00	183.00
300 MW GTE - Combine Cycle	-	-	112.00	112.00	112.00	112.00
300 MW GTE Project BESS	-	-	30.00	30.00	30.00	30.00
GUYSOL - Berbice	-	-	10.00	10.00	10.00	10.00
GUYSOL Linden BESS	-	-	-	-	15.00	15.00
GUYSOL Linden Solar PV	-	-	-	-	15.00	15.00
Total Committed Generation	**28.90**	**28.90**	**363.90**	**363.90**	**393.90**	**393.90**
Total Existing DBIS + Committed	**222.92**	**222.92**	**557.92**	**549.82**	**579.82**	**570.82**
Min Required Spinning Reserve (MW)	**16.27**	**16.27**	**89.32**	**89.32**	**93.82**	**93.82**
Net Capacity (MW)	**198.93**	**198.93**	**450.88**	**442.78**	**453.28**	**444.28**
Peak Demand (MW)	**181.3**	**231.9**	**283.9**	**317.5**	**357.1**	**403.1**
Contingency Capacity (MW)	**17.6**	**-32.9**	**167.0**	**125.3**	**96.2**	**41.2**

9. Isolated Power System's Generation Reliability – Existing & Committed Generation Projects

The simulations performed in this scenario are primarily to evaluate the Loss of Load Probability (LOLP) of the Isolated Power Systems, individually, against the backdrop of the demand forecast, and assuming no addition of new power generation capacity other than committed

generation expansion projects. See Table 43 for specific details regarding all committed generation expansion projects for individual power systems.

9.1 Anna Regina

The Anna Regina power system is one of the faster growing amongst the isolated power systems in the Essequibo Country. This power system continues to experience a steady load demand growth and as a result, an increase in firm generation capacity is paramount to mitigating generation shortfall and grid instability.

Anna Regina is presently powered by HFO and LFO generators, with the majority generation supplied by high-speed LFO engines. High-speed LFO-fired units have forced outage and maintenance rates doubling those of HFO-fired units. As a result, the LOLP for years 2024, 2025 and 2028 would be violated - see Table 39. Consequently, the stability and reliability of the Anna Regina power system would be at risk in years 2024 and 2025.

Further, it must be brought into the context that the vibrant agriculture sector, which depends on stable and reliable electricity, is one of the main drivers of the economy on the Essequibo Coast. As such, economic and socio-economic growths are likely to be constrained, should there be poor power generation reliability and quality of electricity service on the Essequibo Coast.

Table 39: Anna Regina Scenario No.1 Reliability Results for 2023-2028

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Committed Capacity (MW)
2023	42.76	7.37	11.69	11.40	4.03	70.53	1.11	0.00
2024	59.47	9.70	13.19	12.90	3.20	193.45	2.51	0.00
2025	80.19	12.26	28.69	20.40	8.14	134.08	1.60	7.50
2026	92.27	13.83	28.69	20.40	6.57	0.83	0.02	0.00
2027	99.94	14.88	28.69	20.40	5.52	4.54	0.08	0.00
2028	115.00	16.90	28.69	20.40	3.50	62.11	0.86	0.00

9.2 Bartica

Bartica has recorded a steady load growth since the installation of the 3.3 MW power plant in 2019. It is forecasted that the load would grow by over 243% between 2023 and 2028. As a result, Table 40 shows that the LOLP would be violated from 2023. Progressively, the capacity reserve would decrease against the growing peak demand, where it becomes negative by 2025, with significant increasing LOLP violations annually.

Within the context of providing business services, electricity is a known and well established catalyst for economic development. Given that Bartica is one of the major gateways to the hinterland regions, power generation and supply of reliable electricity is critical to residents of Bartica to provide essential services to sustain the mining industry. In light of the

aforementioned, the generation reliability results shown in Table 40 would constrain economic and socio-economic growth in Bartica.

Table 40: Bartica Scenario No.1 Reliability Results for 2023-2028

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Committed Capacity (MW)
2023	12.54	2.15	7.72	4.70	2.55	40.03	0.85	0.00
2024	19.32	3.33	7.72	4.70	1.37	50.52	1.24	0.00
2025	24.82	4.04	6.32	3.30	-0.74	1349.07	34.29	0.00
2026	28.74	4.41	6.32	3.30	-1.11	2765.12	53.73	0.00
2027	31.55	4.75	6.32	3.30	-1.45	4593.24	72.64	0.00
2028	35.26	5.23	6.32	3.30	-1.93	8415.84	98.57	0.00

9.3 Wakenaam

In view of the demand forecast, the simulation results shown in Table 41 indicate that the Wakenaam power system has sufficient generation capacity and capacity reserve. It must be highlighted that although the capacity reserve margin in 2025 is high for such small power system, should there be an increase in the forced outage rate of the 25-year-old generator unit, which would result in the power system becoming unstable, adversely impacting reliability. However, the timely addition of 1.15 MW of committed generation in 2024 ensures that the region will enjoy sufficient generation capacity and system reserves, from the 0.4 MW BESS, for this planning period. This committed generation capacity is referenced to the UAE-CREF grant funded Solar PV plus BESS project for Wakenaam.

Table 41: Wakenaam Scenario No.1 Reliability Results for 2023-2028

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Committed Capacity (MW)
2023	2.48	0.46	1.17	1.15	0.69	3.12	0.26	0.00
2024	3.22	0.54	2.32	1.55	1.01	2.56	0.21	0.40
2025	4.13	0.66	2.32	1.55	0.89	0.26	0.02	0.00
2026	4.75	0.74	2.32	1.55	0.81	0.46	0.03	0.00
2027	5.30	0.81	2.32	1.55	0.74	1.15	0.09	0.00
2028	5.96	0.91	2.32	1.55	0.64	3.46	0.29	0.00

9.4 Leguan

According to the results shown in Table 42, there would be an LOLP violation of the Leguan power system in years 2024 and 2025. Even though Leguan has sufficient generation capacity and reserves, some amount of unserved energy is expected. The LOLP considers the probability of failure of the power plant due to a N-G-1-1 while supplying a demand above 0.53 MW. The addition of the 0.6 MW BESS in 2025 bolsters the firm capacity of the region, but it

does not prevent the violation of the LOLP. The committed generation capacity to be added in Leguan in year 2024 is referenced to loan funding from the IaDB/GoG.

Table 42: Leguan Scenario No.1 Reliability Results for 2023-2028

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Committed Capacity (MW)
2023	2.24	0.39	1.25	1.23	0.84	0.66	0.02	0.00
2024	3.21	0.53	1.25	1.23	0.70	5.27	0.47	0.60
2025	4.22	0.66	2.45	1.83	1.17	5.02	0.35	0.00
2026	4.84	0.73	2.45	1.83	1.10	0.07	0.01	0.00
2027	5.28	0.78	2.45	1.83	1.05	0.14	0.01	0.00
2028	5.94	0.88	2.45	1.83	0.95	0.28	0.02	0.00

In consideration of the dispatch of generator units to satisfy the forecast peak demand and ensuring the availability of adequate contingency capacity after allocating the required spinning reserve, Table 43 illustrates the following salient points:

1. **Anna Regina** –In 2024, 23% of Anna Regina generation capacity would be supplied by HFO generators and 75% by LFO generators. This generation mix ensures sufficient capacity reserves and contingency capacity. However, as indicated before, this system is susceptible to high force outage and maintenance rates. Therefore, the Loss of Load Probability for this region will be higher than its target value in years 2024 and 2025, respectively. For the years beyond 2025, the power system will have an aggregated 6 MW BESS installed. This battery prevents provides enough contingency capacity until 2028, where a marginal shortage of contingency capacity is forecasted (Table 43).
2. **Bartica** – In March 2023, GEA installed and commissioned a 1.531 MWp PV solar farm plus 1.6 MW/0.838 MWh grid following BESS. However, the solar PV output capacity is constrained to 1.26 MWac. The 1.26 MWac of non-firm generation capacity added to the Bartica power system increased the region's RE penetration to 35% on a 24hr basis, and 56% during average daily solar hours (6:00am to 6:00pm). The solar farm and BESS increased the generation capacity to 6.12 MW and supported marginal compliance to the required contingency capacity. However, from 2024 and onwards, Bartica would not have sufficient contingency capacity to mitigate an N-G-1 contingent event (see Table *43*). It must be noted that the Bartica solar farm and BESS do not contribute to the firm capacity of the power system, and as a result, cannot provide critical grid ancillary services to ensure grid stability. As such, to further capitalise on the total installed solar PV capacity, it is recommended that the firm generation capacity of Bartica be increased using BESS configured as a grid forming source.
3. **Wakenaam** – this power system is expected to have sufficient available generation capacity to satisfy its spinning reserve requirement, as well as provide adequate contingency capacity to mitigate an N-G-1 contingency until year 2025. By year 2026,

the power system would not have enough contingency capacity, which can result in unstable and unreliable operations. See Table 43 for numerical details.

4. **Leguan** – The Leguan power system is expected to have sufficient available generation capacity to satisfy the spinning reserve requirement as well as provide adequate contingency capacity to mitigate an N-G-1 contingency for this planning horizon. This is due to the forecasted demand and with to the committed generation projects planned for year 2024. See Table 43 for numerical details.

Given the forecast status of the Leguan's contingency capacity, one of the immediate solutions to resolve the contingency capacity deficiency of Wakenaam would be to interconnect the islands.

Table 43: Scenario No.1- Available Contingency Capacity Forecast– Isolated Power Systems

Existing + Committed Capacity (MW)	2023	2024	2025	2026	2027	2028
Anna Regina						
MAN - Existing	1.50	3.00	4.50	4.50	4.50	4.50
Mobile Sets - Existing	9.90	9.90	9.90	9.90	9.90	9.90
AR Solar-DER- Existing	0.29	0.29	0.29	0.29	0.29	0.29
Total Anna Regina- Existing	**11.69**	**13.19**	**14.69**	**14.69**	**14.69**	**14.69**
Total Anna Regina- Existing Firm Capacity	**11.40**	**12.90**	**14.40**	**14.40**	**14.40**	**14.40**
GUYSOL Solar PV- Committed	0.00	0.00	8.00	8.00	8.00	8.00
GUYSOL BESS- Committed	0.00	0.00	6.00	6.00	6.00	6.00
Total Anna Regina- Committed	**0.00**	**0.00**	**14.00**	**14.00**	**14.00**	**14.00**
Total Anna Regina- Existing + Committed	**11.69**	**13.19**	**28.69**	**28.69**	**28.69**	**28.69**
Total Anna Regina- Firm Capacity Existing + Committed	**11.40**	**12.90**	**20.40**	**20.40**	**20.40**	**20.40**
Min Required Spinning Reserve	**2.79**	**2.79**	**5.19**	**5.19**	**5.19**	**5.19**
Net Capacity	**8.61**	**10.11**	**15.21**	**15.21**	**15.21**	**15.21**
Peak Demand	7.37	9.70	12.26	13.83	14.88	16.90
Contingency Capacity	**1.24**	**0.41**	**2.95**	**1.38**	**0.33**	**-1.69**
Bartica						
Cummins - Existing	3.30	3.30	3.30	3.30	3.30	3.30
Mobile Units - Existing	1.40	1.40	0.00	0.00	0.00	0.00
Bartica Solar-DER- Existing	0.16	0.16	0.16	0.16	0.16	0.16
Solar Farm PV+BESS- Existing	1.26	1.26	1.26	1.26	1.26	1.26
Total Bartica- Existing	**6.12**	**6.12**	**4.72**	**4.72**	**4.72**	**4.72**
Total Bartica- Existing Firm Capacity	**4.70**	**4.70**	**3.30**	**3.30**	**3.30**	**3.30**
Committed Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total Bartica- Firm Capacity Existing + Committed	**4.70**	**4.70**	**3.30**	**3.30**	**3.30**	**3.30**
Min Required Spinning Reserve	**2.53**	**2.53**	**2.08**	**2.08**	**2.08**	**2.08**
Net Capacity	**2.17**	**2.17**	**1.22**	**1.22**	**1.22**	**1.22**
Peak Demand	2.15	3.33	4.04	4.41	4.75	5.23
Contingency Capacity	**0.02**	**-1.16**	**-2.82**	**-3.19**	**-3.53**	**-4.01**
Wakenaam						
Caterpillar - Existing	1.15	1.15	1.15	1.15	1.15	1.15
Wakenaam Solar -DER	0.02	0.02	0.02	0.02	0.02	0.02
Total Wakenaam- Existing	**1.17**	**1.17**	**1.17**	**1.17**	**1.17**	**1.17**
Total Wakenaam- Existing Firm Capacity	**1.15**	**1.15**	**1.15**	**1.15**	**1.15**	**1.15**
Wakenaam Solar PV- Committed	0.00	0.75	0.75	0.75	0.75	0.75
Wakenaam BESS- Committed	0.00	0.40	0.40	0.40	0.40	0.40

Existing + Committed Capacity (MW)	2023	2024	2025	2026	2027	2028
Total Wakenaam- Committed	**2.33**	**3.48**	**3.48**	**3.48**	**3.48**	**3.48**
Total Wakenaam- Existing + Committed	**3.50**	**4.65**	**4.65**	**4.65**	**4.65**	**4.65**
Total Wakenaam- Firm Capacity Existing + Committed	**1.15**	**1.55**	**1.55**	**1.55**	**1.55**	**1.55**
Min Required Spinning Reserve	**0.62**	**0.85**	**0.85**	**0.85**	**0.85**	**0.85**
Net Capacity	**0.52**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**
Peak Demand	0.46	0.54	0.66	0.74	0.81	0.91
Contingency Capacity	**0.06**	**0.16**	**0.04**	**-0.04**	**-0.11**	**-0.21**
Leguan						
Caterpillar	1.23	1.23	1.23	1.23	1.23	1.23
Leguan Solar-DER	0.02	0.02	0.02	0.02	0.02	0.02
Total Leguan- Existing	**1.25**	**1.25**	**1.25**	**1.25**	**1.25**	**1.25**
Total Leguan- Existing Firm Capacity	**1.23**	**1.23**	**1.23**	**1.23**	**1.23**	**1.23**
Leguan Solar PV- Committed	0.00	0.00	0.60	0.60	0.60	0.60
Leguan BESS- Committed	0.00	0.00	0.60	0.60	0.60	0.60
Total Leguan- Committed	**2.50**	**2.50**	**3.70**	**3.70**	**3.70**	**3.70**
Total Leguan- Existing + Committed	**3.76**	**3.76**	**4.96**	**4.96**	**4.96**	**4.96**
Total Leguan- Firm Capacity Existing + Committed	**1.23**	**1.23**	**1.83**	**1.83**	**1.83**	**1.83**
Min Required Spinning Reserve	**0.62**	**0.62**	**0.80**	**0.80**	**0.80**	**0.80**
Net Capacity	**0.61**	**0.61**	**1.03**	**1.03**	**1.03**	**1.03**
Peak Demand	0.38	0.51	0.62	0.65	0.72	0.81
Contingency Capacity	**0.23**	**0.10**	**0.41**	**0.38**	**0.31**	**0.22**

10. Committed and Planned Generation Capacities - DBIS

The Demerara Berbice Interconnected System incorporates all the transmission and distribution network from Moleson Creek East Berbice-Corentyne to Parika East Bank Essequibo, and from Georgetown to Kuru Kuru on the Linden/Soesdyke highway. This means the DBIS has the largest coverage of customers supplied with grid electricity. Year 2023 has seen significant expansion in the commercial and residential sectors. As result, the grid has been unable to supply sufficient generation capacity to meet demand reliably. Consequently, the DBIS experienced generation shortfall and load shedding was the immediate step taken to preserve grid stability.

The objective of this chapter is to provide the relevant details, in the form of recommendations, to bolster the existing and committed generation capacities to achieve the planning and operational targets. The recommended additional firm capacities are based on optimization of conventional generation and BESS capacities, having the objective of maintaining the levelized cost of electricity as low as possible.

The major economic activities, which includes agriculture and service industries to the mining and the Oil and Gas sector, are within the coverage of the DBIS. Consequently, it is crucial for the DBIS to operate at the highest level of reliability and stability. Further, a reliable and stable electric power system is one of the crucial drivers of the planned economic activities and for aligning the electricity sector with the goals of LCDS-2030, long-term National Energy Priorities and other Government initiatives. As result, achieving the expansion planning targets (see section 5.2.1 on page 69) is critical to a well-developed and run utility company.

Further, it is intended that Linden's power system becomes interconnected with the DBIS by year 2027.

Improvement in LOLP is primarily driven by increasing the firm generation capacity within a power system. This can be better achieved by using, for example, conventional generation units that have forced outage rates lower than 3%, a well scheduled annual maintenance plan and timely project commissioning dates to satisfy the forecast demand reliably. Also, modern grid forming BESS is also considered firm generation capacity, providing the grid with much dire needed ancillary services.

The Government's committed generation expansion projects that drive LOLP improvements within the current planning period across the DBIS includes:

1. 300 MW Gas-to-Energy Project.
2. 30 MW/30MWh BESS to compliment the generator units at the 300 MW GTE Project and provide critical grid ancillary services.
3. 15 MW-1hr BESS to be installed in Linden.

On the account of the above, several probabilistic simulation exercises were conducted to determine the additional required firm generation capacity to achieve the LOLP target and the other expansion planning targets. The required firm generation capacities were further developed to formulate the expansion projects in this 5-year Programme for the DBIS. Table 44 shows the positive effects of further adding firm generation capacity to the DBIS.

Comparing with Table *37* on page 106, by adding the firm capacities as shown in Table 44, there would be no major violation of the annual LOLP target and significant improvements in the capacity reserve in the DBIS. Additionally, the other expansion planning targets, as set out in the National Grid Code, are expected to be achieved with this Programme.

The LOLP violation shown in Table 44 for year 2024 and 2025 is due to the commissioning dates 65 MW of firm HFO and BESS capacity, and the commissioning of the 300 MW GTE project during the Q1 to Q4 of year 2025.

Table 44: Generation Reliability with Planned Expansions – DBIS

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Additional Generation Capacity (MW)
2023	1094.38	181.30	222.92	215.20	33.90	6367.20	9.55	0.00
2024	1460.19	232.21	288.32	280.60	48.39	164.88	0.31	65.40
2025	1866.51	284.50	638.32	620.60	336.10	511.36	0.79	15.00
2026	2138.39	327.12	630.22	612.50	285.38	2.40	0.00	0.00
2027	2536.62	380.31	660.22	627.50	247.19	6.58	0.00	0.00
2028	2847.70	421.73	651.22	618.50	196.77	25.29	0.01	0.00

Table 45 shows a summary of all committed and recommended generation projects, and their contribution towards the annual capacity, reaching 618.5 MW by year 2028. The recommended

additional firm generation capacity would improve the capacity reserve margin of the DBIS significantly, thereby allowing sufficient contingency capacity and the LOLP target to be achieved annually within the current planning period.

Table 45: Proposed Generation Addition – DBIS

New Generators (DBIS)	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
DBIS Solar-DER	Non-Firm Capacity	7.72	-	-	-	-	-
28.9 MW EPC- Columbia (APAN)	Firm Capacity	28.90	-	-	-	-	-
50.4 MW Power Plant	Firm Capacity	-	50.40	-	-	-	-
DBIS BESS 15 MW/ 30 MWH	Firm Capacity-B	-	15.00	-	-	-	-
DBIS BESS 15 MW/ 30 MWH	Firm Capacity-B	-	-	15.00	-	-	-
GUYSOL - Berbice	Non-Firm Capacity	-	-	10.00	-	-	-
300 MW GTE - Simple Cycle	Firm Capacity	-	-	183.00	-	-	-
300 MW GTE - Combine Cycle	Firm Capacity	-	-	112.00	-	-	-
300 MW GTE Project BESS	Firm Capacity-B	-	-	30.00	-	-	-
GUYSOL Linden BESS	Firm Capacity-B	-	-	-	-	15.00	-
GUYSOL Linden Solar PV	Non-Firm Capacity	-	-	-	-	15.00	-
Total New Additions - Generators		**36.62**	**65.40**	**350.00**	**-**	**30.00**	**-**
Total Accumulated Additions - Generators		**36.62**	**102.02**	**452.02**	**452.02**	**482.02**	**482.02**
Annual Non-Firm Capacity		**7.72**	**-**	**10.00**	**-**	**15.00**	**-**
Annual Firm Capacity - Generators		**28.90**	**50.40**	**295.00**	**-**	**-**	**-**
Accumulated Firm Capacity - Generators		**28.90**	**79.30**	**374.30**	**374.30**	**374.30**	**374.30**
Existing Firm Capacity - Generators		**186.30**	**186.30**	**186.30**	**178.20**	**178.20**	**169.20**
Total Firm Capacity - Generators		**215.20**	**265.60**	**560.60**	**552.50**	**552.50**	**543.50**
Accumulated Firm Capacity - BESS		**-**	**15.00**	**60.00**	**60.00**	**75.00**	**75.00**
Grand Total Firm Capacity - Generators + BESS		**215.20**	**280.60**	**620.60**	**612.50**	**627.50**	**618.50**

With regards to all HFO-fired generator units, the Company intends in the long-term to reconfigure these units s with a focus on furthering the use of clean, indigenous, and affordable energy resources to:

1. Satisfy the forecast demand reliably.
2. Improve power generation reliability.
3. Reduce Guyana's dependency on imported fossil fuels for electricity generation.
4. Reduce production cost and by extension, tariff.
5. Assist in increasing the disposable income for Customers.
6. Allow Government and GPL to support other critical energy-driven development programmes; and
7. Facilitate Guyana to be achieve its climate change commitments, as expressed in the LCDS-2030, and for alignment with the Sustainable Development Goals.

In consideration of the operating planning criteria[7], Table 46 shows the annual contingency capacity of the DBIS. For each year, the planned contingency capacity is larger than the unit capacity of the largest generator. As a result, it is expected for the DBIS to operate stably and to have the technical capacity to mitigate an N-G-1 for the annual peak period.

In view of the above, this Programme demonstrates that the DBIS will have the technical capabilities to meet the energy and power requirements of the peak demand forecast, coupled with the currently existing self-generators and new large industrial customers.

From the perspectives of the above generation expansion plan for the current planning period, the electricity sector is positioned to satisfy customers electricity requirements and to support Government's planned economic activities sustainably.

Further to the current planning horizon, as the peak demand is forecasted to increase, should the firm generation capacity remain fixed, the contingency capacity will decrease. The situation can be exacerbated in the event of increased forced outage rate, improper and protracted delay in generator maintenance and untimely commissioning firm power generation expansions. As such, it is mandatory for GPL to assess continuously the critical planning and operational parameters to ensure the electricity sector remains committed to the planning and operation targets set out in the expansion programme.

[7] See section 5.2.2 on 4070 for the relevant details.

Table 46: Generation Contingency Capacity Forecast with Recommended Additions – DBIS

Existing and New Power Generators	Type	2022	2023	2024	2025	2026	2027	2028
DEMERARA								
Garden of Eden Power Station	Firm Capacity	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Garden of Eden 46.5 MW	Firm Capacity	46.5	46.5	46.5	46.5	46.5	46.5	46.5
Demerara Power 1 (GoE)	Firm Capacity	20.6	20.6	20.6	20.6	20.6	20.6	20.6
Demerara Power (Kingston 1)	Firm Capacity	21.5	21.5	21.5	21.5	21.5	21.5	21.5
Demerara Power, (Kingston 11)	Firm Capacity	36.3	36.3	36.3	36.3	36.3	36.3	36.3
Vreed en Hoop Power Station	Firm Capacity	26.1	26.1	26.1	26.1	26.1	26.1	26.1
DBIS Solar-DER	Non-Firm Capacity	-	7.7	7.7	7.7	7.7	7.7	7.7
28.9 MW EPC- Columbia (APAN)	Firm Capacity	-	28.9	28.9	28.9	28.9	28.9	28.9
50.4 MW Power Plant	Firm Capacity	-	-	50.4	50.4	50.4	50.4	50.4
DBIS BESS 15 MW/ 30 MWH	Firm Capacity	-	-	15.0	15.0	15.0	15.0	15.0
DBIS BESS 15 MW/ 30 MWH	Firm Capacity	-	-	-	15.0	15.0	15.0	15.0
300 MW GTE - Simple Cycle	Firm Capacity	-	-	-	183.0	183.0	183.0	183.0
300 MW GTE - Combine Cycle	Firm Capacity	-	-	-	112.0	112.0	112.0	112.0
300 MW GTE Project BESS	Firm Capacity	-	-	-	30.0	30.0	30.0	30.0
Demerara Total Installation Generation Capacity (MW)		**154.4**	**191.0**	**256.4**	**596.4**	**596.4**	**596.4**	**596.4**
Demerara Total Firm Generation Capacity (MW)		**154.4**	**183.3**	**248.7**	**588.7**	**588.7**	**588.7**	**588.7**
Demerara Total Non-Firm Generation Capacity (MW)		**0.0**	**7.7**	**7.7**	**7.7**	**7.7**	**7.7**	**7.7**
BERBICE								
Canefield	**Type**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
Hyundai	Firm Capacity	5.2	5.2	5.2	5.2	5.2	5.2	5.2
No. 4 Mirrlees Blackstone	Firm Capacity	3	3	3	3	3	3	0
Mobile Sets	Firm Capacity	6.5	6.5	6.5	6.5	0	0	0
GUYSOL - Berbice	Non-Firm Capacity			3	3	3	3	3
Onverwagt		**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
No. 5 General Motor	Firm Capacity	2.3	2.3	2.3	2.3	2.3	2.3	0
No. 7 General Motor	Firm Capacity	2.3	2.3	2.3	2.3	2.3	2.3	0

Existing and New Power Generators	Type	2022	2023	2024	2025	2026	2027	2028
Mobile Sets	Firm Capacity	3	3	3	3	1.4	1.4	0
GUYSOL - Berbice	Non-Firm Capacity			4	4	4	4	4
Williamsburg		**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
GUYSOL - Berbice	Non-Firm Capacity			3	3	3	3	3
Skeldon		**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
SEI	Firm Capacity	9.6	9.6	9.6	9.6	9.6	9.6	9.6
Berbice Total Installation Generation Capacity (MW)		**31.9**	**31.9**	**41.9**	**41.9**	**33.8**	**33.8**	**24.8**
Berbice Total Firm Generation Capacity (MW)		**31.9**	**31.9**	**31.9**	**31.9**	**23.8**	**23.8**	**14.8**
Berbice Total Non-Firm Generation Capacity (MW)		**0**	**0**	**10**	**10**	**10**	**10**	**10**
Linden		**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
GUYSOL Linden BESS	Firm Capacity	0	0	0	0	0	15	15
GUYSOL Linden Solar PV	Non-Firm Capacity	0	0	0	0	0	15	15
Linden Total Installation Generation Capacity (MW)		**0**	**0**	**0**	**0**	**0**	**15**	**15**
Linden Total Firm Generation Capacity (MW)		**0**	**0**	**0**	**0**	**0**	**15**	**15**
Linden Total Non-Firm Generation Capacity (MW)		**0**	**0**	**0**	**0**	**0**	**15**	**15**
DBIS Existing Firm Capacity (MW)		**186.3**	**186.3**	**186.3**	**186.3**	**178.2**	**178.2**	**169.2**
DBIS Existing Non-Firm Capacity (MW)		**-**	**7.7**	**7.7**	**7.7**	**7.7**	**7.7**	**7.7**
DBIS New Firm Capacity (MW)		**-**	**28.9**	**94.3**	**434.3**	**434.3**	**434.3**	**434.3**
DBIS New Non-Firm Capacity (MW)		**0**	**0**	**10**	**10**	**10**	**25**	**25**
Power Grid Accumulated Firm Generation Capacity (MW)		**186.3**	**215.2**	**280.6**	**620.6**	**612.5**	**627.5**	**618.5**
Power Grid Accumulated Non-Firm Generation Capacity (MW)		**-**	**7.72**	**17.72**	**17.72**	**17.72**	**32.72**	**32.72**
Power Grid Min Required Spinning Reserve (MW)		**13.95**	**16.27**	**19.27**	**89.32**	**89.32**	**93.82**	**93.82**
Total BESS Capacity (MW)		**-**	**-**	**15.00**	**60.00**	**60.00**	**75.00**	**75.00**
Power Grid Net Capacity (MW)		**172.35**	**198.93**	**261.33**	**531.28**	**523.18**	**533.68**	**524.68**
Power Grid Forecast Peak Demand (MW)		**153.50**	**181.30**	**232.21**	**284.50**	**327.12**	**362.84**	**400.92**
Contingency Capacity (MW)		**18.85**	**17.63**	**29.12**	**246.78**	**196.06**	**170.84**	**123.76**

11. Planned Firm and Committed Intermittent Generation Capacities - Isolated Power Systems

11.1 Anna Regina

Table 47 shows the reliability benefits of including additional generation capacity to the existing and committed generation capacities. The 2 x 1.7 MW HFO generators added in 2024 and one 1.7 MW in 2028 ensure compliance with the planning targets while optimising generation dispatch.

The 1.7 MW generator units are used as templates to represent similar capacities that would become available for use in the isolated system power systems after 2025. Given the need to ensure the expansion plan is target compliant in 2024, it is recommended to increase the firm generation capacity at the Anna Regina power plant by 3.4 MW.

Table 47: Generation Reliability with Planned Expansions – Anna Regina

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Additional Generation Capacity (MW)
2023	42.76	7.37	11.69	11.40	4.03	70.53	1.11	0.00
2024	59.47	9.70	16.59	16.30	6.60	2.80	0.05	3.40
2025	77.62	12.26	32.09	23.80	11.54	2.68	0.04	0.00
2026	92.08	13.83	32.09	23.80	9.97	0.00	0.00	0.00
2027	103.40	14.88	32.09	23.80	8.92	0.03	0.00	0.00
2028	116.59	16.90	33.79	25.50	8.60	0.07	0.00	1.70

A breakdown of the committed and additional generation capacities required to achieve the planning target is given in Table 48.

Table 48: Proposed Generation Capacity Addition - Anna Regina

Anna Regina	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
AR GUYSOL Solar PV	Non-Firm Capacity	-	-	8.00	-	-	-
AR GUYSOL BESS	Firm Capacity	-	-	6.00	-	-	-
AR Solar-DER	Non-Firm Capacity	0.29					
AR HFO Unit (2x1.7 MW)	Firm Capacity	-	3.40	-	-	-	-
AR HFO Unit (1x1.7 MW)	Firm Capacity	-	-	-	-	-	1.70
Total Non-Firm Capacity		0.29	-	8.00	-	-	-
Total Firm Capacity		-	3.40	6.00	-	-	1.70
Total Accumulated Firm Capacity		-	3.40	9.40	9.40	9.40	11.10
Existing Firm Capacity		**11.40**	**12.90**	**14.40**	**14.40**	**14.40**	**14.40**
Grand Total Firm Capacity		**11.40**	**16.30**	**23.80**	**23.80**	**23.80**	**25.50**

In consideration of the operation planning criteria, the planned generation expansion (Table 48) would deliver positive contingency capacity, with annual values larger than the largest generator unit capacity present in that year. See Table 49 for further numerical details.

The benefits of the planned generation expansion for Anna Regina include, but are not limited to the following:

- Decarbonization of Anna Regina electricity grid.
- Reduction of fossil fuel dependence.
- Provide the required firm power generation capacity to meet the growing electricity demand on the Essequibo Coast and to sustain economic growth.
- In view of the above mentioned, improvement in electricity reliability, stability and quality of electric serve will certainly benefit the livelihood and personal development of residents on the Essequibo Coast.
- Reduce dependency on the use of LFO to generate electricity, thereby reducing production cost in support of tariff reduction.
- Improve generation reliability and capacity reserve margin at the plant.
- The planned use of 2x1.7 MW units in 2024 and 2026 will enable the power plant to have firm baseload capacity, which will also bolster the stability of the power system.

Table 49: Generation Contingency Capacity Forecast with Additions - Anna Regina

Anna Regina Generation Capacity		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
Existing MAN	Firm Capacity	1.50	3.00	4.50	4.50	4.50	3.00
Existing Mobile Sets	Firm Capacity	9.90	9.90	9.90	9.90	9.90	9.90
AR GUYSOL Solar PV	Non-Firm Capacity	-	-	8.00	8.00	8.00	8.00
AR GUYSOL BESS	Firm Capacity	-	-	6.00	6.00	6.00	12.00
AR Solar-DER	Non-Firm Capacity	0.29	0.29	0.29	0.29	0.29	0.29
AR HFO Unit (2x1.7 MW) - Addition	Firm Capacity	-	3.40	3.40	3.40	3.40	
AR HFO Unit (1x1.7 MW) - Addition	Firm Capacity	-	-	-	-	-	-
Total Installed Generation (MW)		**11.69**	**16.59**	**32.09**	**32.09**	**32.09**	**33.79**
Total Firm Generation Capacity (MW)		**11.40**	**16.30**	**23.80**	**23.80**	**23.80**	**25.50**
Total Non-Firm Generation Capacity (MW)		**0.29**	**0.29**	**8.29**	**8.29**	**8.29**	**8.29**
Min Required Spinning Reserve (MW)		**2.79**	**2.79**	**5.19**	**5.19**	**5.19**	**5.19**
Net Capacity (MW)		**8.61**	**13.51**	**18.61**	**18.61**	**18.61**	**20.31**
Peak Demand (MW)		**7.37**	**9.70**	**12.26**	**13.83**	**14.88**	**16.90**
Contingency Capacity (MW)		**1.24**	**3.81**	**6.35**	**4.78**	**3.73**	**3.41**

11.2 Bartica

Although Bartica's power system is physically small, it is expected to experience electricity demand growth due to the positive prospects of the mining industry, amid developments of the other economic sectors, such as, tourism.

Given the above, it is recommended to install a 2 MW/ 2 MWh BESS at the Bartica power plant to comply with planning targets and to provide sufficient spinning reserves to mitigate power system instability due to high variable RE penetration within the Bartica power system. This BESS also provides a 2-year buffer window to install additional firm generation in 2026. This additional firm generation can be provided by similar sized LFO units (1.10 MW) or 1.7 MW HFO units as in the case of Annar Regina.

The planned addition in 2024 of 2 MW of firm capacity BESS in Bartica will certainly improve the baseload performance of the power plant and grid stability, amid the growing peak demand and the absence of grid forming capability in the Solar PV+BESS system.

To complete this planning period, an additional 1.1 MW generator unit is recommended to bolster the power plant's capacity, which will satisfy the forecast demand for electricity in 2026.

The Bartica hybrid energy system has the capacity, but not the capability to operate as a grid forming system. The Company intends to have this lacking capability addressed in order to mitigate the LOLP violation, as well as use the 2 MW BESS to optimise generator dispatch and reduce production cost. In view of the aforementioned, the BESS will therefore add approximately 2 MW of firm capacity to the grid, and also provide the requisite ancillary services to achieve the LOLP target.

In 2028, the Barica power system will require another 2 MW of firm generation, this generation can be proved by another 2 MW battery, or another 1.7 MW HFO generator.

Table 50:Generation Reliability with Planned Expansions – Bartica

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Additional Generation Capacity (MW)
2023	12.54	2.15	7.72	4.70	2.55	40.03	0.85	0.00
2024	19.32	3.33	9.72	6.70	3.37	0.08	0.00	2.00
2025	24.82	4.04	8.32	5.30	1.26	4.30	0.11	0.00
2026	27.47	4.41	9.42	6.40	1.99	0.89	0.04	1.10
2027	30.63	4.75	9.42	6.40	1.65	3.48	0.12	0.00
2028	35.86	5.23	11.42	8.40	3.17	0.01	0.00	2.00

In view of the generation expansion plan for Bartica (Table 51) within the current planning period, there is an opportunity to convert the existing units and ensure the new units are capable of combusting an optimal blend of diesel-natural gas. Such fuel blend will certainly aid to reducing production cost and supporting tariff reduction. The Company intends to relish opportunities that support tariff reduction and the LCDS-2030 goals.

Table 51: Proposed Generation Capacity Addition to Bartica

Bartica	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
Bartica LFO Unit (1x1.1 MW)	Firm Capacity	-	-		1.10		
Bartica BESS 2 MW/ 2 MWH	Firm Capacity	-	2.00	-	-	-	2.00

Bartica	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
Bartica Solar-DER	Non-Firm Capacity	0.16	-	-	-	-	-
Bartica Solar Farm PV+BESS	Non-Firm Capacity	1.26	-	-	-	-	-
Total Non-Firm Capacity		**1.42**	**-**	**-**	**-**	**-**	**-**
Total Firm Capacity		**-**	**2.00**	**-**	**1.10**	**-**	**2.00**
Total Accumulated Firm Capacity		**-**	**2.00**	**2.00**	**3.10**	**3.10**	**5.10**
Existing Firm Capacity		**4.70**	**4.70**	**3.30**	**3.30**	**3.30**	**3.30**
Grand Total Firm Capacity		**4.70**	**6.70**	**5.30**	**6.40**	**6.40**	**8.40**

The BESS that compliments the Solar PV farm is configured to be a grid following system. Consequently, the utility scale Solar PV farm + BESS in Bartica will require a spinning reserve of 0.378 MW (30% of 1.26 MW) that has to be sourced from the conventional generator units.

Notwithstanding the above, the results shown in Table 52 indicate that the operation planning targets are achievable against the backdrop of the planned expansions of firm generation to satisfy the forecast peak demands. The marginal violation of contingency capacity can be provided by mobile sets from Canefield and Onverwagt which will become available in 2025.

Table 52: Generation Contingency Capacity Forecast with Additions – Bartica

Bartica Generation Capacity		2023	2024	2025	2026	2027	2028
Existing Cummins	Firm Capacity	3.30	3.30	3.30	3.30	3.30	3.30
Existing Mobile Units	Firm Capacity	1.40	1.40	-	-	-	-
Bartica LFO Unit (1x1.1 MW)	Firm Capacity	-	-	-	1.10	1.10	1.10
Bartica BESS 2 MW/ 2 MWH	Firm Capacity	-	2.00	-	-	-	-
Bartica Solar-DER	Non-Firm Capacity	0.16	0.16	0.16	0.16	0.16	0.16
Bartica Solar Farm PV+BESS	Non-Firm Capacity	1.26	1.26	1.26	1.26	1.26	1.26
Total Installed Generation (MW)		**6.12**	**8.12**	**4.72**	**5.82**	**5.82**	**5.82**
Total Firm Generation Capacity (MW)		**4.70**	**6.70**	**5.30**	**6.40**	**6.40**	**8.40**
Total Non-Firm Generation Capacity (MW)		**1.42**	**1.42**	**1.42**	**1.42**	**1.42**	**1.42**
Min Required Spinning Reserve (MW)		**2.11**	**2.11**	**2.11**	**2.11**	**2.11**	**2.11**
Net Capacity (MW)		**2.59**	**4.59**	**3.19**	**4.29**	**4.29**	**6.29**
Peak Demand (MW)		**2.15**	**3.33**	**4.04**	**4.41**	**4.75**	**5.23**
Contingency Capacity (MW)		**0.44**	**1.26**	**-0.85**	**-0.12**	**-0.46**	**1.06**

With the BESS providing ancillary services to the grid, the contingency capacity will increase by approximately 2 MW in 2025.

The key benefits of this expansion plan for Bartica include, but are not limited to the following:

- Decarbonization of Bartica electricity grid.
- Reduction of fossil fuel dependence.
- Provide the required firm power generation capacity to meet the growing electricity demand Bartica and to sustain economic growth.
- Improve in electricity supply reliability, stability, and quality of serve.
- In view of the above, improve the livelihood and personal development of residents in Bartica.

- Provide firm capacity to improve the reliability of electricity supply as well as facilitate ancillary services for the integration of the 1.5 MWp Solar PV Project.
- Reduce dependency on older LFO generators.
- Improved fuel efficiency.
- Lower production cost.
- Allow for Bartica to have sufficient generation capacity to ride-through an N-1 contingency for the loss of a feeder or generator.

11.3 Wakenaam

Wakenaam power system has been a testament to the accuracy of the expansion projects given in the previous iterations of the GPL's Development and Expansion Plan. Wakenaam has installed 2 x 410 kW diesel generators between 2022 and 2023 which added sufficient firm capacity to the region and has ensured compliance with the planning targets. Furthermore, GPL is committed to install a 0.75 MW solar farm along with 0.4 MW / 1.15 MWH BESS in 2024. The BESS will provide capacity reserves as well as ancillary services to the grid which further reduces the LOLP from 0. 4% to 0.02% (Table 53). Due to the high levels of system reserves and low LOLP no additional generation is planned for Wakenaam within this planning cycle. However, GPL will continue to monitor Wakenaam annual demand growth to determine if additional generating capacity is required in year 2028.

Table 53: Generation Reliability with Planned Expansions – Wakenaam

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Additional Generation Capacity (MW)
2023	2.48	0.46	1.17	1.15	0.69	3.12	0.26	0.00
2024	3.22	0.54	2.32	1.55	1.01	2.56	0.21	0.00
2025	4.13	0.66	2.32	1.55	0.89	0.26	0.02	0.00
2026	4.75	0.74	2.32	1.55	0.81	0.46	0.03	0.00
2027	5.30	0.81	2.32	1.55	0.74	1.15	0.09	0.00
2028	5.96	0.91	2.32	1.55	0.64	3.46	0.29	0.00

The Company remains cognizant that should the forced outage rate of generator units increase in 2027, the LOLP target will not be satisfied amid the BESS is providing ancillary services. Nevertheless, the Company will address these setbacks progressively as the demand is expected to increase within the current planning period.

Table 54 shows no additional generating capacity is needed to meet demand the forecast demand.

Table 54: Proposed Generation Capacity Addition to Wakenaam

Wakenaam	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
Wakenaam Solar PV	Non-Firm Capacity	-	0.75				

Wakenaam	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
Wakenaam BESS	Firm Capacity		0.40				
Wakenaam Solar -DER	Non-Firm Capacity	0.02					
Total Non-Firm Capacity		**0.02**	**0.02**	**0.75**	**-**	**-**	**-**
Total Firm Capacity		**-**	**-**	**0.40**	**-**	**-**	**-**
Total Accumulated Firm Capacity		**-**	**-**	**0.40**	**0.40**	**0.40**	**0.40**
Existing Firm Capacity		**1.15**	**1.15**	**1.15**	**1.15**	**1.15**	**1.15**
Grand Total Firm Capacity		**1.15**	**1.55**	**1.55**	**1.55**	**1.55**	**1.55**

As it relates to the operation planning targets, the Wakenaam power system is expected to have sufficient contingency capacity to ensure stable operation annually during the peak demand periods. The Company remains cognizant that while the contingency becomes negative from 2026 onwards as shown in Table 55, while the LOLP and capacity reserves remain within the limits of the planning targets. The Company will address these setbacks progressively as the demand forecast is updated.

Table 55:Generation Contingency Capacity Forecast with Additions – Wakenaam

Wakenaam Generation Capacity		2023	2024	2025	2026	2027	2028
Existing Caterpillar	Firm Capacity	1.15	1.15	1.15	1.15	1.15	1.15
Wakenaam Solar PV	Non-Firm Capacity	-	0.75	0.75	0.75	0.75	0.75
Wakenaam BESS	Firm Capacity	-	0.40	0.40	0.40	0.40	0.40
Wakenaam Solar -DER	Non-Firm Capacity	0.02	0.02	0.02	0.02	0.02	0.02
Total Installed Generation (MW)		**1.17**	**1.17**	**2.32**	**2.32**	**2.32**	**2.32**
Total Firm Generation Capacity (MW)		**1.15**	**1.55**	**1.55**	**1.55**	**1.55**	**1.55**
Total Non-Firm Generation Capacity (MW)		**0.02**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**
Min Required Spinning Reserve (MW)		**0.62**	**0.85**	**0.85**	**0.85**	**0.85**	**0.85**
Total BESS Capacity (MW)		**-**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**
Net Capacity (MW)		**0.52**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**
Peak Demand (MW)		**0.46**	**0.54**	**0.66**	**0.74**	**0.81**	**0.91**
Contingency Capacity (MW)		**0.06**	**0.16**	**0.04**	**-0.04**	**-0.11**	**-0.21**

Notwithstanding the aforementioned, given the technical characteristics of the Wakenaam power system contingency capacities from 2027 and onwards, the 0.4 MW/ 3Hr BESS will provide sufficient capacity reserves to ensure stable operation during the peak hours of the current planning period.

The salient benefits of this planned expansion, which includes the 700 kW Solar PV, and the BESS are:

- Decarbonization of Wakenaam electricity grid.
- Reduction of fossil fuel dependence.
- Provide the required firm power generation capacity to meet the growing electricity demand Wakenaam and to sustain economic growth.

- Improve in electricity supply reliability, stability, and quality of serve.
- In view of the above, improve the livelihood and personal development of residents in Wakenaam.
- Provide firm capacity to improve the reliability of electricity supply.
- Reduce dependency on older LFO generators.
- Improved fuel efficiency.
- Lower production cost.

11.4 Leguan

Leguan has existing firm capacity of 3 x 410 kW (1.23 MW) diesel generators. This installed capacity is sufficient to meet the demand, however, it does not conform to the LOLP planning target of 0.27% for years 2024 and 2025 (Table 42). GPL intends to install another 410 kW LFO generator in 2024 to solve this issue. This generator also gives sufficient buffer for the solar farm and BESS which is expected to be commissioned in Q2 of 2025. GEA is committed to install a 0.6 MW solar farm along with 0.6MW / 0.6 MWH BESS in 2025. Post 2025, the BESS will provide capacity reserves as well as ancillary services to the grid which will reduce the LOLP to nearly zero (Table 56). Due to the elevated levels of system reserves and low LOLP, no additional generation is planned for Leguan within this planning cycle.

Table 56: Generation Reliability with Planned Expansions – Leguan

Fiscal Year	Load (GWh)	Peak Load (MW)	Generation Capacity (MW)	Firm Generation Capacity (MW)	Capacity Reserves (MW)	EENS (MWh)	LOLP (%)	Additional Generation Capacity (MW)
2023	2.24	0.39	1.25	1.23	0.84	0.66	0.02	0.00
2024	3.21	0.53	1.66	1.64	1.11	0.40	0.04	0.41
2025	4.22	0.66	2.86	2.24	1.58	0.39	0.03	0.00
2026	4.84	0.73	2.86	2.24	1.51	0.00	0.00	0.00
2027	5.28	0.78	2.86	2.24	1.46	0.01	0.00	0.00
2028	5.94	0.88	2.86	2.24	1.36	0.02	0.00	0.00

The solar PV system would be designed as a hybrid system with grid forming capabilities. The diesel generators and the solar PV would be operating in parallel and supplemented by the 600-kW nominal output BESS which will provide the required ancillary services. As such, the BESS is expected to add firm capacity and provide reserves (Table 57).

Table 57: Proposed Generation Capacity Addition to Leguan

Leguan	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
Leguan Solar PV	Non-Firm Capacity	-	-	0.60	-	-	-
Leguan BESS	Firm Capacity	-	-	0.60	-	-	-
Leguan Solar-DER	Non-Firm Capacity	0.02	-	-	-	-	-
Leguan LFO Unit (1x0.41 MW)	Firm Capacity	-	0.41	-	-	-	-

Leguan	Type	Installed Capacity (MW)					
		2023	2024	2025	2026	2027	2028
Total Non-Firm Capacity		0.02	-	0.60	-	-	-
Total Firm Capacity		-	-	0.60	-	-	-
Total Accumulated Firm Capacity		-	-	0.60	0.60	0.60	0.60
Existing Firm Capacity		1.23	1.23	1.23	1.23	1.23	1.23
Grand Total Firm Capacity		1.23	1.23	1.83	1.83	1.83	1.83

As it relates to the operation planning targets, the Leguan power system is expected to have sufficient contingency capacity to ensure stable operation annually during the peak demand periods. The Company remains cognizant that while the contingency capacity remains positive from 2025 to 2028, it gradually reduces form 0.41 (year 2025) to 0.22 (year 2028) signalling the need to build additional generation capacity within the next planning cycle (Table 58).

Table 58: Generation Contingency Capacity Forecast with Additions – Leguan

Leguan Generation Capacity		2023	2024	2025	2026	2027	2028
Existing Caterpillar	Firm Capacity	1.23	1.23	1.23	1.23	1.23	1.23
Leguan Solar PV	Non-Firm Capacity	-	-	0.60	0.60	0.60	0.60
Leguan BESS	Firm Capacity	-	-	0.60	0.60	0.60	0.60
Leguan Solar-DER	Non-Firm Capacity	0.02	0.02	0.02	0.02	0.02	0.02
Leguan LFO Unit (1x0.41 MW)	Firm Capacity	-	0.41	0.41	0.41	0.41	0.41
Total Installed Generation (MW)		**1.25**	**1.23**	**2.43**	**2.43**	**2.43**	**2.43**
Total Firm Generation Capacity (MW)		**1.23**	**1.23**	**1.83**	**1.83**	**1.83**	**1.83**
Total Non-Firm Generation Capacity (MW)		**0.02**	**0.02**	**0.62**	**0.62**	**0.62**	**0.62**
Min Required Spinning Reserve (MW)		**0.62**	**0.62**	**0.80**	**0.80**	**0.80**	**0.80**
Total BESS Capacity (MW)		**-**	**-**	**0.60**	**0.60**	**0.60**	**0.60**
Net Capacity (MW)		**0.61**	**0.61**	**1.03**	**1.03**	**1.03**	**1.03**
Peak Demand (MW)		**0.38**	**0.51**	**0.62**	**0.65**	**0.72**	**0.81**
Contingency Capacity (MW)		**0.23**	**0.10**	**0.41**	**0.38**	**0.31**	**0.22**

Further, given the technical characteristics of the Leguan power system, the contingency capacities are considered adequate for stable operation within the peak hours of the current planning period.

The salient benefits of this planned expansion, which includes the 700 kW Solar PV, and the BESS are:

- Decarbonization of Leguan electricity grid.
- Reduction of fossil fuel dependence.
- Provide the required firm power generation capacity to meet the growing electricity demand Leguan and to sustain economic growth.
- Improve in electricity supply reliability, stability, and quality of serve.

- In view of the above, improve the livelihood and personal development of residents in Leguan.
- Provide firm capacity to improve the reliability of electricity supply.
- Reduce dependency on older LFO generators.
- Improved fuel efficiency.
- Lower production cost.

12. Summary of Firm and Intermittent Generation Expansion Projects

The Company remains committed to aligning its generation strategies with the Low Carbon Development Strategy – LCDS 2030, National Energy Priorities, and other Government Energy-driven Initiatives.

By the end of this Programme, the total installed capacity by type in the **DBIS** is as follows:

- Total HFO Capacity by 2028 - 245.1 MW
- Total LFO Capacity by 2028 – 3.4 MW
- Total Solar PV Capacity by 2028 – 32.72 MW
- Total NG Capacity by 2028 – 295.0 MW
- Total BESS Capacity by 2028 – 75.0 MW

The percentage share of each installed capacity by type in the **DBIS** is as follows:

- Natural Gas – 45.3%
- HFO – 37.6%
- Grid Forming BESS – 11.5%
- Solar PV – 5.0%
- LFO – 0.5%

Similarly, for the **Aggregated Isolated Systems**, the total installed capacity by 2028 is as follows:

- Total HFO Capacity by 2028 – 9.6 MW
- Total LFO Capacity by 2028 - 17.1 MW
- Total Solar PV Capacity by 2028 -11.1 MW
- Total BESS - Grid Forming Capacity - 11 MW

The percentage share of each type of installed capacity by 2027 for the **Aggregated Isolated Systems** is as follows:

- Isolated System HFO % Share – 19.7%
- Isolated System LFO % Share – 35.0%
- Isolated System Solar PV % Share – 22.8%
- BESS - Grid Forming Capacity % Share – 22.5%

The annual grid emission factor is calculated utilising referenced values shown in Table 59 and the annual total GWh of electricity based on economic dispatch of the generator units to satisfy the demand forecast.

Table 59: Reference values to determine Grid Emission Factor

Row Labels	Emission factor (tCO2/GWh)	Emission factor (tCO2/MWh)
DFO-DP5	643.670	0.644
HFO-CAN	758.186	0.758
HFO-DP1	768.719	0.769
HFO-DP2	726.231	0.726
HFO-DP3	643.707	0.644
HFO-DP4	643.670	0.644
HFO-EPC	758.186	0.758
HFO-IPP	758.186	0.758
HFO-SKE	661.671	0.662
LFO-CAN	843.616	0.844
LFO-GOE	803.169	0.803
LFO-ONV	828.802	0.829
NG-300MW	497.000	0.497
Solar PV	0.000	0.000
Average	**666.772**	**0.667**

A sharp reduction in emissions is observed in 2025 for the DBIS, which coincides with the commissioning year of the 300 MW GTE Project. See Figure 11 for further details.

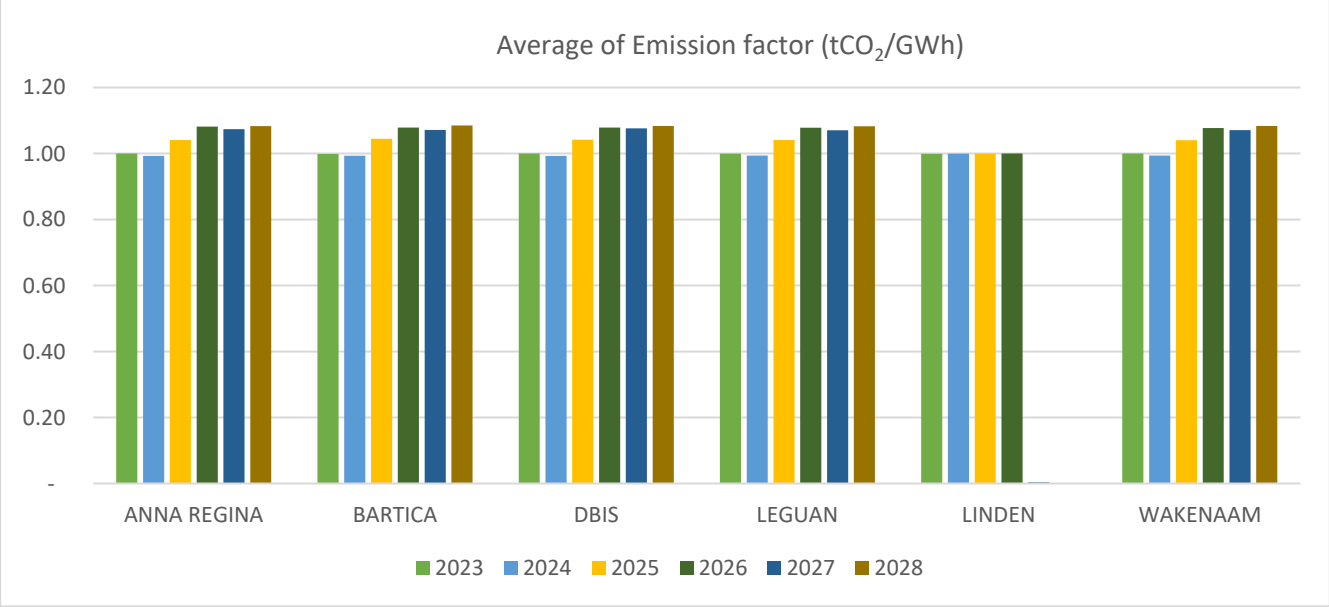

Figure 11: Average Emission factor per power systems

Table 60: GPL 5-Year Generation Capacity Expansion Plan and Energy Mix- DBIS

Planned Commissioning Year	Generation Source	Installed Capacity (Megawatts)	Location	Ownership
2023	RE - Solar	7.7	DBIS Solar-DER	GPL
	HFO	28.9	28.9 MW EPC- Columbia (APAN)	EPC
2024	HFO	50.4	50.4 MW Power Plant	GOG/GPL
	BESS	15.0	DBIS BESS 15 MW/ 30 MWH	GOG/GPL
2025	BESS	15.0	DBIS BESS 15 MW/ 30 MWH	GOG/GPL
	RE - Solar	10.0	GUYSOL - Berbice	IDB/GOG
	NG	183.0	300 MW GTE - Simple Cycle	GOG/GPL
	NG	112.0	300 MW GTE - Combine Cycle	GOG/GPL
	BESS	30.0	300 MW GTE Project BESS	GOG/GPL
2026	NILL	0.0	NILL	NILL
2027	BESS	15.0	GUYSOL Linden BESS	IDB/GOG
	RE - Solar	15.0	GUYSOL Linden Solar PV	IDB/GOG
2028	NILL	0.0	NILL	NILL
Existing Capacity (MW)	HFO- Until 2028	165.8	DBIS	GOG/GPL
	LFO- Until 2028	3.4		GOG/GPL/ IDB
Total Existing Firm Capacity (MW) - Generators		169.2		
Total Additional Firm Capacity by 2028 (MW)		449.3		
Total Additional Non-Firm Capacity by 2028 (MW)		32.7		
Total Additional Capacity by 2028 (MW)		482.0		
Total Firm Capacity by 2028 (MW)		618.5		
Total Non-Firm Capacity by 2028 (MW)		32.7		
Total Capacity by 2028 (MW)		651.2		
Total HFO Capacity by 2028 (MW)		245.1		
Total LFO Capacity by 2028 (MW)		3.4		
Total Solar PV Capacity by 2028 (MW)		32.7		
Total NG Capacity by 2028 (MW)		295.0		

Total BESS Capacity by 2028 (MW)	75.0		
Heavy Fuel Oil % Share	37.6%		
Diesel % Share	0.5%		
Natural Gas % Share	45.3%		
Solar PV % Share	5.0%		
BESS - Grid Firming Capacity % Share	11.5%		

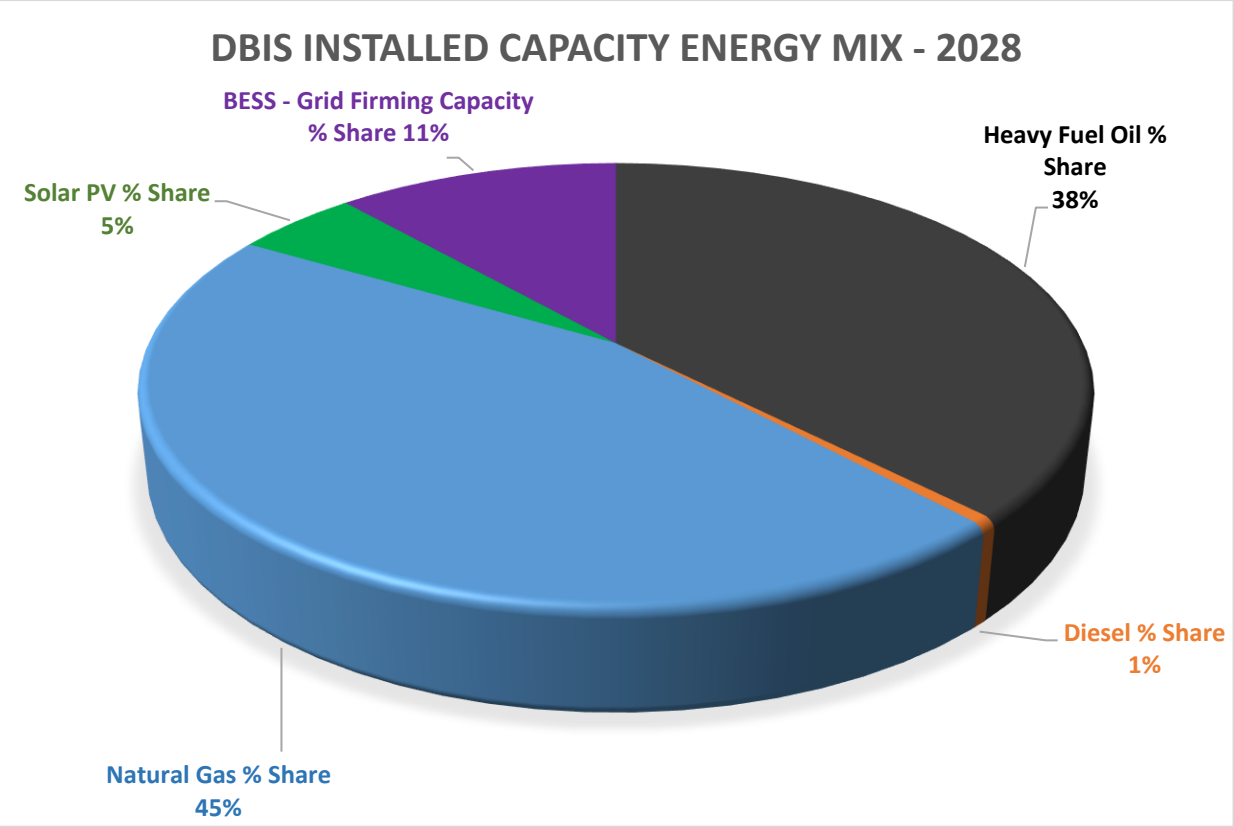

Figure 12: DBIS Installed Capacity Energy Mix – 2028

Table 61: GPL 5 Year Generation Expansion Plan and Energy Mix- Isolated Systems

Planned Commissioning Year	Generation Source	Installed Capacity (Megawatts)	Location	Ownership
2023	RE - Solar	0.29	AR Solar-DER	GOG/ GPL
	RE - Solar	0.16	Bartica Solar-DER	
	RE – Solar + BESS	1.26	Bartica Solar Farm PV+BESS	
	RE - Solar	0.02	Wakenaam Solar -DER	
	RE - Solar	0.02	Leguan Solar-DER	
2024	HFO	3.40	AR HFO Unit (2x1.7 MW)	
	BESS	2.00	Bartica BESS 2 MW/ 2 MWH	
	RE - Solar	0.75	Wakenaam Solar PV	
	BESS	0.40	Wakenaam BESS	
	LFO- Diesel	0.41	Leguan LFO Unit (1x0.41 MW)	
2025	RE - Solar	8.00	AR GUYSOL Solar PV	
	BESS	6.00	AR GUYSOL BESS	
	RE - Solar	0.60	Leguan Solar PV	
	BESS	0.60	Leguan BESS	
2026	LFO- Diesel	1.10	Bartica LFO Unit (1x1.1 MW)	
2027	NILL	0.00	NILL	
2028	HFO	1.70	AR HFO Unit (1x1.7 MW)	
2028	BESS	2.00	Bartica BESS 2 MW/ 2 MWH	
Existing Capacity	HFO- Unitl 2028	4.5	Isolated Systems	
	LFO- Until 2028	15.575	Isolated Systems	
Total Existing Available Capacity		20.08	Isolated Systems	
Total Additional Firm Capacity by 2028 (MW)		17.61		
Total Additional Non-Firm Capacity by 2028 (MW)		11.10		
Total Additional Capacity by 2028 (MW)		28.71		
Total Firm Capacity by 2028 (MW)		37.69		
Total Non-Firm Capacity by 2028 (MW)		11.10		

Total Capacity by 2028 (MW)	48.78		
Total HFO Capacity by 2028 (MW)	9.60		
Total LFO Capacity by 2028 (MW)	17.09		
Total Solar PV Capacity by 2028 (MW)	11.10		
Total BESS - Grid Firming Capacity (MW)	11.00		
Isolated System HFO % Share	19.7%		
Isolated System LFO % Share	35.0%		
Isolated System Solar PV % Share	22.8%		
BESS - Grid Firming Capacity % Share	22.5%		

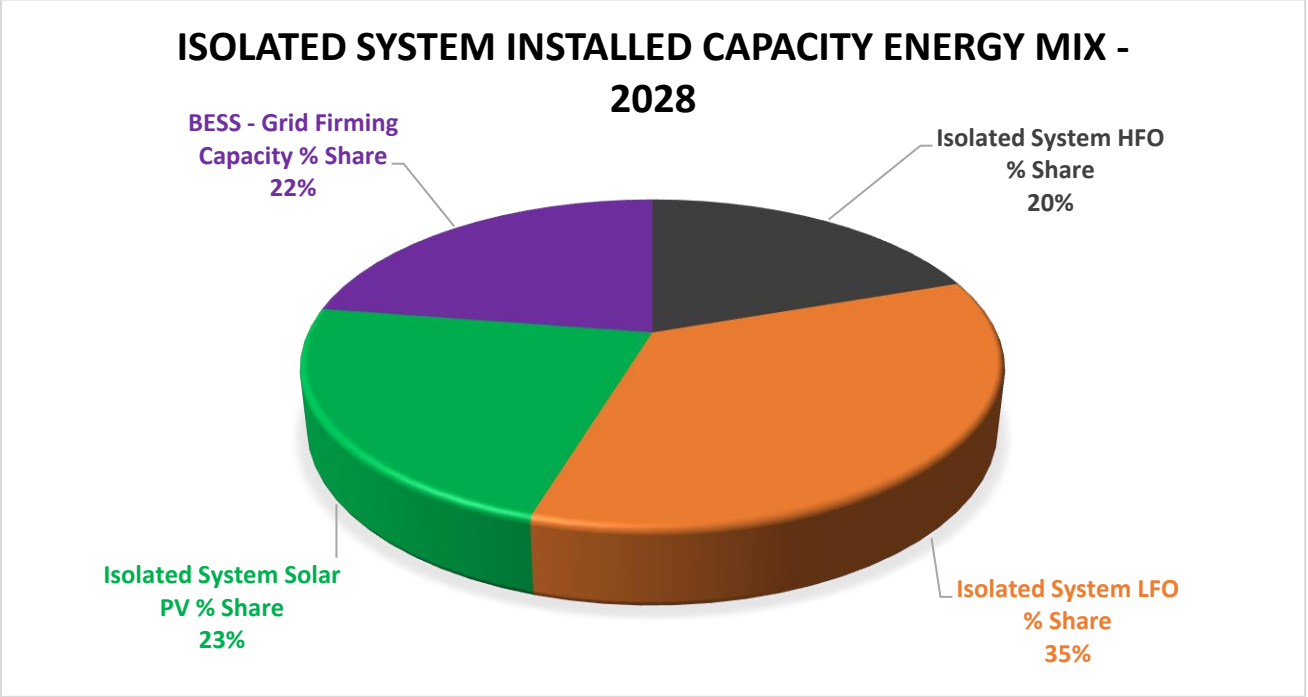

Figure 13: Isolated Power System's Installed Capacity Energy Mix - 2028

13. Integrated Utility Service (IUS) and Net Billing

The Integrated Utility Services (IUS) Model is integral to the goals of the Low Carbon Development Strategy (LCDS) – 2030 and customers currently served by the power grid.

13.1 Net Billing Programme

GPL has developed the Net Billing Programme (NBP) that utilised the Feed-in Tariff (FIT) system. This programme is meant:

1. To increase the contribution of renewable energy in the energy mix.
2. To provide Grid-tie Customers with a framework for renewable energy investments and returns; and
3. To facilitate energy sector investments while ensuring transparency, safety, sustainability, continuity, reliability, and security of electricity supply.

In view of the positive prospects of the NBP, GPL is cognisant of the technical constraints of the present distribution system. The current system is designed and operated in the classical regimen – electricity flows in one direction, i.e., from the substation to customer interconnection points on the feeders. However, to date, the aggregated 304 prosumers have not resulted in the power system experiencing reverse power flow at the substations or any negative impacts on the total installed capacity. See section 3.2.1 on page 39 for further details on the current installed capacity of Distributed Energy Resources (DER).

Notwithstanding the current operating state, the expected growth of DER capacity due to the NBP will increase the aggregated intermittent DER capacity connected to the grid. As the aggregated DER capacity increases, it will reach a point where the total injected power will result in significant reverse power flow that adversely affects the stability of the grid.

In the interim, GPL performs grid interconnection assessment of each candidate system having an installed capacity equal to and greater than 100 kWac. The aim of each assessment is to ensure that the power system is not at risk due to significant reverse power flow. On the operational side, GPL currently monitors power flow, voltage, and power factor of specific feeders during the solar hours.

To address the long-term grid hosting capacity issues, the current Development and Expansion Programme includes projects that will address the technical concerns relative to reverse power flow. The Development and Expansion projects will undoubtedly allow GPL to provide greater value to its customers by supporting their investments in renewable energy systems and their contributions towards Guyana's National Energy Initiatives.

13.2 SolarCity Simulator

The SolarCity simulator, developed by IRENA, is a remarkable web application tool that helps to assess the prospects of electricity generation using rooftop solar PV systems. It calculates solar PV potential, annual energy production, revenue, payback period, and social-

environmental benefits for residential and commercial purposes, combining 3D building footprints with solar irradiation data, making it an efficient and reliable solution for solar power generation. The online tool also supports assessments of different policy instruments and incentive schemes. Figure 14 below summarises the approach and results of SolarCity Simulator.

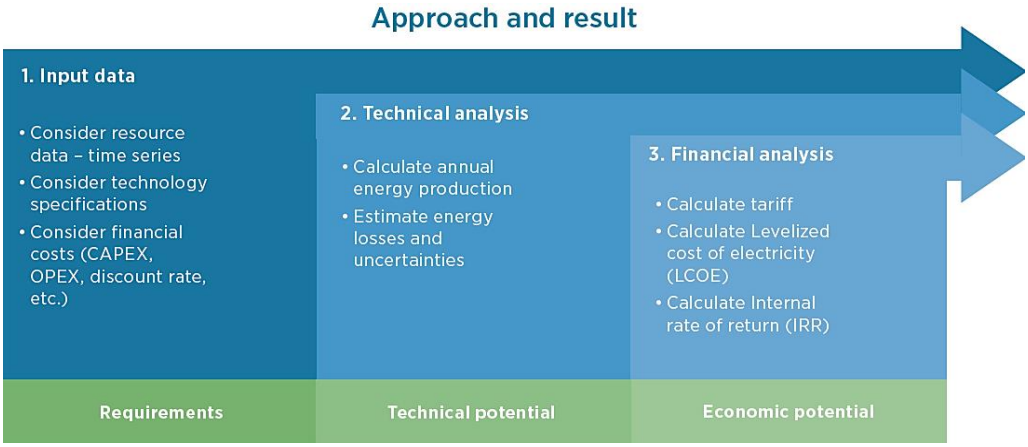

Figure 14: Approach and result of SolarCity Simulator (source: IRENA)

The Government of Guyana has formally engaged IRENA on 16th August 2023 to developing the SolarCity Simulator for Guyana's capital city, Georgetown. The SolarCity Simulator would assist Guyana to achieve Objective 2 of the LCDS 2023 – stimulate future growth through Clean Energy and Sustainable Economic Activities. Additionally, the simulator tool would help to boost GPL's Net Billing Programme.

The project was commenced officially on 31st August 2023. Referencing the project implementation plans, as shown in Figure 15 below, current progress is at step no.2 – building 3D building footprints of Georgetown. The project is expected to be completed and fully implemented on or before the end of Q2 year 2024.

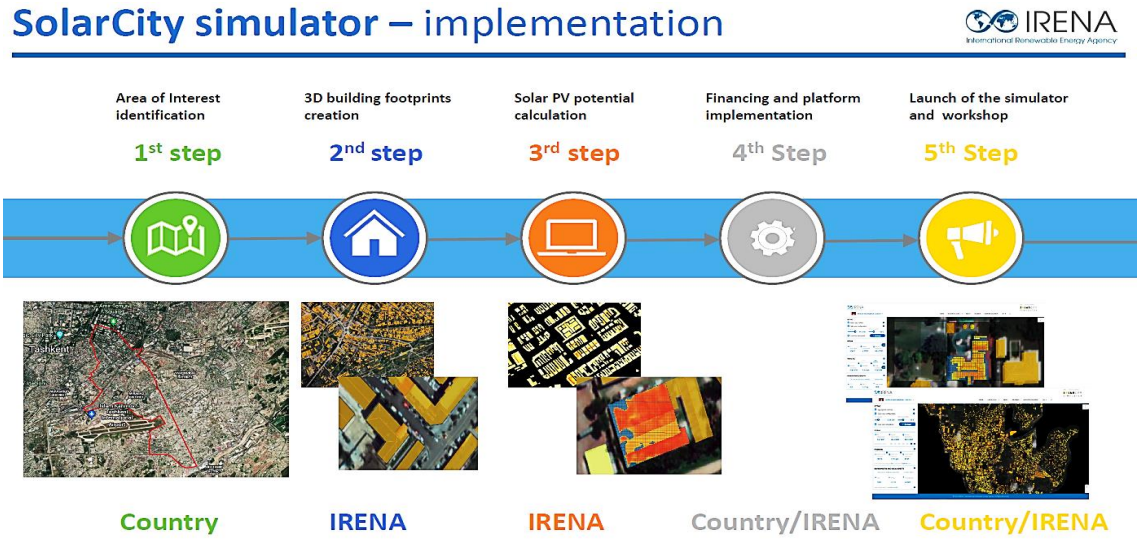

Figure 15:SolarCity Simulator Implementation Plan.

14. Long-term Expansion and International Grid Interconnection

For the long-term generation expansion plan, the Government of Guyana continues working strenuously on the Amaila Falls Hydro Power Project (AFHP). This project is primarily aimed at reducing the overall cost of generation and by extension, the electricity tariff. Additionally, the AFHP Project will add significant inertia to the technical stability of the power grid.

The expansion plans in this Development and Expansion Programme are aligned with the AFHP power evacuation requirements – 230 kV transmission system for large power block transfer across long distances. Additionally, the expansion of the power grid considers the need to improve power system security, resiliency, and reliability.

The 'Arco Norte' Interconnection Project expects to realize the development and commissioning of a significant amount of hydropower generation capacity in Guyana. With such a long-term planned development, the total generation capacity will buttress local generation capacity, and export electricity to Brazil, connecting with the State of Roraima (North-West Brazil) and Amapa (South-East Brazil).

The interconnection with the State of Roraima would be direct with Guyana, while Amapa is planned to be through Suriname and French Guyana (Figure 16).

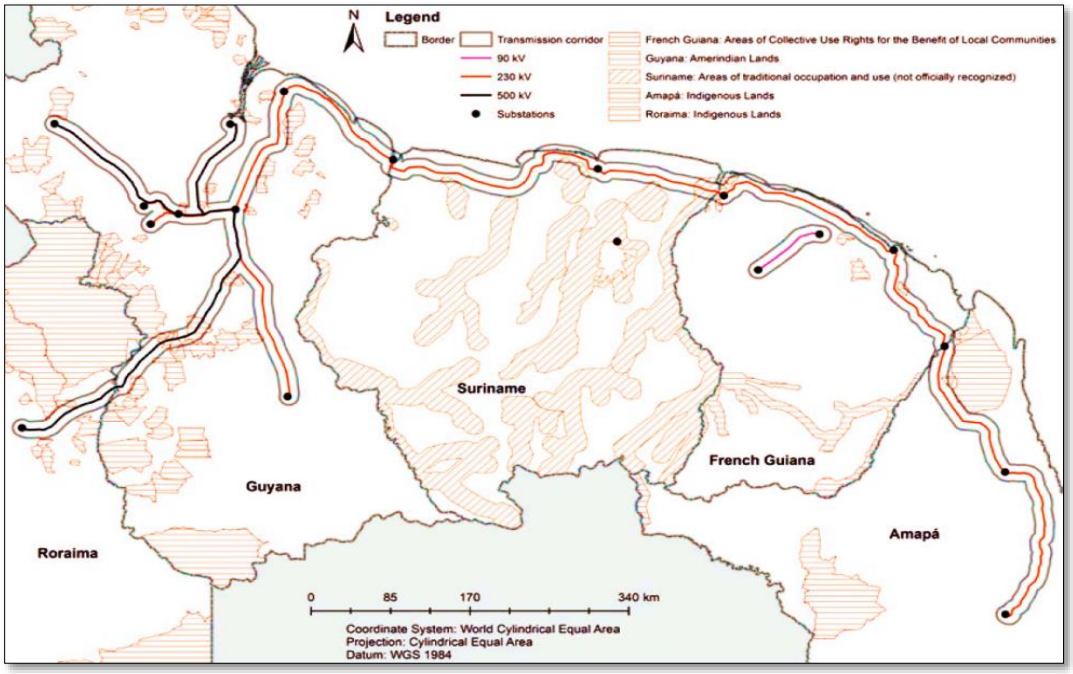

Figure 16:Illustration of the Arco Norte Interconnection Plan (source: Arco Norte Electrical Interconnection Study – Component II)

Some of the main benefits of this interconnection would be:

- Lower-cost generation in Guyana, French Guiana, and Suriname. A regional interconnection would allow these countries to exploit the most efficient generation sources at the regional level and meet regional demand through trade.

- Lower electricity prices for consumers in Guyana, French Guiana, and Suriname due to lower-cost generation and greater competition in the regional market (Figure 17).
- More secure supply in all four Arco Norte countries—Guyana, French Guiana, Suriname, and Brazil. Trading across international borders would allow each country a larger reserve margin since they would have access to international electricity when domestic sources were inadequate.
- The opportunity to develop renewable energy sources in the region - gradually displacing liquid fossil fuels; and
- Export earnings, especially for Guyana. The most efficient large generation sites in the Arco Norte are potential hydro projects in Guyana. By developing these sites and exporting excess generation to Brazil, Guyana—and to a lesser extent French Guiana and Suriname—could become large energy exporters.

Currently, the 'Arco Norte' Interconnection Project is still at the feasibility stage and is currently awaiting the renewal of the MOU that binds the member states of this project.

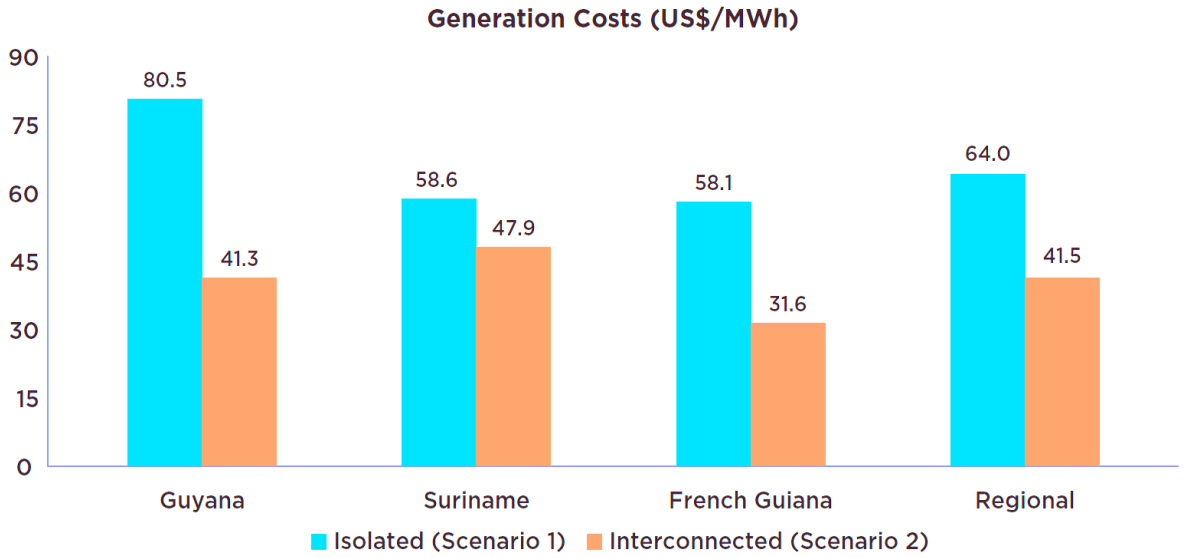

Figure 17: Average generation cost in the interconnected and isolated scenarios (source: Arco Norte Electrical Interconnection Study – Component II, dated 2017)

15. Transmission, Distribution and Substation Upgrades and Expansions

15.1 Short to Medium Term (2024-2028) – Transmission and Substation Expansions and Upgrades (see Figure 18 for block diagram summary)

GPLs Transmission and Distribution expansion programme, which includes the details shown in Table 65, totals GY$186.5B (US$866.7 M) to upgrade and construct new Transmission and Distribution networks, Substations and Transmission system reinforcements (reactive power compensations) projects for the short- to medium-term planning horizon, 2024 to 2028.

The planned Transmission and Distribution expansion programme essentially seeks to accommodate the present and forecasted peak demand growth concomitant with efforts to reduce technical losses, improving grid security, flexibility, reliability, and resiliency. See Table 62 to Table 64*,* and Figure 18 for further details.

The construction and upgrade of distribution substations (load centres) would allow new distribution feeders and customer service transformers to be deployed in all geographic areas to serve the present and forecasted loads efficiently, and by extension support planned economic activities.

The expansion and construction of substations are required to deploy 230 kV and 69 kV transmission lines to connect substations, introduce parallel transmission lines to mitigate N-1 contingency and to reduce technical losses (the replacement of lengthy distribution feeders, and the upgrading of feeder backbones).

Regarding unserved areas, GPL is cognisant there are presently 589 beneficiaries. The unserved areas are stretched across regions number 2, 3, 4, 5, 6 and 7. The total estimated cost to service the total number of beneficiaries is approximately GY$213.98 million (US$0.994 million).

Table 62: Short-term Transmission and Substation New, Expansions and Upgrades

Activity	**Short Term Transmission and Substation Projects**	
	2024	**2025**
Transmission	L5 & L5-P (Sophia Upgraded to Kingston), L 8 (Edinburgh to Hydronie), L11-1 (Kingston New to Princess Street), L11-2 (Princess Street to New Georgetown), L30a, & L30aP1 & L30aP2 (Wales NG Power Plant to Wales Industrial), L30b & L30bP	L1 & L3 (Garden of Eden to Golden Grove), LS6 and L6 P (Kingston to Vreed-en-Hoop), L17P (Good Hope to Enmore/Victoria), L18P (Enmore/Victoria to Columbia), L22-1 (Canefield to Williamsburg Line Splitting and Upgrade) and L22-2 (Williamsburg to

Activity	Short Term Transmission and Substation Projects	
	2024	**2025**
	(Wales Industrial to Wales Residential/Commercial), L31 (Vreed-en-Hoop to Wales Residential/Commercial), L31-P (Vreed-en-Hoop to Wales Residential/Commercial), L12 & L13 (Sophia Upgraded to New Sophia), L21 (Onverwagt to Canefield), L2-1 & L4-1 (Golden Grove to Goedverwagting Line Splitting) and L2-2 & L4-2 (Goedverwagting to Sophia Upgraded & New Sophia Line Splitting). HV_L1 & HV_L1P (Wales NG Power Plant to Goedverwagting) - 230 kV.	No. 53 Village Line Splitting and Upgrade), L23 (No.53 to Skeldon New Line), L25 & L25P (Goedverwagting to Ogle), L26 (Ogle to Enmore/Victoria), L35 & L35P (GOE to Kuru Kururu), L17 (Good Hope to Enmore/Victoria Line Splitting), L18 (Enmore/Victoria to Columbia Line Splitting), L16-1 & L16-1P (New Sophia to Ogle Line Splitting), L16-2 & L16-2P (Ogle to Good Hope Line Splitting).
Substation	Princess Street 69/13.8 kV Substation, Hydronie 69 - 13.8 kV Substation, Goedverwagting 120 MVA 69/13.8 kV Substation, Wales Residential/Commercial 105 MVA 69/13.8 kV Substation and Wales Industrial 120 MVA (2x60MVA) 69/13.8 kV Substation, 2 x 35 MVA Mobile Substation. Edinburgh 69/13.8 kV Substation, New G/town 69/13.8 kV Substation, Golden Grove 69/13.8 kV Substation, Good Hope 69/13.8 kV Substation, Canefield 69/13.8 kV Substation, Vreed-en-Hoop 69/13.8 kV Substation, No. 53 69/13.8 kV Substation and Kingston 69/13.8 kV Substation.	Ogle 69/13.8 kV Substation, Enmore/Victoria 69/13.8 kV Substation, Williamsburg 69/13.8 kV Substation, Kuru Kururu 70 MVA 69kV/13.8kV Substation, 2 x 35 MVA Mobile Substation. New Sophia 69 kV Switching Substation, Edinburgh 69/13.8 kV Substation, GOE 69/13.8 kV Substation, Good Hope 69/13.8 kV Substation, Columbia 69/13.8 kV Substation, Onverwagt 69/13.8 kV Substation, Canefield 69/13.8 kV Substation, No. 53 69/13.8 kV Substation and Old Sophia 69/13.8 kV Substation.

Table 63: Medium Term Transmission and Substation New, Expansions and Upgrades

Activity	Mid Term T&D and Substation Expansion Projects		
	2026	2027	2028
Transmission	L22-1a (Canefield to Crab Island Line Splitting), L22-1aP (Canefield to Crab Island Line Splitting), L22-1b (Crab Island to Williamsburg Line Splitting) and L22-1bP (Crab Island to Williamsburg Line Splitting), L22-2-P (Williamsburg to No. 53 Village), L42 (Onderneeming to Anna Regina), L36 (Yarrowkabra to Kuru Kururu).	L10 (Old Sophia to New Georgetown), L20P (Columbia to Onverwagt), L23P (No. 53 Village to Skeldon), L33 (Wales Residential/Commercial to Hydronie), , L22-2a (Williamsburgh to Bushlot Line Splitting), L22-2a-P(Williamsburgh to Bushlot Line Splitting), L22-2b (Bushlot to No. 53 Village Line Splitting), L22-2b-P (Bushlot to No. 53 Village Line Splitting), L37-1 & L37-1-P (Goedverwagting to Bamia) and L37-2 (Bamia to Mckenzie).	L21-OHL 1a (Onverwagt to Canefield), L21-1P (Onverwagt to Rossignol), L21-2P (Rossignol to Canefield), L27 (LBI to Goedverwagting), L8-1 (Edinurgh to Tuschen Line Splitting), L8-2 (Tuschen to Parika/Hydronie Line Splitting), L26-1 (Ogle to LBI Line Splitting), L26-2 (LBI to Enmore/Victoria Line Splitting), L31-1 (Wales R/C to Westminister Line Splitting), L31P-1 (Wales R/C to Westminister Line Splitting), L31-2 (Vreed-en-Hoop to Westminister Line Splitting), L31P-2 (Vreed-en-Hoop to Westminister Line Splitting), L33-1 (Wales R/C to Westminsiter Line Splitting), L33-2 (Westminister to Tuschen Line Splitting), L33-3
		HV_L5 & HV_L5P (Goedverwagting to Crab Island 230 kV Line), HV_L6 & HV_L6P (Crab Island to Williamsburg 230 kV Line).	
Substation	Crab Island 69/13.8 kV Substation and Yarrowkabra 69/13.8 kV Substation, Onderneeming 69/13.8 kV Substation and Anna Regina 69/13.8 kV Substation, 1 x 35 MVA Mobile Substation.	Bushlot EBC 69/13.8 kV Substation, Bamia 69/13.8 kV Substation and McKenzie 69/13.8 kV Substation.	Westminister 69/13.8 kV Substation, LBI 69/13.8 kV Substation, Rossignol 69/13.8 kV Substation and Tuschen 69/13.8 kV Substation.
		Columbia 69/13.8 kV Substation, Onverwagt 69/13.8 kV Substation, Skeldon 69/13.8 kV Substation.	
	Canefield 69/13.8 kV Substation.	Williamsburg 230/69 kV Substation and Crab Island 230/69 kV Substation	Onverwagt 69/13.8 kV Substation.

Given the high priority placed on improving reliability, flexibility, resiliency and reducing technical losses of the transmission and distribution network, the Company has comprehensively examined and inspected the networks to update its inventory of corrective actions and improvement initiatives.

The Company expects to finance these critical projects via concessional financing. See Table 64 for further details.

Table 64: Projects Financed through Grants and Loans: Short to Medium Term: 2024-2028

Activity	Location	Impact
Upgrade Transmission Lines	L5 & L5P (Kingston to Old Sophia), L1 & L3 (Garden of Eden to Golden Grove).	Improved reliability in the transmission and distribution network by expanding the infrastructure to meet and exceed the needs of the customers.
Improve Reactive Compensation	Installation of 15 MVAr at New Sophia, installation of 15 MVAr at Columbia Substation, installation of 15 MVAr at #53 Substation and installation of 10 MVAr at Edinburgh.	The commissioning of reactive power compensators with auxiliaries, control and protection will significantly improve and stabilize transmission and distribution voltage levels on the network.

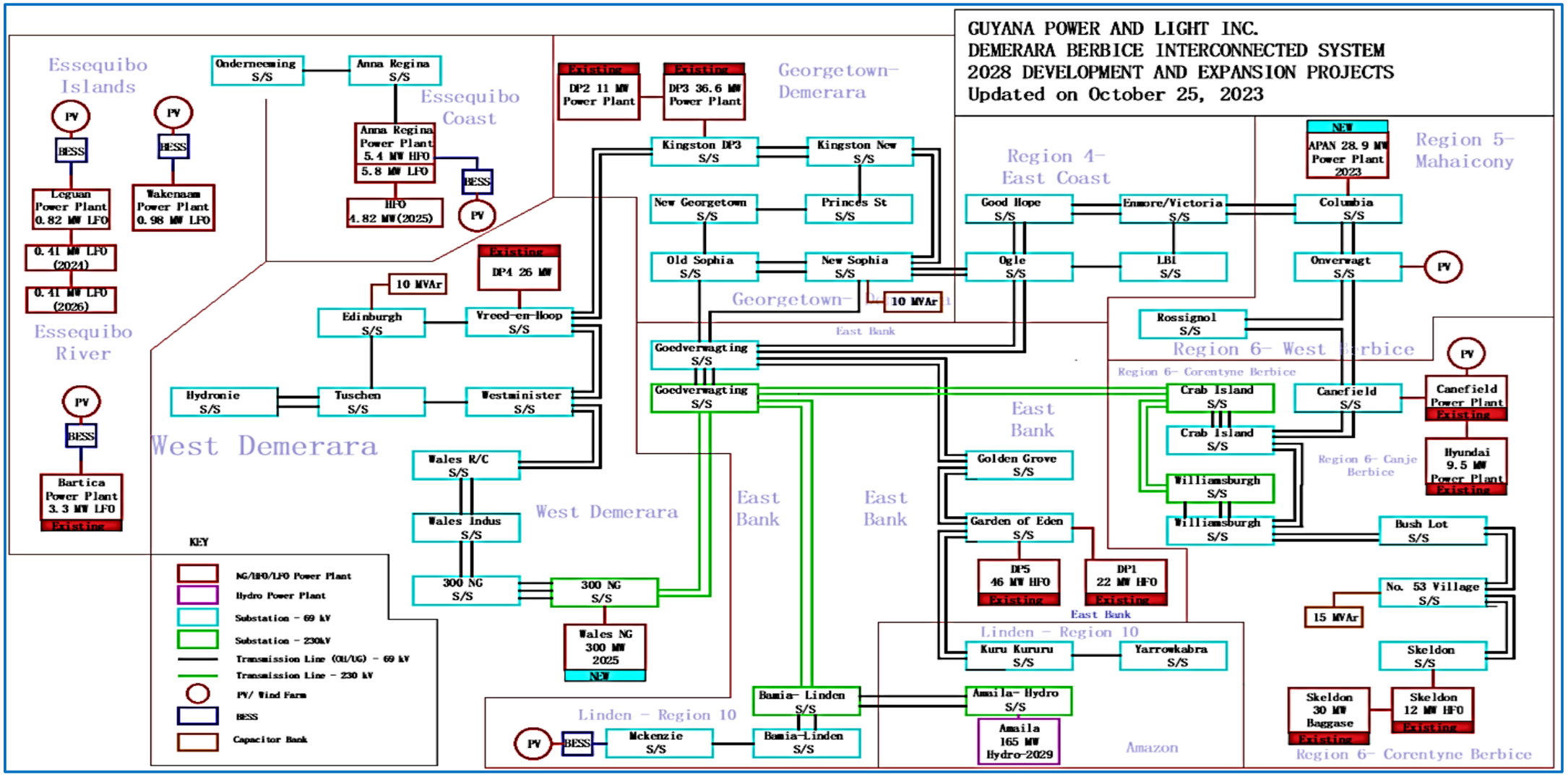

Figure 18: Block Diagram of Power System Development for the current D&E (2024-2030)

15.1 Short to Medium Term (2024-2028) – Distribution Expansions and Upgrades

The increase in demand for electricity stems from the consumers at the distribution level, and GPL must ensure that the primary distribution feeders are in the right condition to satisfy the needs of customers efficiently. Additionally, to improve the voltage profile along the length of the feeder, reduce technical losses and improve system reliability indices (SAIFI and SAIDI), resiliency, and capacity to manage increased power flow and deliver quality electricity supply service to customers.

Within the current Development and Expansion programme, the following are planned works at the primary distribution level:

Short-term (2024-2025):

- The construction of following 13.8 kV feeder:
  - Four (4) Feeders coming out of Columbia Substation.
  - Three (3) Feeders coming out of Good Hope Substation.
  - Three (3) Feeders coming out of No. 53 Substation.
  - One (1) Feeder coming out of Vreed-en-Hoop Substation.
  - One (1) Feeder coming out of DP3 Power Plant.
  - Two (2) Feeders coming out of GOE Substation.
  - Five (5) Feeders coming out of Canfield Substation.
  - One (1) Feeder coming out of Edinburgh Substation.
  - One (1) Feeder coming out of Old Sophia Substation.
  - Four (4) Feeders coming out of Parika/Hydronie Substation.
  - Six (6) Feeders coming out of Princes St Substation.
  - Six (6) Feeders coming out of Kingston New Substation.
  - Eight (8) Feeders coming out of Goedverwagting Substation.
  - Six (6) Feeders coming out of Wales R/C Substation.
  - Six (6) Feeders coming out of Wales Industrial Substation.
  - Four (4) Feeders coming out of Victoria/Enmore Substation.
  - Three (3) Feeders coming out of Kuru Kururu Substation.
  - Eight (8) Feeders coming out of Ogle Substation.
  - Four (4) Feeders coming out of Williamsburgh Substation.
- The upgrade (reconductor with Cosmos and use of Concrete Poles) of the following 13.8 kV feeders:
  - Golden Grove F1 – 89.1 km of network to be upgraded.
  - Golden Grove F3 – 14.8 km of network to be upgraded.
  - New Georgetown F1 – 17.25 km of network to be upgraded.

- Good Hope – 29.6 km of network to be upgraded.
- Edinburgh F2 – 94 km of network to be upgraded.
- Canefield F1 – 1.4 km of network to be upgraded.
- Canefield F4 – 1.4 km of network to be upgraded.
- Canefield F3 – 27.9 km of network to be upgraded.
- Garden of Eden F1 – 94.29 km of network to be upgraded.
- Anna Regina - South Feeder - Express to Onderneeming – 10 km of network to be upgraded.
- Anna Regina South Feeder – 8 km of network to be upgraded.
- Anna Regina West Feeder – 17 km of network to be upgraded.
- Garden of Eden F2 – 16.4 km of network to be upgraded.
- Garden of Eden F3 – 19.1 km of network to be upgraded.
- No. 53 – both feeders – 47.7 km of network to be upgraded.

- Installation of Fifteen (15) Distribution Capacitor Banks.
- Power Plant Switchgear Upgrades:
  - Wakenaam Power Plant.
  - Upgrade tie-lines between DP2 -DP3.
  - Upgrade 13.8 kV Switchgear at DP2.
  - Upgrade Grounding Transformer at DP3.
  - Upgrade Grounding Transformer at DP4.
  - Generator Neutral Earthing Resistors at DP4.
  - Upgrade 13.8 kV Switchgear at DP3.
  - Leguan Power Plant Switchgear Upgrade.
- Installation of eighty (80) Auto-Reclosers.
- JICA Grant: Grant covers expenses for line conductors and automatic power factor correction capacitor only. GPL to finance the balance of line hardware materials, labour, and transportation costs for these projects. The outstanding works are as follows:
  - Golden Grove F1/F2 -- System Improvement - Express Feeder – 50% remaining.
  - Onverwagt F2 -- System Improvement -No. 7 to Ithica W.C.B Express Feeder – 60% remaining.
- Leguan Feeder Voltage Upgrade – from 4.16 kV to 13.8 kV.
- Installation of one hundred and sixty (160) Sectionalisers.
- Installation of one hundred and twenty (12) Smart FCIs.

Medium-term (2026-2028):

- Construction of the following 13.8 kV feeders:
  - Two (2) Feeders coming out of Parika/Hydronie Substation.
  - Two (2) Feeders coming out of Princes St Substation.
  - Two (2) Feeders coming out of Kingston New Substation.
  - Six (6) Feeders coming out of Wales R/C Substation.
  - Two (2) Feeders coming out of Wales Industrial Substation.

- One (1) Feeder coming out of Victoria/Enmore Substation.
- Three (3) Feeders coming out of Kuru Kururu Substation.
- One (1) Feeder coming out of Ogle Substation.
- One (1) Feeder coming out of Williamsburgh Substation.
- Two (2) Feeders coming out of Anna Regina Substation.
- Four (4) Feeders coming out of Onderneeming Substation.
- Four (4) Feeders coming out of Bamia Substation.
- Four (4) Feeders coming out of Bushlot Substation.
- Four (4) Feeders coming out of LBI Substation.
- Six (6) Feeders coming out of Westminister Substation.
- Four (4) Feeders coming out of Tuschen Substation.
- Two (2) Feeders coming out of Edinburgh Substation.
- Four (4) Feeders coming out of Old Sophia Substation.
- Six (6) Feeders coming out of Mckenzie Substation.
- Four (4) Feeders coming out of Rossignol Substation.
- Seven (7) Feeders coming out of Crab Island Substation.
- Five (5) Feeders coming out of Yarrowkabra Substation.

- Installation of one hundred and twenty (120) Auto Reclosers.
- Installation of two hundred and forty (240) Sectionaliser.
- Installation of one hundred and eighty (180) Smart FCIs.
- Installation of thirty-five (35) Distribution Capacitor Banks

These additional critical network projects are expected to deliver a significant improvement in quality of service, feeder reliability, and strengthen the grid for the incremental penetration of electricity from renewable resources and reduce technical losses. The cost of the proposed expansion and improvement of the T&D Systems is shown in Table 65.

Table 65: Planned T&D Expansion and Upgrade Capital Investment

T&D Summary	2024	2025	2026	2027	2028	Total
	US$,000	US$,000	US$,000	US$,000	US$,000	US$,000
Transmission Lines	65,354.7	71,656.2	124,851.9	96,008.5	11,332.6	369,203.9
Transmission Reinforcements	6,854.3	5,701.1	660.0	297.0	-	13,512.4
New Substations	106,969.2	67,907.4	54,762.4	56,087.7	21,746.9	307,473.6
Substation Upgrade & Expansion	42,552.1	30,107.9	339.7	616.9	-	73,616.7
New Distribution Lines	18,210.2	8,817.9	7,556.4	9,346.7	5,006.2	48,937.4
Distribution Line Upgrades & Reinforcements	22,855.4	2,626.3	1,236.5	1,223.8	1,148.6	29,090.6
Electrification	4,155.1	4,313.2	4,374.1	5,551.6	6,427.4	24,821.3
Total	266,951.0	191,130.0	193,781.0	169,132.1	45,661.7	**866,655.9**

15.2 Long Term (2029-2040)

The Low Carbon Development Strategy (LCDS) 2030 highlights Government's plan to expand the use of existing hydro potential sites. LCDS 2030 communicates that the Government of Guyana plans to construct three hydropower facilities, each having approximately 200 MW. The planned timelines of each of the above-mentioned hydropower facilities are 2030, 2035 and 2040.

For production cost and power system modelling purposes, hydro potential sites that are within the vicinity of the Amaila Falls Hydropower Project line right of way were selected as candidate hydropower facilities. The candidate hydro potential sites are Turtuba (2035) and Arisaru (2040).

Given the forecasted electricity and peak demands, the Company's long-term plan focuses on transmission, sub-transmission, and substation expansions. These long-term planned projects will primarily cater for power evacuation and delivery of power to planned substations. See Table 66 for further details.

Table 66: Long term expansion plans

Activity	Quantity	Location
Additional 230 kV Transmission Lines Construction	6	HV_L2 & HV_L2-P (Bamia to Yarrokabra), HV_L3 & HV_L3-P (Yarrokabra to Goedverwagting), HV_L4 & HV_L4-P (AMAILA HYDRO to Bamia-Linden), HV_L7 & HV_L7-P (Turtuba to EBE), HV_L8 & HV_L8-P (Arisaru to Turtuba) and HV_L9 & HV_L9-P (EBE to Wales NG Power Plant).
Additional 69 kV Transmission Lines Construction	19	L26-2a-P (Lusignan to LBI), L38 (Mckenzie to Wisma), L39 (Hydronie to Leguan), L40 (Leguan to Wakenaam), L41 (Wakenaam to Onderneeming), L 43 (Bartica Substation to Del Conte), L44 (Del Conte to Beribissiballi), L45 (Beribissiballi to EBE), L46 (EBE to Hydronie), L47 (Turtuba to Bartica), L49 (Kuru Kururu to Silica City Sub), L50 (Silica City Sub to Yarrokabra), L51 (Anna Regina to Marias Delight), L20-1 (Columbia to Burma Line Splitting), L20-P-1 (Columbia to Burma Line Splitting), L20-2 (Burma to Onverwagt Line Splitting), L20-P-2 (Burma to Onverwagt Line Splitting), L26-2a (LBI to Lusignan Line Splitting) and L26-2b (Lusignan to Enmore/Victoria Line Splitting).

Activity	Quantity	Location
Additional Substations	18	Silica City, Lusignan, Burma, Wismar, Leguan, Wakenaam, Mariahs Delight, Beribissiballi, Del Conte, Bartica, East Bank Essequibo 69/13.8 kV. Bamia-Linden 230/69 kV, New Yarrowkabra 230/69 kV, Amaila Falls Hydro Project-230 kV, Turtuba Hydro Electric-230 kV, Arisaru Hydro Electric-230 kV and East Bank Essequibo 230/69 kV.

16. Guyana National Control Centre/Smart Grid

The following is the summarised list of GNCC/Smart Grid related projects for the short to medium term of this Development and Expansion Programme:

Short-term: Guyana Transmission and Generation Control Centre (GTGCC) - to efficiently manage and dispatch power from the 300 Megawatt Gas-fired Power Plant to load-centres served by the Demerara Berbice Interconnected System (DBIS).

1. Construction of Guyana National Control Centre at Goedverwagting.
2. Installation of new SCADA/EMS/GMS/DTS and RTUs (Phase No.1)
3. Integration of 300 MW Gas-to-Energy Power Plant with GNCC
4. DP5 SCADA Integration with GNCC.
5. Garden of Eden 69kV and 13.8 kV substation
6. No. 53 69/13.8 kV substation.
7. Old Sophia 13.8 kV substation

Medium-term:

1. Installation of equipment to complete Phase No. 2 of GNCC Project - Guyana Distribution Control Centre (GDCC). The completion of this phase will realize the full implementation of SCADA in the DBIS and Isolated Power Systems – at the Distribution levels, Automated Metering Infrastructure (AMI) and T and D Network Supervision and Automation
2. HFO-fired, Wartsila Power Plant Integration with GNCC:
    i. DP4 SCADA Integration.
    ii. DP1 SCADA Integration.
    iii. DP2 SCADA Integration.
    iv. DP3 SCADA Integration.

v. SEI Power Plant SCADA Integration.
vi. Onverwagt Power Plant
vii. Garden of Eden Power Plant
viii. Canefield Power Plants
ix. Canefield 13.8 kV substation
x. SEI 69/13.8 kV substation.

17. Network Maintenance Plan – 2024-2028

The 2024 -2028 network maintenance plan seeks to ensure that all sections of sub-transmission lines and distribution feeders are in optimal operating conditions to support GPL to achieve its planned reliability and power quality targets.

The outsourcing of a portion of this section of the programme's components and investments in GPL's maintenance capacity and capability are expected to deliver reduced outages resulting from distribution feeder and transmission line trips. See Table 67 for further details.

Table 67: 2023 -2027 Network Maintenance Plan

DATE:	2024 – 2028		2024			2025			2026			2027			2028		
TARGET INDICATORS			T & D	Contractor	Total	T & D	Contractor	Total	T & D	Contractor	Total	T & D	Contractor	Total	T & D	Contractor	Total
POLE REPLACEMENT	1	PRIM.	2158	834	2992	2800	3220	6020	3000	2100	5100	3900	3120	7020	5070	2964	8034
		SEC.	2661	1497	4158	3800	5040	8840	4800	3360	8160	5800	4640	104 40	7540	4408	119 48
POLE PLUMBING	2	PRIM.	1066	209	1275	1400	1680	3080	1400	980	2380	1900	1520	3420	2470	1444	3914
		SEC.	1051	217	1268	1550	2030	3580	1550	1085	2635	1850	1480	3330	2405	1406	3811
POLE TREATMENT	3	PRIM.	8008	4614	12622	120 00	14000	260 00	120 00	8400	204 00	140 00	11200	252 00	182 00	10640	288 40
		SEC.	11550	6735	18285	140 00	18200	322 00	140 00	9800	238 00	160 00	12800	288 00	208 00	12160	329 60
OLD POLE REMOVAL	4	PRIM.	1989	462	2451	1506	2109	3615	1506	1054	2560	1506	1205	2711	1958	1145	3103
		SEC.	2175	706	2881	3416	4782	8198	3416	2391	5807	3416	2733	6148	4440	2596	7036

DATE:	2024 – 2028		2024			2025			2026			2027			2028		
POLE STUBBING	**5**	PRIM.	527	102	629	428	599	1027	428	299	727	428	342	770	556	325	881
		SEC.	380	39	419	400	560	960	400	280	680	400	320	720	520	304	824
ANCHOR BLOCK REPLACEMENT.	**6**	PRIM.	353	38	391	300	420	720	300	210	510	300	240	540	390	228	618
		SEC.	449	98	547	250	350	600	250	175	425	250	200	450	325	190	515
GUY REPLACEMENT	**7**	PRIM.	475	101	576	420	588	1008	420	294	714	420	336	756	546	319	865
		SEC.	318	58	376	350	490	840	350	245	595	350	280	630	455	266	721
REPLACEMENT DEFECTIVE CROSS ARMS	**8**	PRIM.	2363	327	2690	1500	2520	4020	1500	1050	2550	1500	1200	2700	1950	1140	3090
INSULATOR REPLACEMENT	**9**	PRIM.	3096	491	3587	9433	10406	19839	9433	6603	16036	9433	7546	169 79	12263	7169	19432
		SEC.	2214	186	2400	3650	5110	8759	3650	2555	6205	3650	2920	6570	4745	2774	7518
LINE/HARDWARE TRANSFER	**10**	PRIM.	2254	862	3116	5585	7819	13404	5585	3909	9494	5585	4468	100 53	7260	4245	11505
		SEC.	3021	1286	4307	4257	5960	10218	4257	2980	7238	4257	3406	7663	5535	3236	8770
LINE EXTENSION (KM)	**11**	PRIM.	30.16	31	61	18	25	42	18	12	30	18	14	32	23	13	36
		SEC.	24.3	34	58	52	72	124	52	36	88	52	41	93	67	39	106

DATE:	2024 – 2028		2024			2025			2026			2027			2028		
LINE UPGRADEMENT (KM)	12	PRIM.	115.1	111	226	95	133	228	95	67	162	95	76	171	124	72	196
		SEC.	45.99	161	206	77	108	186	77	54	131	77	62	139	101	59	159
LINE RETENSION (KM)	13	PRIM.	116.13	75	191	520	728	1248	520	364	884	520	416	936	676	395	1071
		SEC.	86.89	97	184	1200	1680	2880	1200	840	2040	1200	960	2160	1560	912	2472
SERVICE LINE REPLACEMENT (MTS)	14		10863.8	735	11599	12500	17500	30000	8500	5950	14450	6000	4800	10800	6500	3800	10300
INSTALLATION/REPLACEMENT (GAB/RECLOSER/SECTIONALISER)	15	PRIM.	76	5	81	70	60	130	50	30	80	25	20	45	58	34	91
INSTALLATION/REPLACEMENT (SPD)	16	PRIM.	221	15	236	150	168	318	80	56	136	50	40	90	65	38	103
INSTALLATION/REPLACEMENT (RCO)	17	PRIM.	737	199	936	792	1108	1900	792	554	1346	792	633	1425	1029	602	1631
INSTALLATION/REPLACEMENT (PMCO)	18		496	53	549	150	336	486	150	105	255	150	120	270	130	76	206
TRANSFORMER MAINTENANCE	19	SEC.	1540	108	1648	1170	1639	2809	1170	819	1990	1170	936	2107	1522	890	2411
INSTALLATION OF ADDITIONAL TRANSFORMERS (REPLACEMENT)	20	SEC.	400	136	536	110	210	320	100	70	170	80	64	144	104	61	165
MAINTENANCE OF CAPACITOR/VOLTAGE REGULATORS BANKS	21		21	10	31	26	48	74	26	18	44	26	21	46	33	19	53

DATE:	2024 – 2028		2024			2025			2026			2027			2028		
JUMPER SERVICING/REPLACEMENT	22	PRIM.	4577	191	4768	1249	1748	2997	1249	874	2123	1249	999	2248	1623	949	2572
		SEC.	4911	142	5053	2589	3625	6215	2589	1813	4402	2589	2072	4661	3366	1968	5334
SERVICE CONNECTION @ CONSUMER	23		19687	1322	21009	120 00	16800	288 00	120 00	8400	204 00	120 00	9600	216 00	156 00	9120	247 20
INSTALLATION OF ADDITIONAL EARTHS	24		920	226	1146	725	1016	1741	725	508	1233	725	580	1306	943	551	1494
ROUTE CLEARING (KM)	25	PRIM.	375.03	708	1083	420	850	1270	320	920	1240	280	900	1180	280	900	1180
		SEC.	246.71	805	1052	15	250	265	12	320	332	12	260	272	10	200	210
LINE INSPECTION (KM)	26	PRIM.	2185.295	639	2824	2700	3500	6200	3000	2100	5100	3300	2640	5940	4680	2736	7416
		SEC.	2469.79	525	2994	6200	8400	146 00	6500	4550	110 50	6800	5440	122 40	9100	5320	144 20

18. Loss Reduction

In keeping with the Electricity Sector Reform Act (ESRA), the progressive and sustained reduction in system losses remains a corporate priority as it is the bedrock to the Company financial sustainability.

18.1 Critical Issues

The current level of total losses, especially non-technical/commercial losses, are above sustainable levels:

I. Losses from electricity theft by customers and unregistered “users”.
II. Losses from customers with faulty meters.
III. Losses from billing system (meter reading errors, under estimations); and
IV. Losses from substandard network design and maintenance.

18.2 Loss Reduction Projections

The projected total 5-year system losses are targeted to be 9.96% by year 2028 - a 13.47% total reduction. See Figure 19.

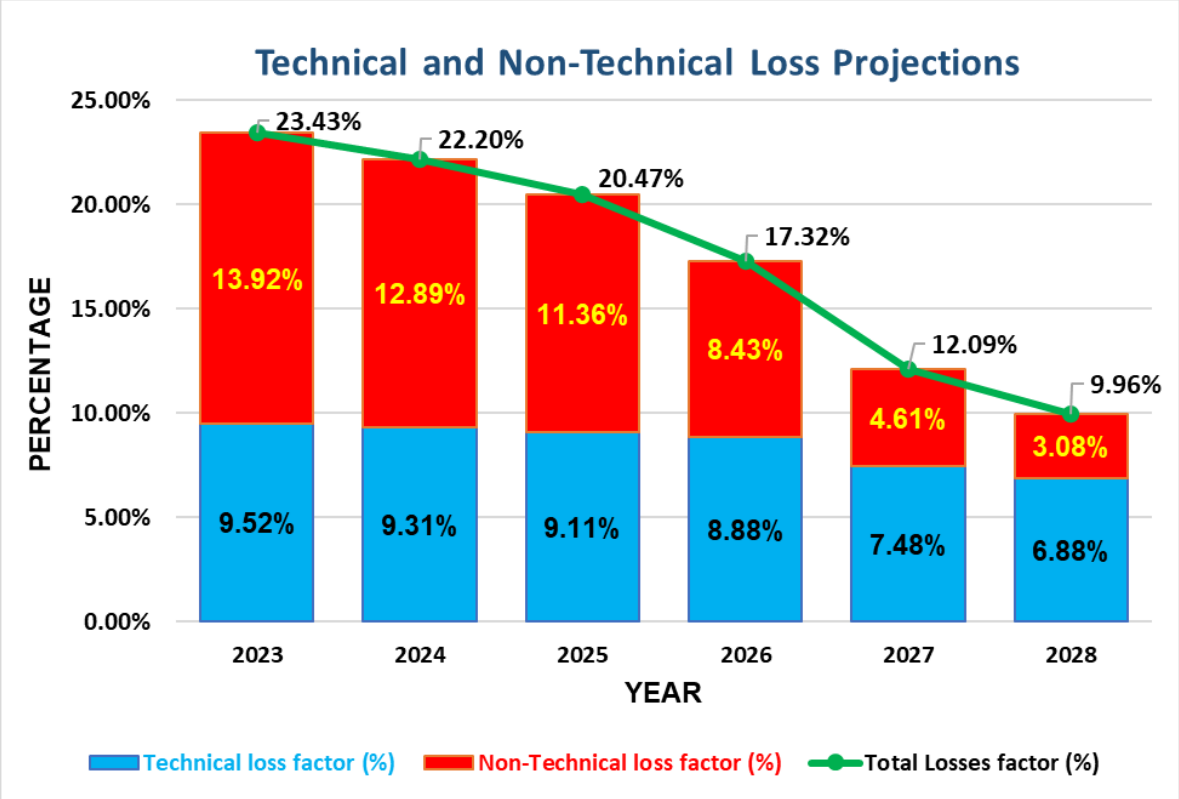

Figure 19: 2024- 2028 Technical and Non-Technical Loss Reduction Projections

In light of the 12% growth in electricity demand from year 2022 to 2023, total losses reduced from 24.92% in 2022 to 23.43% in 2023. Total losses for year 2023 are estimated based on the monthly trend of Q4 of year 2022.

In 2022, total losses for 2023 was project to be 24.1% - a 1.1% reduction. However, for year 2023, the estimated reduction is 1.49%. Although the loss reduction target would be achieved, it remains a corporate mandate to further reduce losses – especially non-technical losses.

18.3 Loss Reduction Strategies

18.3.1 Commercial Losses (Non-Technical Losses)

The Company will continue to adopt a phased approach to establishing its Advance Metering Infrastructure (AMI). AMI meters will not be restricted to customer installations. The AMI meters will also be used for grid metering to compare energy delivered to a geographic area and the energy registered by Consumers' meters. This technology will significantly enhance GPL's theft detection capabilities and therefore reduce non-technical losses. The technology will also help identify voltage levels within the distribution network and inform on the performance of GPL's Operational Standard and Performance Measure.

The activities envisaged over the life of this Programme require a capital investment of US$91.135 million (GY$19.6 billion) and include:

1. Installation of 180,300 AMI meters complete with new service lines and associated materials,
2. Installation of 20,000 energy efficient LED streetlamp as part of a proposed streetlamp upgrade programme.
3. Regular inspection of areas with new, reinforced networks to reduce illegal connections,
4. Efforts to encourage prosecution of all cases of illegal electricity extraction, and
5. Execution of a Social Management Programme to educate consumers on the impact and consequences of electricity theft.
6. Execution of a Social Management Programme to educate consumers on the use of energy efficient lighting and impact and consequences of installing illegal streetlamps.

In addition to the above, the Company plans to address the following aggressively:

1. Reduce and deter electricity theft by carrying out regular:
    d. Field assessment of customers.
    e. Field assessment of zero consumption accounts
    f. Monitoring of defaulting customers
    g. Removal of illegal connections and prosecuting of persons caught.
2. Reduce billing system errors and estimations by:
    c. Verification of all streetlights within NDC's and Municipalities
    d. Implementation of the Street lamp upgrade programme.

18.3.2 Technical Losses

Given that technical losses are strongly associated with T&D, which also includes substations, total planned investment during the life of this Programme is estimated at US$886.7 million.

In addition to addressing the increasing total number of customers and demand, this investment will also mitigate associated increase of technical losses at the transmission, primary and secondary distribution levels.

At the 230kV and 69 kV transmission levels, transmission losses due to increasing power flow would be mitigate using carbon composite core aluminium conductors – ACCC. It is estimated that loss reduction benefits using this type of conductor is within the range of 13% to 16% relative to ASCR conductor type.

With the Guyana National Control Centre being equipped with modern SCADA equipment, technical losses will also be reduced through economic dispatch of generator units.

Additionally, these planned investments are expected to improve the electric supply quality, reduce operating costs, support tariffs reduction, and ultimately improve the Company's grid emission factor.

19. Non-Technical Operations

19.1 Facilities Management Programmes

The Company continues aiming at an investment of US$14.73 million in new accommodation facilities during the life of this programme. See Table 68 for further details.

Table 68: Design and Construction of New Facilities

No.	Project Description	Location	Year
	Year 2024		
1	Construction of Internal Roads and casting of pole yard at Sophia Complex	Sophia	2024
2	Construction of Training ground for live /Hotwire, Sophia	Sophia	2024
3	Construction of RC and chain-link fence to switch yard Sophia Complex	Sophia	2024
4	Rehabilitation of Access Road, Perimeter Fences, and Demolition of Building at Power Station Compound, Kingston, Georgetown	Kingston	2024
5	Rehabilitation Works to Victoria T& D location	Victoria	2024
6	Repairs to Cluster Piles at Vreed-en Hoop Wharf	West Bank Demerara	2024
7	Rehabilitation of Training School	Sophia	2024
8	Repairs to Sub-stations Buildings	Various Locations	2024
9	Removal of Asbestos Roof Sheets from the Power Station Building and install new roofing sheets at Canefield Power Station	Canefield, Berbice	2024
10	Completion of the Rehabilitation of old System Control Building at Sophia	Sophia	2024
11	Rehabilitation of Mechanical Workshop, GOE	Garden of Eden	2024
12	Construction of Timber Revetment to Anchors of Transmission Structure at No.19, East Berbice	East Berbice	2024
13	Repairs to access road at Canefield Berbice	Canefield, Berbice	2024
14	Rehabilitation to Perimeter Fence at Leguan Power Station.	Leguan	2024
15	Buildings and Infrastructure Improvements	Various Locations	2024
16	Complete the construction of Stores Building, Sophia	Sophia	2024
17	Construction of T & D Main Building at Sophia	Sophia	2024
18	Construction of Base and Bond Wall for 20,000 gallon fuel tank at Anna Regina	Essequibo	2024
19	Repairs to the Power station building at Anna Regina	Essequibo	2024
20	Construction of a Lube Oil Bond at Onverwagt Power Station	West Coast Berbice	2024

No.	Project Description	Location	Year
21	Rehabilitation of Parking Lot, Construction of Shed over Inventory Storage Container and Painting of the Commercial and T&D Office at Onverwagt	West Coast Berbice	2024
22	Construction of Lube Oil Bond and Workshop at Bartica Power Station Compound	Bartica	2024
23	Renovate and extend T & D Building at Versailles	West Bank Demerara	2024
24	Repairs to Perimeter Fence at Versailles Power station	West Bank Demerara	2024
25	Rehabilitation works to metering stores, engineer office, carpentry workshop building and extension of washrooms Sophia.	Sophia	2024
26	Rehabilitation Works to Internal Roads and Drains at GPL Compound, Garden of Eden Power Station	Garden of Eden	2024
27	Construction of Mechanical Workshop, at Sophia Complex	Sophia	2024
28	Buildings and infrastructure improvements	Various Locations	2024
	Year 2025		
1	Completion of construction of T&D Building	Sophia	2025
2	Construction of Mechanical Workshop, at Sophia Complex	Sophia	2025
3	Construction of RC drain to North-eastern section of the Sophia Complex.	Sophia	2025
4	Rehabilitation of Internal Roads at No.53 Sub-Station	East Berbice	2025
5	Construction of concrete internal Drains at Canefield Berbice	Canefield, Berbice	2025
6	Rehabilitation of Internal Roads at No.53 Sub-Station	East Berbice	2025
7	Rehabilitation of Building and fence at Onverwagt Engineer's Residence to house T&D	West Coast Berbice	2025
8	Maintenance Dredging of GPL'S Wharf Facilities	Kingston, Vreed-En-Hoop, GOE	2025
9	Construction of Revetment to the Western Side of the Compound at GOE	Garden of Eden	2025
10	Complete the Rehabilitation of Building and fence at Onverwagt Engineer's Residence to house T&D	West Coast Berbice	2025
11	Buildings and infrastructure improvements	Various Locations	2025
	Year 2026		
1	Construct T and D Building at East Bank Berbice (location to be determined)	East Bank Berbice	2026
2	Construct Commercial office buildings at East Berbice, Corriverton, Grove, ECD and Parika	Various Locations	2026
3	Maintenance Dredging of GPL'S Wharf Facilities	Kingston, Vreed-En-Hoop, GOE	2026
4	Buildings and infrastructure improvements	Various Locations	2026

No.	Project Description	Location	Year
	Year 2027		
1	Complete the construction of T and D Building at East Bank Berbice	New Amsterdam	2027
2	Complete Commercial office buildings at East Berbice, Corriverton, Grove, ECD and Parika	Various Locations	2027
3	Maintenance Dredging of GPL'S Wharf Facilities	Kingston, Vreed-En-Hoop, GOE	2027
	Year 2028		
1	Maintenance Dredging of GPL'S Wharf Facilities	Kingston, Vreed-En-Hoop, GOE	2028
2	Buildings and infrastructure improvements	Various Locations	2028

20. Divisional Plans

20.1 Engineering Service Division

Mission Statement: To efficiently plan, engineer and execute major infrastructural projects in a timely and cost-effective manner through an empowered workforce embracing modern technologies.

Objective/Measure: The objective of the Projects Division is to adhere to the established standards and regulations in the planning, design, and execution of projects to meet customers' load demands in a reliable, safe, and environmentally friendly manner. This would be established through the KPIs to measure the parameters relevant to the Critical Issues of the Division.

Critical Issues: To achieve Operational Excellence, the following issues are identified as critical to the Projects Division to achieve its mandate and by extension, the goals of the Corporate Strategic Plan:

1. Meeting Forecasted Load Demand
2. Technical Loss Reduction
3. Staff Training and Development

Staff Training and Development

In alignment with the core strategic objectives, this critical area focuses on building human resource capacity to efficiently and effectively execute the strategies highlighted in this business plan. It is intended to accomplish this through the execution of specialised training in Power System Planning and Project Management.

Risks

The following risks would affect the strategies outlined to address the critical issues and projects as identified in this business plan:

1. Availability of adequate resources.
2. Absence of a structured project approval process.
3. Lack of cooperation between divisions.

Deploy Objectives

5. Communicate the Corporate Strategic Plan and Divisional Business Plan to all staff.
6. Employ process mapping techniques to identify urgent and long-term priorities.
7. Engage staff in process improvement within their respective areas.

Develop and deploy a master dashboard for reporting on Corporate, Division and Departmental performance.

20.2 Commercial Division

20.2.1 Critical Issues

The Customer services Division has identified several key areas to enhance the customers experience and their access to services, facilities and information related to their specific services.

20.2.2 New Services

The Company plans to connect approximately 40,012 new consumers to the grid during the life of this Development and Expansion Programme: 2024 to 2028. The larger percentage of this growth in new services recognizes the continued expansion of the housing sector, resulting from the allocation of land by the Government of Guyana for housing and the expansion of existing structures into multi-storey premises.

On the assumption that Linden is connected with the DBIS by year 2027, the total number of additional customers on the grid by 2028 would be 57,912, where 17,900 is the expect total number of customers from Linden.

Potential consumers will be encouraged through faster service requests timings, which will allow for them to establish electricity accounts and desist from invitations to acquire electricity through illegal arrangements.

20.2.3 Efficiency and Customer Service Improvements

Whilst the reliability and the quality of the supply of electricity delivered to customers are of significant importance to the Company, the Company remains cognizant of the 'life blood' nature of electricity and remains equally cognizant of the importance of leveraging Information and Communication Technological (ICT) initiatives to improve the efficiencies within its operations.

GPL intends to invest in additional ICT facilities to realize these improvements over the next five years. The investments will facilitate:

- ✓ The extension of the corporate All-Dielectric Self-supporting (ADSS) optical fibre cable to the East Berbice Commercial offices, which will result in an improvement of the performance of the corporate Wide Area Network (WAN).
- ✓ The procurement and implementation of a computerised Business Intelligence System (BIS) that will support the Company's realization of a computerized Enterprise Management Information System (MIS) with strong emphasis on corporate performance against Key Performance Indicators. Implementation commenced in September of 2020 and some Management Information Dashboards were established. The complete suite of Dashboards is expected to be completed by March 2021. These systems were

realized through EU/IDB funding under the Power Utility Upgrade Programme (PUUP). All expected BIS activities were completed by PUUP including the provision of a dedicated server, which GPL is still to fully activate.

- ✓ The procurement and implementation of a computerized Document Management System in 2023 to replace the current unwieldy printed document management.
- ✓ The full implementation of a modern computerized Human Resource Management and Payroll Management system within 2024.
- ✓ The further deployment of an interactive Web Portal to customers for customer account management i.e., recording meter readings, contact numbers, retrieving consumption histories etc.
- ✓ The implementation of a computerized Maintenance Management System.
- ✓ The upgrade the Customer Information System from a client-server platform to a web-based platform in 2023
- ✓ The procurement and implementation of a modern computerized financial budgeting and expenditure monitoring reporting system in 2022.
- ✓ The continued leveraging of the corporate GIS.

20.2.4 Customer-centred Services

Customer feedback remains important to the Company, as it forms the basis for developing strategies for correcting deficiencies and crafting strategies for continuous improvements. During the last quarter of 2017, GPL engaged a reputable Company to coordinate and conduct Customer Satisfaction (qualitative and quantitative) surveys. These surveys will be conducted initially on a quarterly basis and analysed with a focus on improving the quality of customer service.

The Company considers effective information dissemination critical to improving its public image through improved engagements with all stakeholders. It will intensify its information dissemination programs on its electric services via the print and electronic media and from within its Commercial offices. It will also further leverage its ICT solutions in order to improve the ’electronic windows’ into GPL. Customer feedback on the on the corporate online account enquiry and the electronic billing services has been encouraging and therefore the Company will continue its efforts to maximize its use of electronic services.

GPL will continue over the life of this programme and beyond to deploy and review strategies and initiatives that will support the Company’s efforts to continuously improve its quality of service in order to consistently meet and exceed the Customer Service Standards (CSS) and the Operational Service and Performance Targets (OS&PT). These standards reflect the corporate Key Performance Indicators.

The menu of strategies and initiatives include:

- Further leveraging of the corporate web site www.gplinc.com to present monthly electronic bills, which customers can access and download at their leisure.
- Increase the use of the GPL Customer web portal https://my.gplinc.com providing customers access to additional billing features.
- The maximization of a cellular platform that allows customer to retrieve useful account information via the Short Message Service (SMS). This service was introduced as 'SMS Freedom' during 2017.
- The provision of an electronic platform for recording customer retrieved meter readings. This will be subject to GPL's mandatory request to retrieve a minimum of one meter read per quarter.
- One hundred percent (100%) of Advance Metering Infrastructure (AMI) compatible meters. These meters will comprehensively address meter reading issues, disconnection and reconnection, billing, and various billing related queries.
- An expansion of public education initiatives to promote electronic payments via the banking system and the increased use of Payment Agencies, thus widening the options for conducting financial transactions.
- Intensify Corporate Relations efforts using more target audience penetrative methods.

20.2.5 Plans to regain Industrial customers:

Industrial consumers expect:

1. A reliable and efficient service.
2. Competitive tariff.
3. Electric service of acceptable quality. and
4. Available capacity to meet their growing needs.

The investments in generation, transmission, sub-stations, control facilities and loss reduction are all geared towards providing a reliable, least cost service. GPL had expected to rebalance its tariffs once power became commercially available from the hydro to remove the cross subsidy currently being provided by non-residential tariffs. GPL remains optimistic of the commissioning of a large hydropower facility in the long-term planning period. Such a facility would positively impact:

- ✓ Reduction in tariffs hence gradually attracting self-generating businesses to the grid; and
- ✓ Continued support of the 'economic development' in alignment with the Government's vision

GPL is also cognizant that industrial customers may be attracted to self-generation from renewable resources (mainly solar) given that the prices are becoming more affordable. In

addition, the possibility of selling excess electricity to the grid could increase the attraction to invest in these renewable energy technologies. The implementation of the Net billing feature to compensate grid tied customers will positively increase both the relationship with these customers and the returns received, and the electricity export to the grid.

The potential attraction of self-generation from renewable resources will also catalyse a tariff review with the objective of establishing more attractive rates that will afford the Company an acceptable level of profitability while encouraging the larger customers to retain their contractual relationship with GPL.

20.2.6 Strategy

1. Leverage current technological platforms to increase and improve customer engagement: Service Fault reports – the ability of customers to send photos or videos of the service fault to the company's call centre providing preliminary and useful information to field technicians and assist in effective emergency work scheduling with the objective of reducing the time to rectify service fault.

    (a) Application processing updates – provide customer with electronic updates on the requests for Electric services (New services) via email, WhatsApp, SMS, and corporate/ Customer portal. Similarly, for other electric Service requests such as termination of service, change in service, etc.

    Collaboration with the National Deeds and Commercial Registries Authority to establish electronic verification of legal documents associated with premises or land occupancy and company registration. This is to further encourage online applications for electric services and reduce the need to visit the company's commercial offices.

    (b) Provision of online payments via credit cards and the deployment of Payment kiosks at strategic locations. Whilst the company has a large network of payment agents countrywide, it continues its efforts to encourage bill payments by leveraging the myriad of electronic platforms that offer heightened convenience to customers.

    (c) Optimizing the Customer Service portal by ensuring the convenient accessibility to all customer account related information inclusive of consumption, bill and payment histories, bill payments and queries

    (d) Ensure optimization of the corporate website, Facebook page and YouTube channels for useful customer information penetration.

2. Leverage Technology platforms for internal services

    (a) Further leverage the company's Customer Information system (CIS) and GIS systems to manage customer request/ reports, i.e., use of data in CIS to understand network availability in the area to accommodate new service connections, capital work requirements, magnitude of emergency report, etc.

(b) Leverage the Corporate Customer Information System to accommodate “Fast data Capture” and real time updating by Field staff for various field activities such as new installations, meter changes, disconnected and reconnected services.

(c) Implementation of modern technology: Automated Meter reading (AMR) and a migration to Advanced Metering Infrastructure for remote meter reading retrieval and voltage monitoring and general monitoring of customer’ activity at the distribution network level.

3. Reduce commercial losses.

(a) Ensuring 100% accounts billed on actual readings consistently through-improved reading timelines and follow up done where discrepancies identified.

(b) Engage Community Based Representatives (CBR) in strategic areas to further support the Company’s reach into all communities within served areas as part of the corporate continuous customer service improvement efforts.

20.2.7 Critical Projects

- The use of CIS as the emergency database for reporting
- Consolidation of the Berbice call centre.
- Establish a process for addressing severe instances of meter retrieval failures in excess of 3 months.
- Reviewing meter form types, technical issues with the meters where reads are not randomly available, this project is to be completed in coordination with Loss Reduction Division; and
- Ensuring the standardisation and use of standards in billing procedures.

20.2.8 Key Performance Indication

Key Performance Indicator	Target 2024	Target 2025	Target 2026	Target 2027	Target 2028
New Service application processing time	1 days	1 day	1 day	1 day	1 day
New Service installation implementation					
Non-Capital	12 days	10 days	9 days	8 days	7 days
Capital	50 days	40 days	35 days	30 days	25 days
Response to queries					
Queries Acknowledged - Written	3 days	2 days	2 days	1 day	1 day
Enquiries Addressed (W / T)	7 days	5 days	4 days	3 days	2 days
PUC / Legal Issues Resolved	30 days	28 days	21 days	21 days	14 days
Issuance of bills after meter reading	7 days	7 days	7 days	7 days	7 days
Meters Read	95%	96%	97%	98%	99%
Reconnections After Payment	2 days	1 day	1 day	1 day	1 day
Straight connections corrected in 1 day		100%	100%	100%	100%
Call Centre Response	95%	96%	97%	98%	99%
Response to repair calls within 24 hrs.	100%	100%	100%	100%	100%
Meters Tested within 7 days of request	100%	100%	100%	100%	100%
Collection Rate (Average)	95%	96%	97%	98%	99%

20.3 Finance and Supply Chain Management

20.3.1 Critical Issue

1. Delays in the Procurement process.
2. Stock out of Critical Materials.
3. Lack of a Cash Management Policy.
4. Insufficient Control of the Budgeting Process.
5. Level of Insurance coverage on the Company’s assets.
6. Level of Receivables Balances and Collectability.
7. Documentation of Related Party Agreements. and
8. Inadequate Asset Management Database.

20.3.2 Strategies

9. Continuous monitoring of the internal control processes
10. Develop a Financial Model to conduct forecasting, sensitivity analysis and to monitor expenditures.
11. Implement a Budget Module to enable us to prepare variance analyses in a timely manner and to enable user departments to access data on a real time basis.
12. Focus on paperless processes by taking advantage of full integration of existing modules.
13. Develop and implement cash management system.
14. Perform cost of service study.
15. Simplify the Procurement processes by reviewing the approval levels, establishing the EOQ and JIT systems and developing electronic signatures.
16. Negotiate better payment terms and review the PPC guidelines to take full advantages of same
17. Improve the Asset Management and Inventory system.
18. Perform annual reviews of Accounting Policies and Procedures to refine and enhance.
19. Perform annual reviews of insurance policies.
20. Develop core team to review receivables processes.
21. Highlight the need for the Related Party Agreements.
22. Optimize Capital Structure jointly with the Shareholder.
23. Identify unusable materials from projects and identify assets for disposal.
24. Effectively manage asset disposal process.
25. Implement offsite backup of information.
26. Assess fuel storage requirements and improve where necessary; and
27. Create better work environment and take advantage of the Performance Management System.

20.4 Information Technology Division

The overall objective of the IT Division is to facilitate the flow of current information on GPL's processes and KPI's swiftly and securely to staff, customers, suppliers, and stakeholders, where they need it. This objective will be supported by the following measures:

Table 69: IT Division KPIs

Item No.	KPI	Target				
Year		2024	2025	2026	2027	202
	Infrastructure related					
1	Mission-critical Systems (EBS, CIS, JUICE, Email, Emergency) uptime	99.9%	99.9%	99.9%	99.9%	99.9%
2	Percentage of offices connected via broadband	90%	100%	100%	100%	100%
	Client Services related					
2	Help Desk Response <=1 hour	100%	100%	100%	100%	100%
3	Percentage Help Desk Resolution <= 3 Days (Demerara locations)	95%	95%	95%	95%	95%
4	Percentage Help Desk Resolution <= 5 Days (Esseq. & Berbice locations)	95%	95%	95%	95%	95%
6	Time to complete RFP for purchase of computers	1 day	1 day	1 day	1 day	1 day
7	Time to complete RFP for purchase of phones/ smartphones	1 day	1 day	1 day	1 day	1 day
8	Percentage of computer users provisioned with necessary software	100%	100%	100%	100%	100%
9	Percentage of computer users oriented/ needs assessment/ development plan	90%	100%	100%	100%	100%
	GIS related					
10	Percentage of identified field staff/ teams equipped and oriented to collect structured, digital, geospatial, on-site data	100%	100%	100%	100%	100%
11	Percentage of T&D network documented in GIS	90%	100%	100%	100%	100%
12	Percentage of T&D network inspections documented in GIS	90%	100%	100%	100%	100%
13	Percentage of emergency response cases captured via FDCI/ GIS	90%	100%	100%	100%	100%
14	Percentage of customers documented in GIS	90%	100%	100%	100%	100%
15	Percentage of CIS customer records updated with location data	90%	100%	100%	100%	100%
16	Percentage of CIS “transformer module” updated	90%	100%	100%	100%	100%

Much of the work regarding E-Business will be project-based and would result in and may be measured by efficiency/ accuracy outcomes for Business Units

20.4.1 Critical Issues

1. Infrastructure needs improving and expanding, e.g., bandwidth, to facilitate end-users and the flow of data/ information, Distribution SCADA, and AMI/ Smart Grid.
2. A modern, secure user environment needs to be revived/ expanded, including division-level systems under Critical Projects.

3. A reorientation of department managers and end-users to be more performant in data capture (digital, structured, accurate, prompt, on-site) and information-usage. and
4. Computation and data flow for effective planning and decision making.

20.4.2 Strategy

Reorganize IT Division into three teams that will:

1. Provide infrastructure.
2. Provide client services to improve the user capability and user experience.
3. Process data and deliver information and implement e-Business approaches.

Pivot GPL towards being data-driven and an e-Business:

4. Capture current, accurate data about GPL assets (electrical network assets, customers, etc.) and changes regarding these assets.
5. Capture digital, geospatial data immediately when changes occur and on-site where they occur.
6. Use data not opinion or estimates for planning, and reporting operations.

An example of such a pivot is the progress made by acquiring a current, field-based census of streetlamps beginning in 2018 using mobile devices (Fast Data Capture method developed by the IT Division) and comparing field counts with data in the Customer Information System (CIS), via an analytical Dashboard, as shown in Figure 20, Figure 21 and Figure 22 below. One outcome was accurate identification of active streetlamp accounts rising from 88 to 125 between 2018 and 2019, with associated current charges increasing from GY$44.5M to GY$66.9M.

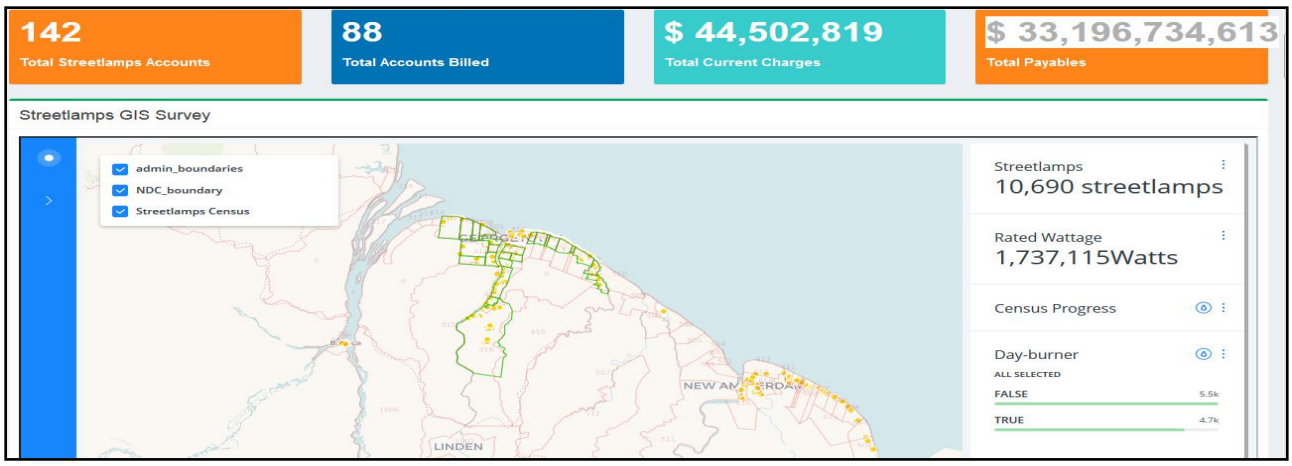

Figure 20: Number of streetlamps in year 2018

GPL billed only 88 of 142 accounts. Data in the CIS used 5+ year old, estimated counts, and active and total accounts were unverified.

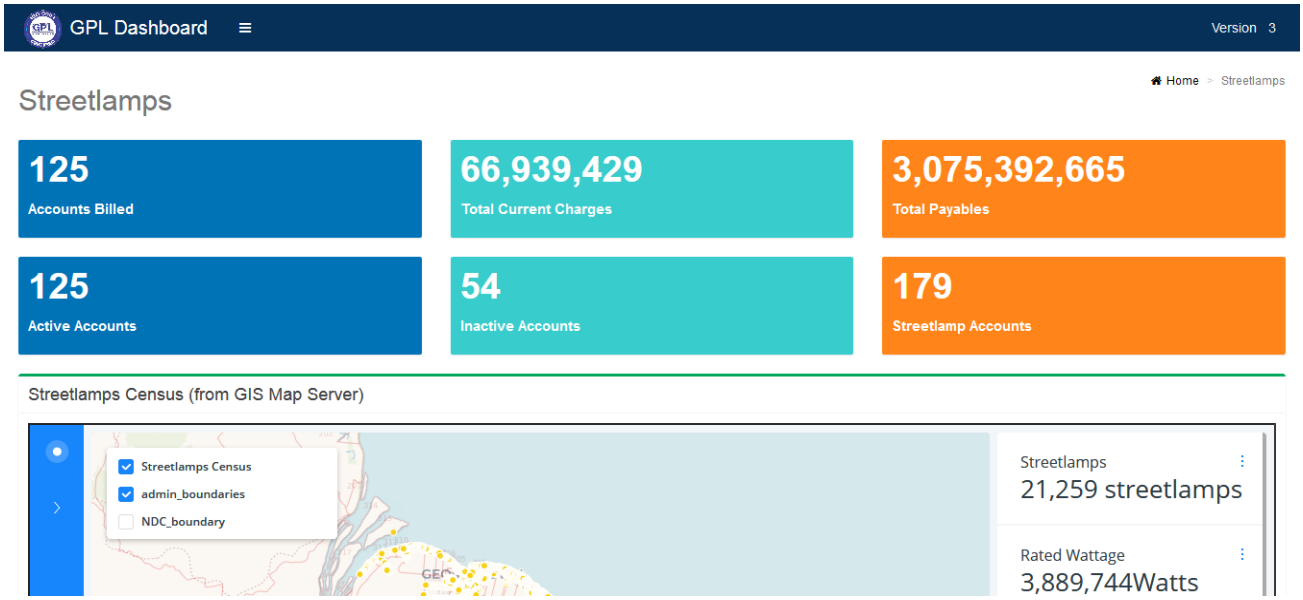

Figure 21: Number of streetlamps in year 2019

GPL began billing 125 of 125 discovered active accounts and 179 total discovered accounts.

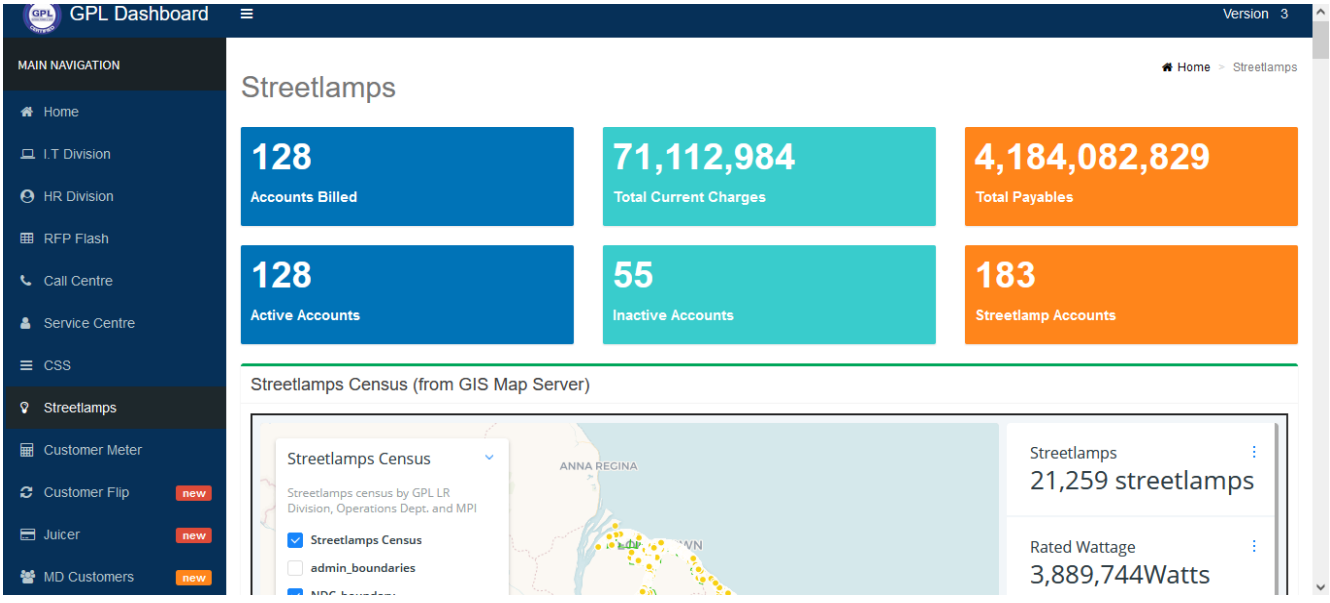

Figure 22: Number of streetlamps in year 2022

With 128 active accounts being billed, of 183 total accounts, associated with 3.9 MW of consumption and current charges of GY$71M.

20.4.3 Critical Projects:

Infrastructure/ WAN restructuring and upgrade. The WAN will be restructured and upgraded for more seamless management and cybersecurity and will include cloud assets where uptime, efficiency and security can be advantageous.

E-Business Suite Upgrade and Expansion. The EBS will be upgraded and other useful aspects of a financial system such as budgeting would be brought online, including modules for E-Tendering (identified as a critical issue by the Executive, based on feedback from Cabinet), Budgeting and Fixed Asset.

CIS Upgrade. The roadmap for a less expensive infrastructure/ database and additional useful modules will be implemented.

GIS expansion. GIS has brought fast, mobile data capture and map visualization to GPL. It will continue to expand the methods/ technology that the company can use to gather data on its assets and operations and develop products/ services that improve decision-making.

Enterprise Resource Planning (ERP) System. An ERP, including an integrated Work Management module, as recommended by the TERI consultants, will be implemented. It has been advised that asset management is key; and a continual, accurate, digital data flow regarding T&D assets needs to be entrenched in the company. The method and technology for mobile data capture for the ERP has already been demonstrated during collection and update of customer, feeder and transformer asset and geospatial data for the entire City of Georgetown in a Dec 2021 project.

Business Intelligence System (BIS). The BIS is the second iteration of solving the operational silos issue identified by consultants by creating a single set of business metrics in a unified way from GPLS's various data sources. The effort to expand its use, build necessary structured, transactional data pipelines from various business units, and pivot to a data driven business will continue.

Office/ collaboration/ backup software system implementation. The use of a tool to support document creation, storage/ sharing, collaboration, and management will be expanded.

Interactive Web Portal. The web portal will continue to be a core means of providing customer services 24/ 7/ 365, and developments in this space will be pursued for greater/ wider effect.

HRIS PMS. The Human Resources Information System (HRIS), which includes payroll and has an associated time and attendance solution, was successfully implemented in 2022. A solution for Performance Management will be implemented.

National Control Centre. The company will seek to implement Smart Grid and developments to implement/ support the AMI infrastructure and develop solutions for other matters using AI are likely to be necessary. Here again, the De Barr SCADA consultants have advised that asset management is key; and a continual, accurate, digital data flow regarding T&D assets and any changes needs to be entrenched in the company. Additional flows of data from SCADA assets

including Auto-Reclosers, and Generation assets, will be made continuous with investments in sensors and a sensor network.

20.5 Human Resources Division

Development and maintenance of the requisite core of skills and competencies to manage the evolving electricity infrastructure that is based increasingly on automation and ICT systems would be critical for GPL. In this regard, GPL will develop and execute targeted training programs in automation engineering in areas where such systems will be introduced.

The continued heavy loss of skills is a severe challenge for the best of plans as new professionals leave after gaining some practical experience. The Company intends to maintain and expand the Management Trainee and technician programs on an ongoing basis to mitigate the loss of skills at the professional entry levels.

The Company's intention to align with the Government's vision on economic development requires training and developing staff in both the technical and commercial components of renewable energy management. GPL will examine a plethora of local and overseas training in order to ensure that it develops and maintains that capacity to manage this evolving technology.

At the technician level, GPL would continue to invest in the apprenticeship programme and specialized six months and one-year intensive programmes to provide the requisite number of entry level technical skills.

The Company will continue to provide opportunities for further tertiary education and professional training. It intends to achieve this by selectively and fairly approving time away from work to attend classes at tertiary institutions. The Company will also consider partial scholarships to employee desirous of pursuing master's degree programmes that will support GPL's operations.

20.5.1 Critical Issues

1. There is an urgent need to continuously review and improve the staff recruitment process to ensure that a better quality of staff is recruited in a timelier manner to meet the skills and competencies required by GPL.
2. The induction and on-boarding of staff need to significantly improve to ensure that staff is fully aware of GPL's personnel policies and their respective roles and responsibilities in their department.
3. The present system for identifying the developmental/training needs of staff needs to be significantly enhanced.
4. The new Performance Management System needs to be fully and effectively implemented to ensure more objective and targeted appraisal of staff.
5. A policy and related procedures for proper Succession Planning at the Management levels needs to be developed and implemented.

6. There is a critical need for a revised Disciplinary Policy and Procedures that aims at becoming a more effective and efficient system for dealing with disciplinary issues.
7. The present system implemented for monitoring safety procedures and effectuating remedial actions in a timelier manner needs to be significantly improved.
8. The construction and ongoing maintenance of GPL's facilities needs to be more efficient and timelier to ensure a better environment for staff and customers.

20.5.2 Strategy

1. Review and Update Human Resources Policies and Procedures.
2. Revise and document GPL Organisational Structure.
3. Acquire and implement automated Human Resources Management System.
4. Review and document Recruitment and On-Boarding procedures.
5. Enhance Employee Development and Training programs.
6. Identify and execute training programs in areas of automation engineering including Sensor technology, PLCs, smart devices etc. in consultation with training providers, and tertiary institutions.
7. Implement new Performance Management System.
8. Develop and implement a system for Succession Planning.
9. Review, document and revise Disciplinary Policy.
10. Develop and Implement Change Management.
11. Develop and negotiate proposals for staff Remuneration benefits and conditions of service.
12. Develop and implement programs for Staff Welfare and Social Activities.
13. Conduct annual Employment Engagement survey and develop and implement action plan for improvements in employee engagement.
14. Develop and implement an improved system for Safety, Health, and Environmental Management.
15. Develop and implement system for the effective maintenance and construction of facilities.

20.5.3 Performance Monitoring

An affordable, stable, and continuous supply of electricity is critical to the development of Guyana's economy and must be in alignment with the National Development Strategy (NDS). It is therefore imperative for the Government of Guyana and sole shareholder of GPL to be

informed of the Company's performance and the extent of its alignment with the NDS via a structured Performance Monitoring and Evaluation mechanism.

In order to formally support this Monitoring and Evaluation mechanism, a Performance Agreement was established between GPL, the Ministry of Finance, and the Ministry of Public Infrastructure, which commenced from January 1, 2017. This Performance Agreement will be reviewed and renewed annually. The agreement will focus on a number of critical Performance measures and Key Performance Indicators that GPL is expected to meet or exceed. GPL will submit performance reports on a monthly basis to the Government of Guyana, through the Ministry of Finance's Monitoring and Evaluation Unit.

In addition to the Performance Agreement, the Company intends to fully implement an objective Performance Management System (PMS) in 2021. This will be aligned with the Corporate Strategic Plan and this programme. Key Performance Indicators and targets will form an integral part of this PMS.

21 Summary of Annual Expansion, Upgrades and Service Work Plan (See Appendix 2, page 202 for details by Geographic Areas)

The following capital program sets out to achieve the generation reliability target (LOLP) and transmission and distribution reliability target and assumes that the required funding for the current planning period would be made available.

21.1 Work Plan Summary Short Term Planning (2024-2025)

Generation Projects	
2024-2025	**Conventional Projects**
2023	1. 25 MW EPC HFO-Fired Power Plant –Columbia 2. Leguan Power Plant Extension Phase 1 3. Wakenaam Power Plant Expansion Phase 1
2024	1. Anna Regina Power Plant Extension 2. Bartica Power Plant Expansion- Phase 1
2025	1. 300 MW Natural Gas Fired Power Plant- Phase 1 2. 300 MW Natural Gas Fired Power Plant- Phase 2 3. Bartica Power Plant Expansion- Phase 2 4. Bartica Power Plant Expansion- Phase 3
2024-2025	**Renewable Energy and Energy Storage Projects**
2024	1. Solar PV- Wakenaam (MWp) BESS- Wakenaam (MWp)
	2. Solar PV- Leguan BESS- Leguan
2024	**GUYSOL Projects:**
	Solar PV - Essequibo (MWp) BESS- Essequibo (MWh) 3. Solar PV - Linden (MWp) BESS- Linden (MWh) Solar PV Berbice (MWp)
	Other:
	4. Golden Grove 13.8 kV BESS (MWh) - 10 MWh 5. Kingston 13.8 kV BESS (MWh) - 10 MWh
2025	6. New Sophia 69 kV BESS (MWh) - 15 MWh

Transmission System and Substation Projects	
2024-2025	**Transmission System**
2024	**69 kV Transmission Lines Projects:** 1. Kingston to Old Sophia Substation parallel and upgraded line (L5-P and L5) 2. Edinburgh to Hydronie new transmission line (L8); 3. Kingston to Princes St substation transmission line (L11-1); 4. Princess Street to New Georgetown substation transmission line (L11-3); 5. L12 and L13 Upgrade – to facilitate increased power transfer between Old and New Sophia Substations; 6. Golden Grove to New Sophia transmission line Upgrade (L4); 7. Golden Grove to Old Sophia transmission line Upgrade (L2);
	8. Golden Grove to New Sophia transmission line splitting into Goedverwagting Substation (L4-1 and L4-2);
	230 kV Transmission Lines Projects:
	9. Wales Natural Gas Power Plant to Goedverwagting 230 kV Double circuit transmission lines (HV_L1 and HV_L1-P);
2025	**69 kV Transmission Lines Projects:**
	1. Golden Grove to Garden of Eden double circuit transmission line upgrade (L1 & L3) 2. Vreed-en-hoop to Kingston double circuit transmission line (LS6 & LS6P) 3. Ogle to Enmore/Victoria transmission line (L26) 4. Ogle to New Sophia new double circuit transmission line (L16-1, & L16 P-1) 5. Ogle to Good Hope new double circuit transmission line (L16-2 &L16 P-2) 6. Good Hope to Columbia transmission line splitting into Victoria/Enmore Sub (L17 & L18) 7. Garden of Eden to Kuru Kururu Double circuit transmission line; 8. Goedverwagting to Ogle new double circuit transmission line (L25 & L25P); 9. No. 53 to Skeldon new transmission line (L23 P)

	10 Williamsburg to No. 52 new transmission line (L22-2)- upgrade to existing transmission lines 11 Canefield to Williamsburg new transmission line (L22-2)- upgrade to existing transmission lines 12 Enmore/Victoria to Columbia new transmission line (L18P) 13 Good Hope to Enmore new transmission line (L17P) 14 Wales NG to Wales Industrial new transmission line (3 circuits); 15 Wales Industrial to Wales Residential Double circuit transmission line; 16 Wales Residential to Vreed-en- hoop Double Circuit transmission line;

2024-2025	**New Substation System and Substation Upgrade**
	Substation Upgrade
2024	1. Edinburgh Substation; 2. New Georgetown Substation; 3. Onverwagt Substation; 4. Old Sophia Substation 5. Good Hope Substation 6. Kingston Substation 7. Golden Grove 8. Canefield Substation 9. Vreed-en-Hoop Substation 10. No. 53 Substation
	New Substation System
	1. Mobile Substation 2. Hydronie 69/13.8 kV Substation; 3. Princess Street 69/13.8 kV Substation; 4. Kingston New GIS Substation
	Power Plant Upgrade
	Upgrade tie-lines between DP2 -DP3 Upgrade 13.8 kV Switchgear at DP2

	Install two (2) grounding transformers at DP3 Upgrade Grounding Transformer at DP4 Generator Neutral Earthing Resistors at DP4 Upgrade 13.8 kV Switchgear at DP3 Leguan Power Plant Upgrade Wakenaam Power Plant Upgrade
2025	**Substation Upgrade**
	New Sophia Substation Garden of Eden Substation; Good Hope Substation; Columbia Substation Onverwagt Substation; Canefield Substation No. 53 Substation Vreed-en-Hoop Substation Old Sophia Substation Edinburgh Substation;
	New Substation System
	Goedverwagting 230 kV Substation Wales NG 230 kV Substation Goedverwagting 69/13.8 kV Substation Wales R/C 69/13.8 kV Substation Wales Indus. 69/13.8 kV Substation Ogle 69/13.8 kV Substation Enmore/Victoria 69/13.8 kV Substation Kuru Kururu 69/13.8 kV Substation Williamsburg 69/13.8 kV Substation Mobile substation
2024-2025	**Transmission Reinforcements**
2025	New Sophia-15 MVAr 69 kV De-tuned Compensation Systems Columbia -15 MVAr 69 kV De-tuned Compensation Systems No. 53 -15 MVAr 69 kV De-tuned Compensation Systems Edinburgh -10 MVAr 69 kV De-tuned Compensation Systems

Distribution Network Projects	
2024-2025	**Upgrade to Existing 13.8 kV Primary Distribution Feeders**
2024	1. Golden Grove F1; 2. Golden Grove F3; 3. New Georgetown F1; 4. Good Hope F4; 5. Edinburgh F2; 6. Canefield F1 River Crossing- Upgrade; 7. Canefield F1- Upgrade 8. Canefield F3- Upgrade 9. Canefield F4 River Crossing – Upgrade 10. Canefield F4 - Upgrade 11. Garden of Eden F1- Upgrade 12. Garden of Eden F2 – Upgrade 13. Garden of Eden F3 – Upgrade 14. Anna Regina - West Feeder - Upgrade and Extend 15. Anna Regina - South Feeder - Express to Onderneeming;
2025	16. No. 53 - both feeders 17. Anna Regina - South Feeder - Upgrade
2024-2025	**New 13.8 kV Primary Distribution Projects**
2024	**New 13.8 kV Distribution Feeders- Existing Substations**
	1. Columbia – 2 new active feeders 2. Good Hope – 2 new active feeder 3. Good Hope – 1 new priority feeder 4. No. 53 – 1 new active feeder 5. Vreed-en-Hoop – 1 new active feeder 6. DP3 – 1 new priority feeder 7. Garden of Eden – 2 new priority feeders 8. Canefield – 3 new priority feeders 9. Edinburgh – 1 new priority feeder

	10. Old Sophia – 1 new priority feeder
	New 13.8 kV Distribution Feeders- New Substations
	1. Parika/Hydronie- 4 new active feeders 2. Princess St- 6 new active feeders 3. Kingston New Substation- 6 new active feeders 4. Goedverwagting- 8 new active feeders 5. Wales R/C- 4 new active feeders 6. Wales Indus. -4 active feeders
	Additional Works
	1. Installation of 40 Reclosers 2. Installation of 80 Sectionaliser 3. Installation of 60 Smart Fault Current Indicators 4. Leguan Feeder Voltage Upgrade
	Reactive Compensation on the Distribution Network
	1. 1 x 150 kVAr Bank 2. 2 x 300 kVAr Bank 3. 2 x 450 kVAr Bank 4. 1 x 600 kVAr Bank 5. 1 x 1050 kVAr Bank
2025	**New 13.8 kV Distribution Feeders- Existing Substations**
	1. Columbia – 2 new active feeders 2. No. 53 – 2 new active feeder 3. Canefield- 2 new active feeders
	New 13.8 kV Distribution Feeders- New Substations
	1. Victoria/Enmore- 4 new active feeders 2. Wales R/C- 2 new active feeders 3. Wales Indus. -2 active feeders 4. Ogle- 8 new active feeders 5. Williamsburg- 4 new active feeders 6. Kuru Kururu- 3 new active feeders
	Additional Works:

	1. Installation of 40 Reclosers 2. Installation of 80 Sectionaliser 3. Installation of 60 Smart Fault Current Indicators
	Reactive Compensation on the Distribution Network
	1. 2 x 150 kVAr Bank 2. 2 x 300 kVAr Bank 3. 2 x 450 kVAr Bank 4. 1 x 600 kVAr Bank 5. 1 x 1050 kVAr Bank

2024-2025	**Electrification – Unserved Areas**
2024	160 beneficiaries
2025	231 beneficiaries
2024-2025	**New Services**
2024	6,623 New Services
2025	7,059 New Services
2024-2025	**Facilities Management**
2024	1. Construction of Internal Roads and casting of pole yard at Sophia Complex 2. Construction of Training ground for live /Hotwire, Sophia 3. Construction of RC and chain-link fence to switch yard Sophia Complex 4. Rehabilitation of Access Road, Perimeter Fences, and Demolition of Building at Power Station Compound, Kingston, Georgetown 5. Rehabilitation Works to Victoria T& D location 6. Repairs to Cluster Piles at Vreed-en Hoop Wharf 7. Rehabilitation of Training School 8. Repairs to Sub-stations Buildings 9. Removal of Asbestos Roof Sheets from the Power Station Building and install new roofing sheets at Canefield Power Station 10. Completion of the Rehabilitation of old System Control Building at Sophia 11. Rehabilitation of Mechanical Workshop, GOE

	12. Construction of Timber Revetment to Anchors of Transmission Structure at No.19, East Berbice 13. Repairs to access road at Canefield Berbice 14. Rehabilitation to Perimeter Fence at Leguan Power Station. 15. Buildings and Infrastructure Improvements 16. Complete the construction of Stores Building, Sophia 17. Construction of T & D Main Building at Sophia 18. Construction of Base and Bond Wall for 20,000 gallon fuel tank at Anna Regina 19. Repairs to the Power station building at Anna Regina 20. Construction of a Lube Oil Bond at Onverwagt Power Station 21. Rehabilitation of Parking Lot, Construction of Shed over Inventory Storage Container and Painting of the Commercial and T&D Office at Onverwagt 22. Construction of Lube Oil Bond and Workshop at Bartica Power Station Compound 23. Renovate and extend T & D Building at Versailles 24. Repairs to Perimeter Fence at Versailles Power station 25. Rehabilitation works to metering stores, engineer office, carpentry workshop building and extension of washrooms Sophia. 26. Rehabilitation Works to Internal Roads and Drains at GPL Compound, Garden of Eden Power Station 27. Construction of Mechanical Workshop, at Sophia Complex 28. Buildings and infrastructure
2025	1. Completion of construction of T&D Building 2. Construction of Mechanical Workshop, at Sophia Complex 3. Construction of RC drain to North-eastern section of the Sophia Complex. 4. Rehabilitation of Internal Roads at No.53 Sub-Station 5. Construction of concrete internal Drains at Canefield Berbice 6. Rehabilitation of Internal Roads at No.53 Sub-Station 7. Rehabilitation of Building and fence at Onverwagt Engineer's Residence to house T&D

	8. Maintenance Dredging of GPL'S Wharf Facilities 9. Construction of Revetment to the Western Side of the Compound at GOE 10. Complete the Rehabilitation of Building and fence at Onverwagt Engineer's Residence to house T&D 11. Buildings and infrastructure improvements
2024-2025	**Non-Technical Loss Reduction**
2024	1. Upgrade 8000 minor meters to AMI meters 2. Replace 5,000 aged/defective meters with AMI meters. 3. Upgrade 2000 large consumers to AMI meters 4. Replace 1,000 tampered meters to AMI meters
2025	1. Upgrade 8000 minor meters to AMI meters 2. Replace 5,000 aged/defective meters with AMI meters. 3. Upgrade 2000 large consumers to AMI meters 4. Replace 1,000 tampered meters to AMI meters. 5. AMI Infrastructure Cost - RF (GPL) 6. Public Education & Social Management Programme 7. Street Light Upgrade Programme (5000 Lamp)

21.2 Work Plan Summary Medium Term Planning (2026-2030)

Generation Projects	
2026-2030	**Conventional Projects**
2026-2030	Amalia Hydro Power Plant

Transmission System and Substation Projects	
2026-2028	**Transmission System**
2026	**69 kV Transmission Lines Projects:** Canefield to Crab Island new transmission line (L22-1a-P); Crab Island to Williamsburg new transmission line (L22-1b-P); Williamsburg to No. 53 new transmission line (L22-2-P); Canefield to Williamsburg transmission line splitting into Crab Island Substation; Onderneeming to Anna Regina new transmission line (L42) Kuru Kururu to Yarrowkabra new transmission line
2027	**69 kV Transmission Lines Projects:**
	Old Sophia to New Georgetown transmission line upgrade (L10); Columbia to Onverwagt new transmission line (L20P); No. 53 to Skeldon new transmission line (L23P); Wales R/C to Hydronie new transmission line (L33); Goedverwagting to Bamia new double circuit transmission lines (L37/L37P) Bamia to McKenzie new transmission line (L37); Williamsburg to No. 53 transmission lines splitting into Bush Lot Substation;
	230 kV Transmission Lines Projects
	Goedverwagting to Crab Island new double circuit transmission line Crab Island to Williamsburg new double circuit transmission line.
2028	**69 kV Transmission Lines Projects:**
	Onverwagt to Rossignol new transmission line;

	Rossignol to Canefield new transmission line; LBI to Goedverwagting new transmission line (L27); Ogle to Enmore transmission line splitting into LBI Substation; Wales RC to Vreed-en-hoop transmission line splitting into Westminster Substation; Westminster to Hydronie new transmission line; Westminster to Hydronie transmission line splitting into Tuschen Substation;

2026-2028	**New Substation System and Substation Upgrade** **Existing Substation Upgrade**
2026	1. Canefield Substation
2027	2. Onverwagt Substation; 3. Columbia Substation; 4. Skeldon Substation
2028	5. Onverwagt Substation; 6. Columbia Substation;
2026	**New Substation** 1. Crab Island 69/13.8 kV Substation 2. Yarrowkabra 69/13.8 kV Substation 3. Onderneeming 69/13.8 kV Substation 4. Anna Regina 69/13.8 kV Substation 5. Mobile Substation
2027	6. Bush Lot 69/13.8 kV Substation 7. Bamia 69/13.8 kV Substation 8. McKenzie 69/13.8 kV Substation
2028	9. Westminster 69/13.8 kV Substation 10. LBI 69/13.8 kV Substation 11. Goedverwagting Substation Upgrade 12. Rossignol 69/13.8 kV Substation 13. Tuschen 69/13.8 kV Substation 14. Williamsburg 230/69 kV Substation 15. Crab Island 230/69 kV Substation

Distribution Network Projects	
2026-2028	**New 13.8 kV Distribution Feeders- Existing Substations**
2026	1. Edinburgh- 2 new active feeders 2. Old Sophia- 4 new active feeders
	New 13.8 kV Primary Distribution Feeders
	1. Parika/Hydronie- 1 new active feeder 2. Princess St- 1 new active feeder 3. Kingston New Substation- 1 new active feeder 4. Wales R/C- 2 new active feeders 5. Wales Indus. -1 new active feeder 6. Crab Island- 6 new active feeders 7. Yarrowkabra- 4 new active feeders 8. Kuru Kururu- 1 new active feeder 9 Suddie Substation- 3 new active feeders 10 Anna Regina- 1 new active feeders
	Additional Works
	9. Installation of 40 Reclosers 10. Installation of 80 Sectionalizers 11. Installation of 60 Smart Fault Current Indicators 12. Leguan Feeder Voltage Upgrade
	Reactive Compensation on the Distribution Network
	1. 2 x 150 kVAr Bank 2. 2 x 300 kVAr Bank 3. 2 x 450 kVAr Bank 4. 1 x 600 kVAr Bank 5. 1 x 1050 kVAr Bank
2027	**New 13.8 kV Primary Distribution Feeders**
	1. Wales RC- 2 new active feeders 2. Wales Indus- 1 new active feeder 3. Ogle- 1 new active feeder

	4. Williamsburg- 1 new active feeder 5. Bamia- 4 new active feeders 6. McKenzie- 6 new active feeders 7. Kuru Kururu- 1 new active feeder 8. Bush Lot – 4 new active feeder
	Additional Works
	9. Installation of 40 Reclosers 10. Installation of 80 Sectionaliser 11. Installation of 60 Smart Fault Current Indicators
	Reactive Compensation on the Distribution Network
	1. 2 x 150 kVAr Bank 2. 2 x 300 kVAr Bank 3. 2 x 450 kVAr Bank 4. 1 x 600 kVAr Bank 5. 1 x 1050 kVAr Bank
2028	**New 13.8 kV Primary Distribution Feeders**
	1. Parika/Hydronie- 1 new active feeders 2. Princess St- 4 new active feeders 3. Kingston New Substation- 1 new active feeder 4. Victoria/Enmore- 6 new active feeder 5. Wales R/C- 6 new active feeders 6. LBI- 5 new active feeders 7. Westminster- 5 active feeders 8. Rossignol- 6 new active feeder 9. Crab Island- 5 new active feeders 10. Yarrowkabra- 6 new active feeders 11. Kuru Kururu- 7 new active feeder 12. Tuschen- 6 new active feeders 13. Suddie Substation- 6 new active feeders 14. Anna Regina- 6 new active feeders

	Additional Works
	15. Installation of 40 Reclosers 16. Installation of 80 Sectionaliser 17. Installation of 60 Smart Fault Current Indicators
	Reactive Compensation on the Distribution Network
	18. 2 x 150 kVAr Bank 19. 2 x 300 kVAr Bank 20. 2 x 450 kVAr Bank 21. 1 x 600 kVAr Bank 22. 1 x 1050 kVAr Bank

2026-2028	**Electrification – Unserved Areas**
2026	95 beneficiaries
2027	55 beneficiaries
2028	48 beneficiaries
2026-2028	**New Services**
2026	7,756 New Services
2027	9,845 New Services
2028	11,457 New Services
2026-2028	**Facilities Management**
2026	1. Construct T and D Building at East Bank Berbice (location to be determined) 2. Construct Commercial office buildings at East Berbice, Corriverton, Grove, ECD and Parika 3. Maintenance Dredging of GPL'S Wharf Facilities 4. Buildings and infrastructure improvements
2027	1. Complete the construction of T and D Building at East Bank Berbice 2. Complete Commercial office buildings at East Berbice, Corriverton, Grove, ECD and Parika 3. Maintenance Dredging of GPL'S Wharf Facilities 4. Buildings and infrastructure improvements

2028	1. Maintenance Dredging of GPL'S Wharf Facilities 2. Buildings and infrastructure improvements
2026-2028	**Non-Technical Loss Reduction**
2026	1. Upgrade 8000 minor meters to AMI meters 2. Replace 5,000 aged/defective meters with AMI meters. 3. Upgrade 2000 large consumers to AMI meters 4. Replace 1,000 tampered meters to AMI meters. 5. AMI Infrastructure Cost - RF (GPL) 6. Public Education & Social Management Programme 7. Street Light Upgrade Programme (5000 Lamp)
2027	1. Upgrade 8000 minor meters to AMI meters 2. Replace 5,000 aged/defective meters with AMI meters. 3. Upgrade 2000 large consumers to AMI meters 4. Replace 1,000 tampered meters to AMI meters. 5. AMI Infrastructure Cost - RF (GPL) 6. Public Education & Social Management Programme 7. Street Light Upgrade Programme (5000 Lamp)
2028	1. Upgrade 8000 minor meters to AMI meters 2. Replace 5,000 aged/defective meters with AMI meters. 3. Upgrade 2000 large consumers to AMI meters 4. Replace 1,000 tampered meters to AMI meters. 5. AMI Infrastructure Cost - RF (GPL) 6. Public Education & Social Management Programme 7. Street Light Upgrade Programme (5000 Lamp)

22 Sales and Revenue Collection

Electricity sales for year 2022 totalled 753,050 MWh. The year-to-year increase in sales comparing August of year 2022 with 2023 increased from 487,572 MWh to 545,942 MWh ~ 12% increase.

It is projected that total sales for year 2023 would be 859,932 MWh – a 14% increase relative to year 2022.

In consideration of the aggregated GPL power systems, sales are projected to grow at an annual average rate of 23.8% per annum over the next 5 years, where in 2028 it is estimated to be 2,475.6 GWh. See Figure 23 for further details.

Assuming Linden is connected to the DBIS in year 2027, sales for the total GPL for year 2027 is estimated to increase from 2,125.8 GWh to 2,223.7 GWh – a 4.6 % increase in sales. At the end of the life of this Programme, with Linden, total sales are estimated to be 2,588.6 GWh.

The current projection is primarily based on the estimated growth of GPL's customer base and the expected significant stimulations in the economy that are currently being provided by the Guyana's vibrant Oil and Gas Industry.

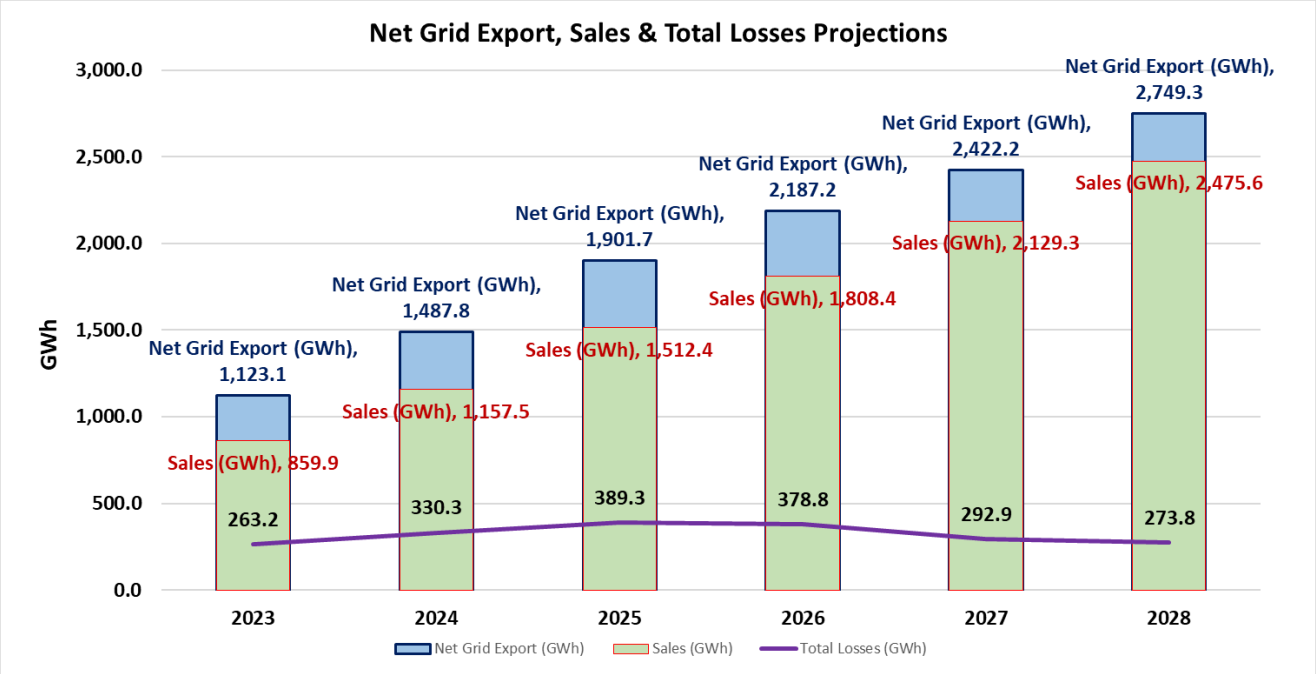

Figure 23: Net generation & Sales (GWh) – GPL Only

The Company intends to ramp-up its campaign to improve receivables, aiming to achieve a cash collection rate of 99.5% (cash collections as a percentage of sales), which is assumed within the life of this Development and Expansion Programme.

23 Projected Capital Expenditure

23.1 Summary of Capital Expenditure, US$

Table 70: Summary of Capital Expenditure, US$

Development and Expansion Projects	US$	Annual Budget (US$)				
		2024	2025	2026	2027	2028
		US$	US$	US$	US$	US$
Conventional Generation	77,110,063	73,391,434		352,629		3,366,000
Solar PV and Battery Energy Storage System	119,885,714	70,800,000	46,285,714			2,800,000
69 kV Transmission Lines (include Sub.Exp.Cost)	286,527,779	65,354,699	71,656,232	79,380,005	58,804,219	11,332,624
230 kV Transmission Lines (Include Sub.Exp.Cost)	82,676,093			45,471,868	37,204,225	
Upgrade - Existing 69/13.8 kV Substation	73,616,671	42,552,103	30,107,937	339,721	616,910	
New 69/13.8 kV Substation	276,255,090	106,969,217	58,541,841	42,275,027	46,722,118	21,746,887
230 kV Substation - New	31,218,477		9,365,543	12,487,391	9,365,543	
New Primary Distribution Feeders	48,937,446	18,210,201	8,817,859	7,556,428	9,346,748	5,006,210
Upgrade to Existing Primary Distribution Network (Technical Loss Reduction)	29,090,616	22,855,373	2,626,316	1,236,498	1,223,785	1,148,644
Transmission Reactive Reinforcement	13,512,390	6,854,315	5,701,076	660,000	297,000	
GNCC/Smart Grid	18,640,000				200,000	18,440,000
Power Plant Upgrades	26,651,582	12,231,539	6,300,000	452,927	321,197	7,345,919
Studies	700,000	700,000				
Meter Upgrades/Replacements (Non-Technical Loss Reduction)	91,135,000	10,730,000	18,264,750	19,203,000	20,879,500	22,057,750
Electrification (Unserved Areas)	994,104	462,809	377,863	50,200	63,053	40,179
New Services	23,827,178	3,692,265	3,935,331	4,323,902	5,488,502	6,387,178
Buildings	14,738,725	6,409,506	3,746,144	1,616,524	1,616,551	1,350,000
Company Tools	35,494,499	11,313,770	10,110,073	4,500,447	6,923,195	2,647,014
Information Technology	1,739,273	989,631	561,180	59,371	62,753	66,338
GRAND TOTAL US$	**1,252,750,701**	**453,516,861**	**276,397,859**	**219,965,938**	**199,135,299**	**103,734,744**
Guyana Dollars Equivalent (GY$ Billion)	**269,655**	**97,620**	**59,495**	**47,348**	**42,864**	**22,329**

Source of Funding – Loans facilitated through the Government of Guyana.

23.2 Operating costs and Capital Expenditures

Table 71:Profit & Loss Account

	2023 Latest Estimate	Yr 2024 Proj	Yr 2025 Proj	Yr 2026 Proj	Yr 2027 Proj	Yr 2028 Proj
	$'M	$'M	$'M	$'M	$'M	$'M
REVENUE						
Turnover	42,975	58,846	77,066	46,031	54,209	63,017
Rebate						
NET REVENUE	**42,975**	**58,846**	**77,066**	**46,031**	**54,209**	**63,017**
GENERATION COSTS						
Fuel & Freight	34,190	49,685	34,664	4,709	5,713	12,150
Operation & Maintenance	5,076	7,021	6,257	1,159	1,500	2,599
Purchased Power (IPP costs)	2,758	2,768	8,734	22,074	24,037	25,475
	42,024	**59,474**	**49,655**	**27,942**	**31,250**	**40,224**
GROSS INCOME	**951**	**(628)**	**27,411**	**18,088**	**22,959**	**22,793**
EXPENSES						
Employment Costs	6,022	6,997	7,697	8,466	9,313	10,244
Repairs & Maintenance T&D	694	1,841	2,351	2,701	2,994	3,398
Depreciation	3,601	3,678	3,682	9,169	12,599	15,673
Administrative Expenses	2,721	3,348	3,616	3,905	4,218	4,555
Bad Debts Provision	568	883	1,156	690	813	945
	13,606	**16,747**	**18,502**	**24,932**	**29,937**	**34,815**
NET (LOSS)/PROFIT FROM OPERATIONS	**(12,655)**	**(17,375)**	**8,909**	**(6,844)**	**(6,978)**	**(12,022)**
INTEREST EXPENSE	1,445	1,941	6,518	8,474	10,029	11,036
	(14,100)	**(19,316)**	**2,391**	**(15,317)**	**(17,007)**	**(23,058)**
OTHER INCOME	882	971	1,117	1,284	1,477	1,698
NET (LOSS)/PROFIT BEFORE TAX	**(13,218)**	**(18,345)**	**3,508**	**(14,033)**	**(15,530)**	**(21,359)**
TAXATION	(2,644)	(3,669)	702	(2,807)	(3,106)	(4,272)
NET (LOSS)/PROFIT FOR THE YEAR	**(10,574)**	**(14,676)**	**2,806**	**(11,226)**	**(12,424)**	**(17,088)**

In accordance with GPL's Licence the Shareholder is entitled to a target rate of return on equity of 8% per annum.

23.3 Cash Flow Statement

Table 72: Cash Flow Statement

Guyana Power & Light	Yr 2024	Yr 2025	Yr 2026	Yr 2027	Yr 2028
Cash flow Statement for the year ended	Proj	Proj	Proj	Proj	Proj
December 31st	$'M	$'M	$'M	$'M	$'M
OPERATING ACTIVITIES					
Profit/(Loss) before Taxation	**(18,345)**	**3,508**	**(14,033)**	**(15,530)**	**(21,359)**
Adjustments for:					
Depreciation	3,678	3,682	9,169	12,599	15,673
Deferred Income	10	47	(80)	21	23
Interest Expense	1,941	6,518	8,474	10,029	11,036
Amortization of Customer Projects					
Operating (loss)/profit before WC changes	**(12,716)**	**13,755**	**3,529**	**7,119**	**5,372**
Working Capital (WC) Changes					
Change in Inventories	(3,429)	2,689	(1,564)	(1,798)	(2,068)
Change in receivables and prepayments	(5)	(2,237)	(1,997)	3,401	(896)
Change in payables and accruals	(20,203)	2,541	(1,275)	693	1,154
Change in related parties	0	0	0	0	0
Taxes paid/refunded	3,669	(702)	2,807	3,106	4,272
Net Cash (Outflow)/Inflow - Operating Activities	**(32,684)**	**16,047**	**1,501**	**12,520**	**7,834**
INVESTING ACTIVITIES					
Acquisition of Property, plant and equipment	17,790	88,092	61,945	59,888	40,804
Increase in WIP	8,920	(9,531)	(3,037)	(1,121)	(5,134)
Net Cash Outflow - Investing Activities	**26,710**	**78,561**	**58,908**	**58,767**	**35,670**
FINANCING ACTIVITIES					
Movement in non current related parties	59,634	67,266	64,668	55,260	37,474
Interest paid	(1,941)	(6,518)	(8,474)	(10,029)	(11,036)
Customer deposits	256	1,392	955	800	1,102
Increase in advances customer financed projects	279	375	257	215	296
Decrease in advances customer financed projects					
Net Cash (Outflow)/Inflow - Financing Activities	**58,229**	**62,515**	**57,407**	**46,247**	**27,836**
NET MOVEMENT IN CASH AND CASH EQUIVALENTS	**(1,166)**	**(0)**	**(0)**	**(0)**	**0**
CASH AND CASH EQUIVALENTS AS AT BEGINNING OF YEAR	(2,834)	(4,000)	(4,000)	(4,000)	(4,000)
CASH AND CASH EQUIVALENTS AS AT END OF YEAR	**(4,000)**	**(4,000)**	**(4,000)**	**(4,000)**	**(4,000)**
Represented By:					
Cash on Hand and at Bank	**(4,000)**	**(4,000)**	**(4,000)**	**(4,000)**	**(4,000)**

23.4 Balance Sheet

Table 73: Balance Sheet

	Unaudited 2023	Year 2024	Year 2025	Year 2026	Year 2027	Year 2028
	G$'m	G$'m	G$'m	G$'m	G$'m	G$'m
ASSETS						
Non Current Assets						
Tangible Fixed Assets	42,537	56,649	141,059	193,835	241,124	266,255
Intangible Fixed Assets	832	832	832	832	832	832
Work in Progress	15,485	24,405	14,874	11,837	10,716	5,582
Investment SEI	3,105	3,105	3,105	3,105	3,105	3,105
Other Assets	10,514	10,514	10,514	10,514	10,514	10,514
	72,473	**95,505**	**170,384**	**220,123**	**266,291**	**286,289**
Current Assets						
Inventories	9,685	13,114	10,426	11,990	13,788	15,856
Related Parties	26,634	26,634	26,634	26,634	26,634	26,634
Receivables	4,206	4,212	6,449	8,446	5,044	5,941
Other Assets	411	411	411	411	411	411
	40,937	**44,371**	**43,920**	**47,480**	**45,878**	**48,842**
TOTAL ASSETS	**113,410**	**139,876**	**214,304**	**267,604**	**312,169**	**335,131**
EQUITY AND LIABILITIES						
Capital and Reserves						
Share Capital	23,118	23,118	23,118	23,118	23,118	23,118
Accumulated (Deficit)/Surplus	(31,822)	(42,396)	(57,072)	(54,266)	(65,492)	(77,917)
Retained Income	(10,574)	(14,676)	2,806	(11,226)	(12,424)	(17,088)
	(19,278)	**(33,954)**	**(31,148)**	**(42,374)**	**(54,799)**	**(71,886)**
Non Current Liabilities						
Deferred Tax	183	183	183	183	183	183
Grants and Customer Financed Projects	1,073	1,352	1,727	1,984	2,199	2,495
Provision for Decommissioning	243	243	243	243	243	243
Customer Deposits	4,770	5,026	6,418	7,374	8,174	9,276
Non-Current Related Party	99,902	159,536	226,802	291,470	346,730	384,204
	106,170	**166,340**	**235,373**	**301,253**	**357,529**	**396,401**
Current Liabilities						
Bank Overdraft	2,834	4,000	4,000	4,000	4,000	4,000
Deferred Income- Prepaid Meters	142	152	199	119	140	163
Payables	23,342	3,138	5,680	4,406	5,099	6,253
Other Liabilities	200	200	200	200	200	200
	26,518	**7,490**	**10,079**	**8,725**	**9,439**	**10,616**
TOTAL EQUITIES AND LIABILITIES	**113,410**	**139,876**	**214,304**	**267,604**	**312,169**	**335,131**

24 Impact of programme on Natural & Social Environment

The Guyana power and Light Incorporated is the holder of Nine (9) Environmental Authorisation Permits for its power generating facilities. As a result, it therefore, ensures that all current and future, operational activities at these locations, are subjected to strict environmental compliance as mandated by the Environmental Protection (Amended) Act, 2005 and enforced by the Environmental Protection Agency. Further, GPL intends to establish an Environmental and Social Management System (ESMS), which will provide a framework to guide all current and future operational activities and projects that may pose a risk or affect the Natural and Social environment. Moreover, the ESMS will ensure that systematic checks are done through "Quarterly" Environmental inspections to ensure compliance, Identify and mitigate risk and impacts, where necessary.

Additionally, GPL intends to pursue a net positive Environmental impact by retiring old inefficient generators and utilizing renewable energy sources, as informed by this Development and Expansion Programme. The Company will continue to ensure EPA's approval for all generation investments regardless of energy source.

Table 74: showing locations with environmental permits and monitoring safeguards.

Power Generating Locations with Environmental Authorisation Permit	Monitoring Schedule for locations	Monitoring test for facilities	Staff Training
1. Canefield 2. Onverwagt 3. Vreed-En-Hoop 4. Kingston 5. Garden of Eden 6. Bartica 7. Anna Regina 8. Wakenaam 9. Leguan	Quarterly Environmental Inspections	Noise Testing Air (Ambient/ Stack) Water (Effluent discharge) Soil (If necessary)	1. Good Environmental Practices 2. Handling of Hazardous Chemicals 3. Waste Management 4. Emergency response (Chemical/Oil Spills). 5. Spill Prevention. 6. Training on ESMS Manual.

Concerning the social environment, GPL will continue its cost-effective investments in addressing the electrification of unserved areas and T&D networks to improve supply reliability and quality, and customer services. The Company will establish a framework (Distribution Code) for the controlled penetration of distributed generation from renewable resources. Prudent financial management will continue balancing capital investments, operational expenditures, and tariffs. The Company expects these strategies and initiatives to impact both the society and economy positively.

GPL is, however, conscious that the removal of illegal services, prosecuting persons caught stealing electricity and taking prompt and firm steps to collect revenues would have some social

consequences. These measures are likely to generate some negative social impact, especially by the perpetrators of illegal activities. To address this, the social management plan, with its three-pronged approach (before, during and after) is anticipated to improve expected results.

25 Major Risks and Contingencies

25.1 Risk: Electricity Theft

A section of the population engages in illegal electricity consumption that negatively impacts internally funded capital investments and reduces operational performance, potentially becoming worse as the network expands according to the D&E projects. This D&E Programme is targeting sustainable loss reduction, which remains a challenge to GPL. The Company embraces the investments financed jointly by the IADB and EU via its PUUP Social Management programme, yet it remains cognizant and concerned of the culture of a section of the population who persist in this illegal practice.

As a result of electricity theft, GPL may have no option but to adjust/defer the timelines of the development and expansion programme accordingly, especially in the event where the Company's cash flow becomes insufficient and necessary concessional loans/grants may become unavailable during the life of this programme. GPL's current revenue projections provide for some capacity to absorb a degree of financial loss due to electricity theft; however, excessive financial losses can significantly derail future D&E projects.

25.1.1 Contingency Measures: Electricity Theft

In terms of recovering financial loss due to electricity theft, GPL recovers money via back-billing errant customer accounts; in cases where a customer is unwilling to pay, the Company's Legal department steps in with high levels of success as long as internal commercial issues are virtually non-existent. In the case of non-customers, the Guyana Police Force engages in arrests and relevant prosecution.

Although there are no assurances that loan/grant resources to GPL would continue to be available, the Company remains optimistic of the Government's interest in the execution of this five-year programme, which is designed to improve reliability and quality of electricity service. Additionally, GPL is hopeful that the PUUP Social Management programme, in conjunction with the continued execution of corporate development plans, will mitigate this unsavoury practice.

25.2 Risk: Fuel Price Volatility

Fuel price can spike upwards due to world HFO demand, meaning it will be more expensive to operate generation assets. Such a movement in HFO price would reduce internal cash flow, as well as affect financing D&E projects. Whilst the Company's license provides for rate adjustments and fuel surcharges and rebates, GPL remains cognizant of the impact of increased rates of fuel surcharges to its customers and the economy. Nonetheless, it is unlikely that any unavoidable upward adjustment to rates or fuel charges would be significant to impact

the availability of internal funding. It should be noted that GPL does not have a hedging strategy; fuel price is determined by 3-day averages from prevailing prices.

25.2.1 Contingency Measures: Fuel Price Volatility

GPL can apply rate adjustments, fuel charges and rebates to cushion financial impact; however, PUC and the Majority Shareholder need to approve this. Additionally, a subvention can be provided to further support the Company in supplying electricity to its customers. Renewable energy and natural gas initiatives are being developed to reduce dependence on foreign fuel supply and related price fluctuations. Continued use of HFO fired generation does provide baseload power. However, it is frowned upon, given the country's aggressive global climate change commitments. The Company will continue to examine power generation from natural gas and intends to use this option for planned firm capacity additions.

It should be noted that GPL is committed to broadening its energy portfolio with renewable energy – solar and wind. However, the intermittent supply of electricity from these sources without significant energy storage will require the use of fossil-fired generation to satisfy the forecasted demand. Regardless, the incremental introduction of these sources of renewable energy should deliver generation cost savings and contribute to a reduction in CO2, NOx, and SOx emissions - improving the grid emission factor. Also, the notable and continued decline in energy storage prices and the increased investment in this technology should reduce the degree of intermittency of electricity generation from solar and wind, thus increasing the attraction of these technologies to contribute to generation capacity, which in turn would assist satisfying the LOLE target.

25.3 Risk: Availability of Fuel Supply

Similar to fuel price, external sources continue to be the main source of fuel supply to GPL. As such, unforeseen and uncontrolled circumstances can hinder reliable fuel supply, resulting in generation shortfall and poor reliability performance. Additionally, new environmental requirements placed on marine vessels only utilize ship fuel with Sulphur 2% has several effects, ranging from reducing the quantity of fuel that can be supplied to GPL, to raising prices and impacting GPL's strategic fuel suppliers. This can lead to dissatisfied suppliers deciding to terminate shipment contracts with GPL, which can then increase time taken for GPL to seek other means of fuel supply – the consequence being increased late shipments, low fuel stock levels and load shedding.

25.3.1 Contingency Measures: Availability of Fuel Supply

GPL has a contract mechanism where foreign suppliers can financially compensate the Company for late fuel shipments - this can help with purchase of fuel locally. The Company is also considering spot contracts to bolster fuel availability in event of low stock levels. Additionally, GPL is focusing on RE projects with the aim to decrease dependency on imported fuels. The Company remains mindful of the risk involved in the availability of fuel supply and is currently planning to expand on-land fuel storage capacity across locations.

25.4 Risk: Foreign Exchange Rate

Global currencies tend to fluctuate; however, a weakening of the Guyana Dollar (relative to USD/Euro/Pound) can have negative impacts ranging from GPL ability to fund internal capital investments and maintain operational performance, to paying staff and servicing its debts.

Traditionally, GPL relies on loans to fund investments for infrastructural development. The funds (equity and debt) required for the high initial investment cost associated with energy infrastructure typically come from multilateral financial agencies, denominated in USD/Euro/Pound.

25.4.1 Contingency Measures: Foreign Exchange Rate

GPL intends to continue working with the Bank of Guyana and the Government of Guyana to ensure that investments for infrastructural developments projects do not adversely impact the cost of operation and to a more considerable extent, electricity tariff.

25.5 Risk: Cyber Threat

Cyber threats are evolving at a tremendous pace, exploiting capabilities created by the modernisation of power systems. This is related to the transition from a centralized power system, based on large power stations and vertically integrated utilities, to a decentralized power system model, as well as the complementary evolution of advanced communication and digital systems.

As GPL modernizes the power system, it becomes increasingly dependent on communication systems for its operations, and as a result increasingly susceptible to cyberattacks. While integrating information technologies is essential to building the smart grid and realizing its benefits, the same networked technologies add complexity and introduce new interdependencies and vulnerabilities to potential attackers and unintentional errors.

The Company has noted that cyber-attacks can be dormant, widely distributed, and executed at a time pre-set by attackers. Once executed, adverse impacts may be difficult to detect. Cyber-attacks lead to unseen damage in operation, information, and control systems.

Potential cybersecurity threats include, but are not limited to the following:

- Smart meters may be used by hackers as entry points into the broader power system.
- unauthorized interference on the measurement of electricity consumption (end-users).
- trip a power-generating unit.
- cause a blackout in a large area of the grid; and
- disrupt the proper functioning of the system.

Currently, SCADA is isolated from the larger network of the Company, so risks to SCADA is perceived as minimal (known unknown risk).

25.5.1 Contingency Measures: Cyber Threat

The IT Division has adopted the **Centre for Internet Security (CIS) Controls (v8)** framework/ standard for its cybersecurity best practice. The standard guides both defence measures and preparation for response to possible cyberattacks. This globally known standard is US-based, with mappings to ISO, GDPR, NIST and other relevant standards, and is now known to be applied by the Guyana National Data Management Agency (NDMA/ E-Gov) in government agencies.

All technical and administrative cybersecurity best practices at GPL is now firstly adopted from the published CIS Controls standard. Amongst other technology, CIS Benchmarks are used to improve the configuration of infrastructure, CIS CAT is used to assess configurations, and a CIS CSAT tool is used by a dedicated IT staff for standardized planning, tracking, and reporting on progress with cybersecurity improvements. GPL also deliberately stays in close contact and actively participates in initiatives and guidance from NDMA regarding IT best practice and policy.

GPL does have network firewalls, antivirus protection, 3-2-1 backup, insurance for tangible/intangible assets (digitized information and IT assets) as well as an internal awareness effort running monthly. This will be continued using in-house and external expert resources, to achieve full meeting the standard of CIS Controls v8.

25.6 Risk: Physical Attack

For GPL, system outages pose large adverse financial impacts on the country, across all tariff categories. Potential coordinated physical attacks (terrorism and riots) are a growing concern for the Company as it seeks to develop a resilient electric power system. With GPL moving towards the use of natural gas-fired power generation, this can pose vulnerabilities if a high-impact event disrupts the gas pipeline or gas processing infrastructure.

The Company is cognizant of the fact that it must focus attention on enhancing physical security and resiliency against physical attacks at substations, generation, transmission, and distribution facilities. It is known that transmission lines, substations, communications facilities, or natural gas supplies are susceptible to attacks with little or no risk of early detection.

Deliberate attacks can result in more-focused damage to facilities and equipment in substations compared to natural events. Substations can be seen as targets, and power system’s future dependence on natural gas pipelines and supervisory control and data acquisition (SCADA) communication systems, as attack points, are equally disruptive.

25.6.1 Contingency Measures

The following are critical parts of an effective physical security approach that the Company t seeks to adapt:

- **Physical barriers around security perimeters**: Physical barriers can prevent access to people and ground vehicles and can enclose equipment housings and supports.

- **Remote monitoring:** Remote monitoring detects intruders and monitors equipment. The Company intends to enhance its remote monitoring and surveillance capabilities of perimeters and access points detects approaching intruders and those attempting entry.
- **Vulnerability assessment**: The Company is cognisant of the benefits of a vulnerability assessment of critical components, which can include ballistic vulnerability. GPL plans to accomplish this task by coordinating a lessons-learned database on material vulnerability based on real-life examples.
- **Recovery and response**: The Company also recognises the need for and importance of effective response immediately after a physical attack is vital.

25.7 Risk: Extreme Weather Events

The resiliency of GPL's electric power system is threatened by extreme weather events that present a risk to system reliability and quality of service to customers. The major and severe weather events that are relevant to the Company are:

1. Flooding that arises out of sea-level rise,
2. Flooding that arises out of heavy rain fall,
3. Drought and heatwaves, and
4. Strong wind gusts.

In the past, these extreme weather events inflicted considerable damages to the Company's electric infrastructure and resulted in customers being without power for several days.

Flooding and Sea-level Rise

Guyana is classified as a high flood risk country, with the most significant vulnerability experienced within the coastal zone. The coastal region is prone to flooding because of the changes in rainfall pattern due to climate change and the fact that the coastal portions of Guyana sit about 0.5 meter to 1 meter below sea-level. Approximately 90% of Guyana's population lives along the coast, as such, the bulk of GPL's electrical infrastructure is concentrated along this region.

Consequently, GPL's generation and delivery assets, as well as the broader energy system infrastructure, are vulnerable to damages arising from flooding due to extreme events. Increases in excessive rainfall over the years have increased the frequency of flooding events in Guyana's' coastal regions. Flooding threatens coastal infrastructure and capital assets that are vital to the Company, as well as ports and other transportation networks that could affect fuel distribution or other essential resources. Current vulnerabilities could be exacerbated by the rising sea-level leading to more extensive flooding.

Drought and heatwaves

Extreme events in the form of droughts and heatwaves threaten the Company's electricity system by restricting water resource availability for power generation - cooling. Moreover,

diminished surface and groundwater levels require additional energy to pump water. Drought and heatwaves result in elevated ambient temperatures that can reduce generation efficiency and reliability, as well as increase energy losses in the transmission and distribution systems, while increasing demand due to the need for ambient cooling and pumping of water. Decreased water availability directly impacts cooling operations in various ways.

Droughts and heatwaves can exacerbate existing challenges related to water resource allocation, competition with other sectors (e.g., agriculture and industrial uses), and water quality.

Strong wind gusts

A wind gust can be described as a sudden, brief increase in wind speed followed by a calm to no breeze. This extreme weather event in Guyana has resulted in the Company suffering power outages and impassable paths to access the damages to conduct repair works and quick restoration of electricity. Over the years, GPL has been implementing measures to improve its infrastructure. However, in some cases, it came at a considerable cost to ensure reliable electricity service is provided in times of great needs for security, comfort, and other electric dependent utility services (water and communication).

25.7.1 Contingency Measures: Extreme Weather Events

The Company and its assets are exposed to a variety of threats. The risks presented now and, in the future, must be examined and mitigated. Protecting GPL's assets from extreme weather events can be accomplished in several ways, including reinforced towers, substations, and underground systems and other equipment. Options include raising existing - and installing new - flood walls; adding to spare parts inventory; incorporating submersible transformers, switches, and pumps; sealing manhole covers and conduit/cable penetrations, storing emergency supplies remotely, using weatherproof enclosures, and establishing a corporate emergency response centre.

Some of the resilience solutions or mitigation strategies suggested to reduce the impact of extreme weather events include:

- Ensure that there are sufficient and adequately distributed power generation facilities across the country, such that, in the event of loss of transmission lines, power can be locally generated and distributed.
- Use of concrete/steel structures with properly designed foundations on the transmission and distribution networks.
- Construction of parallel/contingency transmission network, such that the grid can be compliant with the N-1, N-2, and N-1-1 contingencies requirement of the National Grid Code.
- Implement self-healing smart distribution solution in densely populated areas/villages or communities and towns.

- Use of submarine class underground distribution network where applicable; and
- Ensure strict transmission and distribution network maintenance schedule using modern technology and methods.

26 Cost Benefit Analysis of Investment Projects

The proposed investment in the current Development and Expansion Programmes are geared towards not just responding to the energy demands of the nation, but to pre-emptively prove the energy that will provide a solid foundation for economic growth. In this context the interventions in this D&E will have a meaningful impact on national growth and development.

27 Appendix 1 – Medium to Long Term Demand Forecast

The medium to long term forecast is premised on a 5-year average growth factor that comprises a combination of planned infrastructural developments and historical demand trends.The following tables summarise the medium to long term demand forecast projections for the GPL power systems.

Table 1: Total GPL Power System Forecast: 2029 to 2038

Total GPL Power Systems	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Gross Generation (GWh)	3,048.64	3,293.51	3,392.27	3,493.73	3,645.28	3,731.73	3,821.51	3,914.75	4,011.56	4,112.07
Aux Demand (GWh)	85.76	92.65	95.43	98.28	102.54	93.38	95.62	97.96	100.38	102.89
Net Export (GWh)	2,962.88	3,200.86	3,296.84	3,395.45	3,542.74	3,638.35	3,725.88	3,816.79	3,911.18	4,009.18
Total Losses (%)	9.36%	8.76%	8.16%	7.56%	6.96%	6.36%	6.21%	6.11%	6.01%	5.91%
Technical Losses (%)	6.78%	6.68%	6.58%	6.48%	6.38%	6.28%	6.18%	6.08%	5.98%	5.88%
Non-Technical Losses (%)	2.58%	2.08%	1.58%	1.08%	0.58%	0.08%	0.03%	0.03%	0.03%	0.03%
Total Losses (GWh)	267.08	269.60	258.18	245.82	235.53	220.31	220.22	221.96	223.73	225.51
Sales (GWh)	2,695.80	2,931.26	3,038.66	3,149.62	3,307.20	3,418.04	3,505.66	3,594.83	3,687.45	3,783.66
Load Factor (pu)	0.76	0.77	0.76	0.76	0.76	0.77	0.78	0.79	0.80	0.81
Peak Demand (MW)	457.18	487.25	508.04	523.24	545.92	551.61	557.65	564.03	570.76	577.84

Table 2: DBIS Forecast: 2029 to 2038

DBIS	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Gross Generation (GWh)	2,879.86	3,111.25	3,204.71	3,300.56	3,443.64	3,525.29	3,610.13	3,698.24	3,789.68	3,884.62
Aux Demand (GWh)	76.28	82.41	84.88	87.42	91.21	93.38	95.62	97.96	100.38	102.89
Net Export (GWh)	2,803.58	3,028.84	3,119.82	3,213.14	3,352.42	3,431.91	3,514.51	3,600.29	3,689.30	3,781.73
Total Losses (%)	9.07%	8.47%	7.88%	7.28%	6.68%	6.09%	5.94%	5.85%	5.75%	5.66%
Technical Losses (%)	6.49%	6.39%	6.29%	6.20%	6.10%	6.01%	5.91%	5.82%	5.72%	5.62%
Non-Technical Losses (%)	2.58%	2.08%	1.58%	1.08%	0.58%	0.08%	0.03%	0.03%	0.03%	0.03%
Total Losses (GWh)	254.19	256.58	245.70	233.91	224.08	208.95	208.85	210.51	212.18	213.88
Sales (GWh)	2,549.38	2,772.26	2,874.12	2,979.23	3,128.35	3,222.96	3,305.66	3,389.78	3,477.12	3,567.85
Load Factor (pu)	0.76	0.77	0.76	0.76	0.76	0.77	0.78	0.79	0.80	0.81
Peak Demand (MW)	432.57	461.25	481.36	495.76	517.25	522.64	528.35	534.40	540.77	547.47

Table 3: Anna Regina Forecast: 2029 to 2038

Anna Regina	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Gross Generation (GWh)	118.48	127.98	131.69	135.60	141.53	144.93	148.39	151.99	155.75	159.67
Aux Demand (GWh)	9.34	10.09	10.38	10.69	11.16	0.00	0.00	0.00	0.00	0.00
Net Export (GWh)	109.14	117.89	121.31	124.91	130.38	144.93	148.39	151.99	155.75	159.67
Total Losses (%)	8.22%	7.69%	7.17%	6.64%	6.12%	5.59%	5.46%	5.37%	5.29%	5.20%
Technical Losses (%)	5.96%	5.88%	5.79%	5.70%	5.61%	5.52%	5.44%	5.35%	5.26%	5.17%
Non-Technical Losses (%)	2.25%	1.82%	1.38%	0.94%	0.51%	0.07%	0.03%	0.03%	0.03%	0.03%
Total Losses (GWh)	8.97	9.07	8.69	8.30	7.98	8.11	8.11	8.17	8.23	8.30
Sales (GWh)	100.18	108.83	112.62	116.61	122.40	136.82	140.29	143.82	147.52	151.37
Load Factor (pu)	0.75	0.75	0.75	0.75	0.75	0.76	0.77	0.78	0.79	0.80
Peak Demand (MW)	18.03	19.48	20.04	20.64	21.54	21.77	22.00	22.24	22.51	22.78

Table 4: Bartica: 2029 to 2038

Bartica	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Gross Generation (GWh)	37.47	40.42	41.59	42.86	44.78	45.81	46.90	48.04	49.24	50.48
Aux Demand (GWh)	0.04	0.04	0.04	0.05	0.05	0.00	0.00	0.00	0.00	0.00
Net Export (GWh)	37.43	40.38	41.55	42.82	44.73	45.81	46.90	48.04	49.24	50.48
Total Losses (%)	8.51%	7.97%	7.42%	6.88%	6.33%	5.78%	5.65%	5.56%	5.47%	5.38%
Technical Losses (%)	6.17%	6.08%	5.98%	5.89%	5.80%	5.71%	5.62%	5.53%	5.44%	5.35%
Non-Technical Losses (%)	2.35%	1.89%	1.44%	0.98%	0.53%	0.07%	0.03%	0.03%	0.03%	0.03%
Total Losses (GWh)	3.19	3.22	3.08	2.94	2.83	2.65	2.65	2.67	2.69	2.71
Sales (GWh)	34.25	37.16	38.47	39.88	41.90	43.16	44.25	45.37	46.55	47.77
Load Factor (pu)	0.76	0.84	0.85	0.85	0.85	0.86	0.87	0.88	0.89	0.90
Peak Demand (MW)	5.63	5.49	5.59	5.76	6.01	6.08	6.15	6.23	6.32	6.40

Table 5: Leguan Forecast: 2029 to 2038

Leguan	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Gross Generation (GWh)	6.38	6.89	7.09	7.31	7.63	7.81	7.99	8.19	8.39	8.60
Aux Demand (GWh)	0.04	0.04	0.04	0.05	0.05	0.00	0.00	0.00	0.00	0.00
Net Export (GWh)	6.34	6.85	7.05	7.26	7.58	7.81	7.99	8.19	8.39	8.60
Total Losses (%)	6.49%	6.07%	5.66%	5.24%	4.83%	4.41%	4.31%	4.24%	4.17%	4.10%
Technical Losses (%)	4.70%	4.63%	4.56%	4.49%	4.42%	4.35%	4.28%	4.21%	4.15%	4.08%
Non-Technical Losses (%)	1.79%	1.44%	1.10%	0.75%	0.40%	0.06%	0.02%	0.02%	0.02%	0.02%
Total Losses (GWh)	0.41	0.42	0.40	0.38	0.37	0.34	0.34	0.35	0.35	0.35
Sales (GWh)	5.93	6.43	6.65	6.88	7.21	7.46	7.65	7.84	8.04	8.25
Load Factor (pu)	0.77	0.77	0.77	0.77	0.78	0.79	0.80	0.81	0.82	0.83
Peak Demand (MW)	0.95	1.02	1.05	1.08	1.12	1.13	1.14	1.15	1.17	1.18

Table 6: Wakenaam Forecast: 2029 to 2038

Wakenaam	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Gross Generation (GWh)	6.44	6.97	7.18	7.40	7.71	7.90	8.09	8.28	8.49	8.70
Aux Demand (GWh)	0.07	0.07	0.07	0.08	0.08	0.00	0.00	0.00	0.00	0.00
Net Export (GWh)	6.38	6.90	7.11	7.32	7.63	7.90	8.09	8.28	8.49	8.70
Total Losses (%)	4.99%	4.67%	4.35%	4.03%	3.71%	3.39%	3.31%	3.25%	3.20%	3.15%
Technical Losses (%)	3.61%	3.56%	3.50%	3.45%	3.40%	3.34%	3.29%	3.24%	3.19%	3.13%
Non-Technical Losses (%)	1.38%	1.11%	0.84%	0.58%	0.31%	0.04%	0.02%	0.02%	0.02%	0.02%
Total Losses (GWh)	0.32	0.32	0.31	0.29	0.28	0.27	0.27	0.27	0.27	0.27
Sales (GWh)	6.06	6.58	6.80	7.02	7.35	7.63	7.82	8.01	8.22	8.43
Load Factor (pu)	0.75	0.76	0.76	0.76	0.76	0.77	0.78	0.79	0.80	0.81
Peak Demand (MW)	0.98	1.05	1.08	1.11	1.16	1.17	1.18	1.20	1.21	1.23

28 Appendix 2 – Summary of Project Plas per Region

28.1 Existing Infrastructure Summary as per Locations

Table 1: GPL Existing Infrastructure as per Geographic Regions

Existing GPL			
Regions	**List**	**Demographic**	**Existing Infrastructure**
Region 2	1	Essequibo Coast	Anna Regina Power Plant
			13.8 kV Distribution Networks
Region 3	1	West Bank Demerara	Vreed-en-hoop Substation
	2		Vreed-en-hoop Power Plant
	3	West Coast Demerara	Edinburgh Substation
	4	Essequibo Islands	Leguan Power Plant
			4.16 kV Distribution Networks
	5	Essequibo Islands	Wakenaam Power Plant
			13.8 kV Distribution Networks
Region 4	1	Georgetown	New Sophia Substation
	2	Georgetown	Old Sophia Substation
	3	Georgetown	New Georgetown Substation
	4	Georgetown	Kingston Substation
	5	Georgetown	Kingston II - DP3 Power Plant
	6	Georgetown	Kingston I - DP2 Power Plant
	7	East Coast Demerara	Good Hope Substation
	8	East Bank Demerara	Golden Grove Substation
	9	East Bank Demerara	Garden of Eden Substation
	10	East Bank Demerara	Garden of Eden - DP1 Power Plant
	11	East Bank Demerara	Garden of Eden - DP5 Power Plant
	12	East Bank Demerara	Garden of Eden - GPL Power Plant
Region 5	1	East Coast Demerara	Columbia Substation
	2	West Coast Berbice	Onverwagt Substation
	3	West Coast Berbice	Onverwagt Power Plant
Region 6	1	Canje- Berbice	Canefield Substation
	2	Canje- Berbice	Canefield Power Plant

Existing GPL			
Regions	**List**	**Demographic**	**Existing Infrastructure**
	3	Corentyne Coast- Berbice	No. 53 Substation
	4	Corentyne- Berbice	Guysuco Power Plant- SEI
Region 7	1	Bartica	Bartica Power Plant
			13.8 kV Distribution Network
Region 10	1	Linden	BOSAI Power Plant
	2	Linden	Linden Electricity Corporation Inc
	3	Linden	Wisma Power Company

28.2 Summary of Development and Expansion Infrastructure as per Regions & Demographic

Table 2: Major Development and Expansion Infrastructure as per Geographic Location

Projects Across Geographic Regions- 1. SCADA & SMART GRID, 2. Installation of Auto reclosers, Sectionalizers, Fault Current Indicators, Smart Capacitor Banks, Voltage Regulators, Circuit Load Balancing, 3. Mobile Substations.			
Regions	**List**	**Demographic**	**D&E Infrastructure**
Region 2	1	Essequibo Coast	Anna Regina Power Plant - Upgraded
	2		13.8 kV Distribution- Upgraded
	3		Essequibo 8 MW PV Solar Project - GuySol
	4		Essequibo 12 MW BESS Project - GuySol
	5		Anna Regina Substation
	6		Onderneeming Substation
Region 3	1	West Bank Demerara	Wales NG 300 MW - 13.8 kV Power Plant
	2	West Bank Demerara	Wales NG 300 MW 69/230 kV Substation
	3	West Bank Demerara	Wales Industrial Substation
	4	West Bank Demerara	Wales Residential/ Commercial Substation
	5	West Bank Demerara	Westminister Substation

Projects Across Geographic Regions-

1. SCADA & SMART GRID,
2. Installation of Auto reclosers, Sectionalizers, Fault Current Indicators, Smart Capacitor Banks, Voltage Regulators, Circuit Load Balancing,
3. Mobile Substations.

Regions	List	Demographic	D&E Infrastructure
	6	West Bank Demerara	Vreed-en-hoop Substation
	7	West Bank Demerara	Vreed-en-hoop Power Plant
	8	West Coast Demerara	Edinburgh Substation
	9	East Bank Essequibo	Hydronie Substation
	10	Essequibo Islands	Leguan Power Plant – Upgraded with additional capacities
	11	Essequibo Islands	Leguan 13.8 kV Distribution Network Upgrades
	12	Essequibo Islands	Leguan Solar PV/BESS
	13	Essequibo Islands	Wakenaam Power Plant
	14	Essequibo Islands	Wakenaam Solar PV/BESS
	15	Essequibo Islands	Wakenaam 13.8 kV Distribution Network Upgrades
Region 4	1	Georgetown	New Sophia Substation
	2	Georgetown	Old Sophia Substation
	3	Georgetown	New Georgetown Substation
	4	Georgetown	Kingston Substation
	5	Georgetown	Kingston II - DP3 Power Plant
	6	Georgetown	Kingston I - DP2 Power Plant
	7	Georgetown	Kingston New Substation
	8	Georgetown	Princes St Substation
	9	East Coast Demerara Mahaica	Good Hope Substation
	10	East Coast Demerara Mahaica	Ogle Substation
	11	East Coast Demerara Mahaica	Enmore/Victoria Substation
	12	East Coast Demerara	Goedverwagting 13.8/69 kV Substation

Projects Across Geographic Regions-

1. SCADA & SMART GRID,
2. Installation of Auto reclosers, Sectionalizers, Fault Current Indicators, Smart Capacitor Banks, Voltage Regulators, Circuit Load Balancing,
3. Mobile Substations.

Regions	List	Demographic	D&E Infrastructure
	13	East Coast Demerara	Goedverwagting 69/230 kV Substation
	14	East Coast Demerara	Guyana National Control Center- GNCC
	15	East Bank Demerara	Golden Grove Substation
	16	East Bank Demerara	Garden of Eden 69/230 kV Substation
	17	East Bank Demerara	Garden of Eden - DP1 Power Plant
	18	East Bank Demerara	Garden of Eden - DP5 Power Plant
	19	East Bank Demerara	Garden of Eden - GPL Power Plant
	20	East Bank Demerara- Highway	Kuru Kururu Substation
	21	East Bank Demerara- Highway	Yarrowkabra Substation
Region 5	1	Mahaica- West Bank Berbice	Columbia Substation
	2	Mahaica- West Bank Berbice	Columbia 28.9 MW Power Plant
	3	Mahaica- West Bank Berbice	Onverwagt Substation
	4	Mahaica- West Bank Berbice	Onverwagt Power Plant
	5	Mahaica- West Bank Berbice	Trafalgar 4 MW PV Project - GUYSOL
	6	Mahaica- West Bank Berbice	Rosignol Substation
Region 6	1	Canje- Berbice	Canefield Substation
	2	Canje- Berbice	Canefield Power Plant
	3	Canje- Berbice	Prospect 3 MW PV Solar Project - GUYSOL
	4	East Berbice Corentyne	Hampshire 3 MW Solar PV Project - GUYSOL
	5	East Berbice Corentyne	Crab Island Substation 230/69 kV Substation
	6	East Berbice Corentyne	Crab Island Substation 69/13.8 kV Substation

Projects Across Geographic Regions- 1. SCADA & SMART GRID, 2. Installation of Auto reclosers, Sectionalizers, Fault Current Indicators, Smart Capacitor Banks, Voltage Regulators, Circuit Load Balancing, 3. Mobile Substations.			
Regions	**List**	**Demographic**	**D&E Infrastructure**
	7	East Berbice Corentyne	Williamsburg 230/69 kV Substation
	8	East Berbice Corentyne	Williamsburgh 69/13.8 kV Substation
	9	Corentyne- Berbice	No. 53 Substation - Upgrade
	10	Corentyne- Berbice	Bushlot Substation
	11	Skeldon- Berbice	Guysuco Power Plant- SEI
Region 7	1	Bartica	Bartica Power Plant
	2	Bartica	13.8 kV Distribution Network
	3	Bartica	1.5 MW Solar PV Project
Region 10	1	Linden	BOSAI Power Plant
	2	Linden	Linden Electricity Corporation Inc
	3	Linden	Wisma Power Company
	4	Linden	Linden 15 MWp Solar PV Project
	5	Linden	Linden 22 MWh Solar PV Project
	6	Linden	Linden-Bamia 230/69 kV Substation
	7	Linden	Linden-Bamia 69/13.9 kV Substation
	8	Linden	McKenzie Substation

28.3 Infrastructure Breakdown as per Geographic Regions and Demographics

28.3.1 Region 2: Essequibo Coast

Existing:

1. Anna Regina 5.4 MW 13.8 kV 60 Hz HFO Power Plant
2. Anna Regina 9.9 MW 13.8 kV 60 Hz LFO Mobile Units
3. Anna Regina 13.8 kV Distribution System- Feeder North
4. Anna Regina 13.8 kV Distribution System- Feeder South
5. Anna Regina 13.8 kV Distribution System- Feeder West
6. Anna Regina 13.8 kV Distribution System- Feeder Caricom

28.3.1.1 Generation Conventional & Renewable

- Installation of 5 MWp Solar Photovoltaic Plant at Onderneeming on the Essequibo Coast.
- Installation of 3.75 MWh BESS at Onderneeming on the Essequibo Coast.
- Installation of 3 MWp Solar Photovoltaic Plant at Charity Essequibo Coast.
- Installation of 2.75 MWh BESS at Charity on the Essequibo Coast.
- Installation of two (2) - 1.8 MW additional HFO generation units.

28.3.1.2 Transmission Lines

- Construction of 27.4 km of single circuit 69 kV transmission line utilizing conductor type Rovinj ACCC (371 kcmil) and steel structures between Onderneeming and Anna Regina Substations (L42).

28.3.1.3 13.8 kV 60 Hz Power Plant Upgrade

- Expansion of 13.8 kV Switchgear at Anna Regina Power Plant by installing two (2) additional cubicles to accommodate one (1) 1.8 MW HFO generator.

28.3.1.4 13.8 kV Distribution System Upgrade

I. Essequibo Coast Solar PV Projects Interconnection

- Construction of 2.34 km new 13.8 kV distribution network utilizing conductor type Cosmos AAC 19 Strand- 477 kcmil and concrete poles to integrate 3 MWp Solar PV and 2.75 MWh Bess into the existing North Feeder at Charity Essequibo Coast.
- Construction of 3.9 km new 13.8 kV distribution network utilizing conductor type Cosmos AAC 19 Strand- 477 kcmil and concrete poles to integrate 5 MWp Solar PV and 3.75 MWh BESS the existing South Feeder at Onderneeming Essequibo Coast.

II. Essequibo Coast Distribution Expansion Plan

- Construction of four (4) 6 km new feeder circuits from Onderneeming Substation utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Construction of four (2) 6 km new feeder circuits from Anna Regina Substation utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Construction of one (1) 10 km Express feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures - from Anna Regina Power Plant to Onderneeming.
- Reconductoring of 8 km South feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Upgrade and extend 17 km of West feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.

- Procuring and installation of 5 smart capacitor banks of capacities of 150 kVAr, 300 kVAr and 450 kVAr throughout the Essequibo Coast.

- Procuring and Installation of 15 auto reclosers throughout Essequibo Coast.
- Procuring and Installation of 20 sectionalisers throughout Essequibo Coast.
- Procuring and Installation of 15 FCIs throughout Essequibo Coast.
- Circuit load balancing to be conducted on four selected feeders.

28.3.1.5 New Substation

ANNA REGINA 20 MVA 13.8/69 kV SUBSTATION

- Construction of one new 13.8/69 kV substation by installing:
    (1) Three - breaker and ½ 69 kV switchgear.
    (2) 3 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (3) Two - 10 MVA 13.8/69 kV Transformers.
- Termination of the line from Onderneeming Substation into AIS bay.

ONDERNEEMING 20 MVA 13.8/69 kV SUBSTATION

- Construction of one new 13.8/69 kV substation by installing:
    (1) Three - breaker and ½ 69 kV switchgear.
    (2) 11 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (3) Two - 10 MVA 13.8/69 kV Transformers.
- Termination of the line from Anna Regina Substation into AIS bay.

28.3.2 Region 3: Essequibo Islands

Leguan Existing:

1. Leguan 1.23 MW 480V 60 Hz LFO Power Plant- Caterpillar
2. Leguan 4.16 kV Distribution System - East Feeder
3. Leguan 4.16 kV Distribution System – North/West Feeder

Wakenaam Existing:

1. Wakenaam 1.145 MW 4.16 kV 60 Hz Power Plant
2. Wakenaam 13.8 kV Distribution System- South Feeder
3. Wakenaam 13.8 kV Distribution System- North Feeder

28.3.2.1 Generation Conventional & Renewable

Leguan Power Plant and Renewable Projects

- Installation of one- 0.6 MWp Solar Photovoltaic Plant.
- Installation of one- 0.6 MWh BESS.
- Installation of one (1) 410 kW 480 V LFO generation unit – Phase 1 (2023).

- Installation of two (2) 410 kW 480 V LFO generation unit – Phase 2 (2024).

Wakenaam Power Plant and Renewable Projects

- Installation of one 750 kWp Solar PV Plant.
- Installation of one 1.15 kWh BESS.
- Installation of one (1) 410 kW 480 V LFO generation unit – Phase 1 (2023).
- Installation of two (2) 410 kW 480 V LFO generation unit – Phase 2 (2024).

28.3.2.2 13.8 kV 60 Hz Power Plant Upgrade

Leguan Power Plant Upgrade

- Installation of three (3) 750 kVA 0.48/13.8kV Power Transformer.

Wakenaam Power Plant Upgrade

- Installation of 13.8 kV Metal Clad 6 cubicles Switchgear.
- Installation of two -1 MVA 0.48/13.8 kV Transformers.
- Installation of 8 - 480 V cubicle switchgear.

28.3.2.3 13.8 kV Distribution System Upgrades

I. Leguan 13.8 kV Distribution Upgrade

1. Leguan 4.16 kV Distribution Network Upgrade (under the 0.6 kWp Solar PV/BESS Project):

- Installation of one (1) OVR-15 Auto Recloser on overhead bus at the power plant at the beginning of the interconnecting feeder:
- Replacing of 46 0.24/4.16 kV distribution transformer with 0.24/13.8 kV to facilitate the conversion of the distribution network voltage from 4.16 kV to 13.8 kV.
- Upgrade and extend 1.27 km of 13.8 kV distribution network utilizing Tulip AAC 19 Strand- 336.4 kcmil and concrete pole structures to integrate the 0.6 MWp Solar PV/BESS Plant with Power Plant at Enterprise.

2. Leguan Distribution Expansion Plan

- Procuring and Installation of 2 additional auto reclosers on selected feeders.
- Procuring and Installation of 3 feeder FCIs on selected feeders.
- Procuring and installation of 2 smart capacitor banks on selected feeders.
- Circuit load balancing to be conducted on three feeders.

II. Wakenaam Distribution Expansion Plan

- Procuring and Installation of 2 auto reclosers on selected feeders.
- Procuring and Installation of 2 feeder FCIs on selected feeders.
- Procuring and installation of 1 smart capacitor bank on selected feeder.

- Circuit load balancing to be conducted on two selected feeders.

28.3.3 Region 3: East Bank Essequibo

28.3.3.1 Generation Conventional & Renewable

- No power plant to be built within the planning period of the D&E.

28.3.3.2 Transmission

- L33 - Ref: Section 28.3.6.1.2
- L8 - Ref: Section 28.3.6.1.3

28.3.3.3 New Substation

HYDRONIE 50 MVA 13.8/69 kV AIS SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:
  (1) Two (2) breaker and ½ 69 kV switchgear.
  (2) 11 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
  (3) Two (2) 25 MVA 13.8/69 kV Transformers.
  (4) Six (6) 5 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.
- Termination of transmission lines from Edinburgh (L8) into 69 kV AIS Bay.
- Termination of transmission line from Wales R/C (L33) into 69 kV AIS Bay.

28.3.4 Region 3: West Coast Demerara

28.3.4.1 Conventional Generation Project

- No power plant to be built within the planning period of the D&E.

28.3.4.2 Transmission

- L8 - Ref: Section 28.3.6.1.3
- Splitting of 69 kV transmission line that runs between Edinburgh and Hydronie Substations L8 into Tuschen Substation.

28.3.4.3 Existing Substation

EDINBURGH 20 MVA 13.8 /69 kV SUBSTATION

- Installation of one additional 20 MVA 13.8/69 kV transformer.
- Installation of one AIS 69 kV bay to accommodate the new 20 MVA 13.8/69 kV transformer.
- Installation of one AIS 69 kV bay to accommodate one new transmission line (L8) from Hydronie (EBE) Substation.
- Termination of transmission line from Hydronie (L8) into 69 kV AIS Bay.
- Installation of 15 kV Metal Clad 8 cubicle switchgear with all relevant ancillary services.

EDINGBURGH 10 MVAR DETUNE STATIC COMPENSATOR PROJECT

- Installation of 10 MVAr detuned static compensator bank.
- Expansion of Edinburgh 69 kV substation by installing one AIS 69 kV bay to facilitate the interconnection of the 10 MVAr Detuned Static Compensator.

28.3.4.4 13.8 kV Distribution Network

Edinburgh Distribution Expansion Plan

- Reconductoring of 94 km F2 feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures
- Construction of two (2) 2 km new feeder circuits utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Construction new feeder priority circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM on concrete structures of an approximate length of 2 km.

28.3.4.5 New Substation

TUSCHEN 50 MVA 13.8/69 kV AIS SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:
    (1) Four (4) breaker and ½ 69 kV switchgear.
    (2) 13 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (3) Two - 25 MVA 13.8/69 kV Transformers.
    (4) Three (3) 8 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.
- Splitting of L8 Transmission line into 69 kV AIS Bays.
- Splitting of L33 Transmission line into 69 kV AIS Bays.

28.3.5 Region 3: West Bank Demerara

28.3.5.1 Conventional Generation Project

- Government of Guyana to construction one 300 MW Combined Cycle Power Plant and Natural Gas Liquids (NGL) Plant at Wales through EPC contractor.

28.3.5.2 Transmission

- Construction of three (3) 0.55 km of new 69 kV tie lines considering two (2) wire per phase utilizing conductor type Rovinj ACCC (371 kcmil) linking Wales 300 MW 13.8/69/230 kV NG GSU Substations with Wales Industrial Substations.
- Construction of 7.6 km of new double circuit 69 kV transmission lines utilizing conductor type Rovinj ACCC (371 kcmil) between Wales Ind. and Wales R/C Substations (L30 & L30P).
- Construction of 18.6 km of new double circuit 69 kV transmission line utilizing conductor type Rovinj ACCC (371 kcmil) between Vreed-en-hoop Substation and Wales R/C Substations (L31).
- L33: Ref Sect: 28.3.6.1.2

- Splitting of 69 kV transmission line that runs between Wales R/C and Hydronie Substations L33 into Westminster Substation.
- Splitting of 69 kV transmission line that runs between Wales R/C and Vreed-en-Hoop Substations L31 & L31P into Westminster Substation.
- HVL1, HV L1 P: Ref Sect: 28.3.15.1.2.

28.3.5.3 Existing Substation

VREED-EN-HOOP 40 MVA13.8/69 kV SUBSTATION

- Replacement of one 20 MVA 13.8/69 kV transformer that was transferred to Edinburgh Substation.
- Installation of one AIS 69 kV bays to accommodate one new transmission line (LS6 P) from Kingston Substation.
- Installation of two AIS 69 kV bays to accommodate two new transmission line (L31 and L31 P) from Wales R/C Substation.
- Termination of transmission lines from Wales R/C into 69 kV AIS Bays.
- Installation of one AIS 69 kV tie bay to accommodate 69 kV bus bar extension.
- Repairing Transformer Incomer 13.8 kV cubicle
- Installation of three (3) additional 13.8 kV cubicles to accommodate more feeders.

28.3.5.4 13.8 kV 60 Hz Power Plant Upgrade

VREED-EN-HOOP – DP4 26.6 MW 13.8 kV 60 HZ POWER PLANT

- Upgrade of grounding transformer at DP4 by installing one new grounding transformer with capacities of 1.1 MVA.
- Installation of three (3) Neutral Earthing Resistor on each generator neutral point to ground.
- Integration into GPLs SCADA System

28.3.5.5 13.8 kV Distribution Network

Vreed-en-hoop Distribution Expansion Plan

- Construction of one (1) 3 km new priority feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.

28.3.5.6 New Substation

WALES 300 MW NG POWER EVACUATION 230 kV SUBSTATION

- Construction of one new AIS 230 kV substation by installing:

(1) double bus single breaker 230 kV bays; amount to be determined by EPC contractor.
(2) 1 bus ties single breaker 230 kV bays.
(3) 13.8/230 kV Power Transformers; amount and capacities to be determined by EPC contractor.
(4) Three (3) 125MVA 69/230 kV Power Transformers.
(5) 13.8 kV Switchgear and ancillary components; amount and capacities to be determined by EPC contractor.

- Termination of 13.8 kV out-going power cables from 300 MW NG Power Plant into 13.8 kV bushings of Power transformer units.
- Termination of double circuit 230 kV transmission lines (Ref Sect: 28.3.15.1.2.) from 69/230 kV Goedverwagting (ECD-Region 4) Substation into 230 kV AIS Bays.
- Termination of three (3) tie lines from Wales Ind. on to 69 kV bushing of three (3) 125 MVA 69/230 kV Power Transformers units.

WALES INDUSTRIAL 120 MVA 13.8/69 kV AIS SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:

(1) Five (5) breaker and ½ 69 kV switchgear.
(2) 15 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
(3) Two (2) 60 MVA 13.8/69 kV Transformers.
(4) Eight (8) 4 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.

- Termination of three (3) tie lines from Wales 250-300 MW NG Power Evacuation Substation into 69 kV AIS Bays.
- Termination of double transmission lines from Wales R/C into 69 kV AIS Bays.

WALES RESIDENTIAL/COMMERCIAL 105 MVA13.8/69 kV SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:

(1) Four breaker and ½ 69 kV switchgear.
(2) 23 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
(3) Three (3) 35 MVA 13.8/69 kV Transformers.
(4) Fifteen (15) 5 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.

- Termination of double transmission lines from Wales Ind. into 69 kV AIS Bays.
- Termination of two (2) transmission lines from Vreed-en-hoop into 69 kV AIS Bay.

- Termination of transmission line from Hydronie into 69 kV AIS Bay.

28.3.6 Region 3: Across Demographic Areas

28.3.6.1 Transmission

28.3.6.1.1 East Bank Essequibo-Essequibo Islands

- No Line to be built within the planning period of the D&E.

28.3.6.1.2 West Bank Demerara- East Bank Essequibo

- Construction of 36 km of new 69 kV transmission line utilizing conductor type Rovinj ACCC (371 kcmil) between Wales R/C (WBD) substation and Parika/Hydronie (EBE) Substations (L33).

28.3.6.1.3 West Coast Demerara- East Bank Essequibo

- Construction of 16 km of new 69 kV transmission line utilizing conductor type Canton AAAC 19 Strands (395 kcmil) and concrete poles between Edinburgh (WCD) and Parika/Hydronie (EBE) Substations (L8).

28.3.6.1.4 West Bank Demerara- West Coast Demerara

- No Line to be built within the planning period of the D&E.

28.3.7 Region 4: Georgetown

28.3.7.1 Generation Conventional & Renewable Projects

- Installation of 8 x 3.92 MWh 69 kV BESS at New Sophia
- Installation of 5 x 3.92 MWh 13.8 kV BESS at Kingston

28.3.7.2 Transmission Lines

- Construction of 5.78 km of new 69 kV transmission line utilizing conductor type Rovinj ACCC (371 kcmil) and concrete structures between New Kingston and Princess Street Substations (L11-1).
- Construction of 3.39 km of new 69 kV transmission lines utilizing conductor type Rovinj ACCC (371 kcmil) between Princess Street and New Georgetown Substations (L11-2).
- Construction of 4.86 km of new single circuit 69 kV transmission line split utilizing conductor type Rovinj ACCC (371 kcmil) with steel poles and concrete foundation between New Sophia and Ogle Substations (L16-1).

- Construction of 4.86 km of new single circuit 69 kV transmission line split utilizing conductor type Rovinj ACCC (371 kcmil) with steel poles and concrete foundation between New Sophia and Ogle Substations (L16-P).
- Upgrade the less than 0.34 km existing 69 kV link utilizing conductor type Rovinj ACCC (371 kcmil) between Old Sophia and New Sophia (L12 & L13), this will increase the transfer capacity of existing link, which will be useful as the demand increases throughout the DBIS.
- Construction of 5 km of double circuit 69 kV transmission lines utilizing conductor type Drake ACSR (795 kcmil) and concrete structures between Kingston and Old Sophia Substations (L5 upgraded & L5P).
- Construction of 4.4 km of upgraded 69 kV transmission lines utilizing conductor type Rovinj ACCC (371 kcmil) between Old Sophia and New Georgetown Substations (L10 Upgraded).
- Upgrade and Splitting of L4- (New Sophia- Golden Grove) ref: Sect 28.3.10.1.228.3.10.1.2
- Upgrade and splitting of L2- (Old Sophia- Golden Grove) ref: Sect 28.3.10.1.2
- LS6 P (ref: sect 28.3.15.1.2)28.3.10.1.2

28.3.7.3 Existing Substation

OLD SOPHIA 35 MVA 13.8/69 kV AIS SUBSTATION

- Installation of one AIS 69 kV bay to accommodate one new transmission line (L5P) from Kingston.
- Termination of transmission lines (L5 & L5P) from Kingston into 69 kV AIS Bays.

UPGRADE:

- Relocation of Tx 1- ABB 16.8 MVA-13.8/69 kV to replace the damaged Tx 1- Westinghouse 16.7 MVA-13.8/69 kV at GOE.
- Decommission of Tx 3- Westinghouse 16.7 MVA-13.8/69 kV.
- Installation of one new 35 MVA 13.8/69 kV transformer into existing AIS 69 kV bay (former Tx1 69 kV AIS bay).
- Installation of 15 cubicle -15 kV 2000 Amps Metal-clad enclosed Switchgear.
- Renovation of the control room building and switchgear facility.
- Installation of an additional new 35 MVA 13.8/69 kV transformer into existing AIS 69 kV bay (former Tx2 69 kV AIS bay).
- L5 protection relay upgrade

NEW SOPHIA 69KV SWITCHING AIS SUBSTATION

- Termination of the L16P into the existing 69 kV bay. 69 kV bay is already in place; 69 kV bay is already in place.
- Installation 8 x 3.92 MWh BESS into available 69 kV AIS bay.

NEW SOPHIA 15 MVAR DETUNED STATIC COMPENSATOR

- Installation of 15 MVAR Detuned Static Compensator.
- Installation of two breaker ½ bay to accommodate 15 MVAr detuned static compensator.

NEW GEORGETOWN 33.4 MVA 13.8/69 kV AIS SUBSTATION

- Installation of one AIS 69 kV bay to accommodate one new transmission line from Central Georgetown Substation (Princes St).
- Installation of two (2) new 25 MVA 13.8/69 kV Transformer- upgrading of existing 16.7 MVA capacities.
- Termination of the L11-2 into the new 69 kV bay.
- Termination of the upgraded L10 into the existing 69 kV bay.

KINGSTON 70 MVA 13.8/69KV AIS SUBSTATION

- Installation of one AIS 69 kV bay to accommodate one new transmission line (L5P) from O/Sophia.
- Termination of the L5 P into the new 69 kV AIS bay.
- Termination of the L5 into the existing 69 kV AIS bay.
- Installation of one AIS 69 kV bay to accommodate one new transmission line (L11-1) from Princess Street Substation.
- Termination of the L11-1 into the new 69 kV AIS bay.
- Installation of one AIS 69 kV bay to accommodate one new transmission line (LS6 P) from Vreed-en-Hoop Substation.
- Termination of the LS6 P into the new 69 kV AIS bay.
- Upgrade of current 69 kV Busbar to 3000 A rating.

28.3.7.4 13.8 kV 60 Hz Power Plant Upgrade

KINGSTON II- DP3 36 MW 13.8 kV 60 HZ POWER PLANT

- Upgrade of grounding transformer at DP3 by installing 2 grounding transformers with capacities of 2.5 MVA each.
- Upgrade of 15 kV class 18 cubicle switchgear to 60 kA SC rating at DP3.

- Integration of power plant into GPLs SCADA System

KINGSTON I- DP2 22 MW 13.8 kV 60 HZ POWER PLANT

- Upgrade of tie-lines between DP2 and DP3 (DP2-F1 & DP2 F2) by installing approximately 1275 meters of 1 single core 400 mm^2 XLPE cables place in cable underground raceway.
- Upgrade of 15 kV class 9 cubicle switchgear to 60 kA SC rating at DP2.
- Integration of power plant into GPLs SCADA System

28.3.7.5 13.8 kV Distribution Network

I. Old Sophia Distribution Expansion Plan

- Construction of four (4) 4 km new feeder circuits utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Construction of one (1) 4 km new priority feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.

II. Kingston II- DP3 Distribution Expansion Plan

- Construction of one (1) 3 km new priority feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.

III. New Georgetown Distribution Expansion Plan

- Reconductoring of 17.25 km F1 feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.

28.3.7.6 New Substation

PRINCES ST, CENTRAL GEORGETOWN GIS 120 MVA 13.8/69 kV SUBSTATION

- Construction of one new GIS 13.8/69 kV substation by installing:
    (1) Three - breaker and ½ 69 kV switchgear.
    (2) 13 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (3) Two - 60 MVA 13.8/69 kV Transformers.
    (4) Eight (8) 4 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.
- Termination of the line from Kingston New Substation into AIS bay.
- Termination of the line from New Georgetown Substation into AIS bay.

KINGSTON NEW GIS 120 MVA 13.8/69 kV SUBSTATION

- Construction of one new GIS 13.8/69 kV substation by installing:

(1) Three (3) - breaker and ½ 69 kV switchgear.
(2) 17 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
(3) Two (2)- 60 MVA 13.8/69 kV Transformers.
(4) Eight (8) 4 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.

- Termination of the line from Princess Street Substation into AIS bay.

28.3.8 Region 4: East Coast Demerara- up to Mahaica

28.3.8.1 Generation Conventional & Renewable Projects

- No power plant to be built within the planning period of the D&E.

28.3.8.2 Transmission

- L17 P (parallel circuit to existing L17): Ref. Sect 28.3.15.1.3

69 kV Transmission Line Splits (L17/L17P)- Enmore Substation:

- Splitting of new 69 kV transmission line that run between Good Hope and Columbia Substations L17 into Enmore Substation.
- Splitting of existing 69 kV transmission line that run between Good Hope and Columbia Substations L17 P into Enmore Substation.

69 kV Transmission Line Splits - Ogle Substation:

- Splitting of new double circuit 69 kV transmission line that runs between New Sophia and Good Hope Substation L16 & L16P into Ogle Substation.

69 kV Transmission Line Splits - Goedverwagting Substation:

- Splitting of upgraded 69 kV transmission line that runs between New Sophia and Golden Grove Substations L4 - into Goedverwagting Substation.
- Splitting of upgraded 69 kV transmission line that runs between Old Sophia and Golden Grove Substations L2 - into Goedverwagting Substation.

New 69 kV Transmission Lines as a Result of L 4 - Upgraded/L2 Upgrade splits into Goedverwagting: -

- L 4-2 Upgraded (New Sophia- Goedverwagting)- ref: Sect 28.3.10.1.2
- L 2-2 Upgraded (Old Sophia- Goedverwagting)- ref: Sect 28.3.10.1.2
- L 4-1 Upgraded (Goedverwagting - Golden Grove)- ref: Sect 28.3.10.1.2
- L 2-1 Upgraded (Goedverwagting – Golden Grove)- ref: Sect 28.3.10.1.2

- Construction of 12.7 km of new double circuit 69 kV transmission lines utilizing conductor type Rovinj ACCC (371 kcmil) between Goedverwagting and Ogle Substations - L25 & L25P
- Construction of 22.4 km of new 69 kV transmission lines utilizing conductor type Rovinj ACCC (371 kcmil) between Enmore and Ogle Substations – L26.
- Construction of 4.64 km of new 69 kV transmission lines utilizing conductor type Rovinj ACCC (371 kcmil) between Goedverwagting and LBI Substations – L27.

28.3.8.3 Existing Substation

GOOD HOPE 35 MVA 13.8/69KV SUBSTATION

- Installation of one AIS 69 kV bay to accommodate one new transmission line (L16P) from Ogle Substation.
- Termination of L16 P into substation 69 kV AIS Bay.
- Installation of one AIS 69 kV bay to accommodate one transmission line (L17P) from Enmore/Victoria Substation.
- Termination of L17 P into substation 69 kV AIS Bay.
- Replacement of one (1) 35-MVA 13.8/69 kV Crompton Greeves transformer.
- Installation of four (4) 630 Amps circuit breakers 15 kV Class Metal clad Switchgears.
- Installation of three (3) 2000 Amps circuit breakers 15 kV Class Metal clad Switchgears.
- Upgrade of existing 13.8 kV busbar to 2000 Amps

28.3.8.4 13.8 kV Distribution Network

Good Hope Distribution Expansion Plan

- Construction of one (1) 4 km new priority feeder circuits utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Reconductoring of 29.6 km F4 feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Construction of two (2) 6 km new feeder circuits utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.

28.3.8.5 New Substation

GOEDVERWAGTING 750 MVA 69/ 230 kV AIS SUBSTATION

- Construction of one new AIS 230 kV substation by installing:

    (1) 6 double bus single breaker 230 kV bays.
    (2) 1 bus ties single breaker 230 kV bays.

(3) Two (2) 375 MVA 69/230 kV Power Transformers

- Termination of double circuit 230 kV transmission lines from Wales 300 MW NG Power Evacuation 230 kV Substation into AIS 230 kV bays.
- Termination of double circuit 230 kV transmission lines from Williamsburg 230 kV Substation into AIS 230 kV bays.

GOEDVERWAGTING 120 MVA 13.8/69 kV AIS SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:
  (1) Six (6) breaker and ½ 69 kV switchgear.
  (2) 13 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
  (3) Two- 60 MVA 13.8/69 kV Transformers.
  (4) Eight (8) 5 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.
- Termination of two (2) incoming tie lines from two (2) 300 MVA 69 kV/230 kV transformer into AIS 69 kV Bays.
- Termination of double transmission lines from Golden Grove Substation (L2-1, L4-1) into 69 kV AIS Bays.
- Termination of transmission lines from Old Sophia Substation (L2-2) into 69 kV AIS Bay.
- Termination of transmission lines from New Sophia Substation (L4-2) into 69 kV AIS Bay.
- Termination of double transmission lines from Ogle Substation (L25, L25P) into 69 kV AIS Bays.
- Termination of transmission line from LBI Substation (L27) into 69 kV AIS bay.

OGLE 120 MVA 13.8/69 kV AIS SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:
  (1) Five-breaker and ½ 69 kV switchgear.
  (2) 18 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
  (3) Two- 60 MVA 13.8/69 kV Transformers.
  (4) Nine (9) 6 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.
- Termination of double transmission lines from New Sophia into 69 kV AIS Bays.
- Termination of double transmission lines from Good Hope into 69 kV AIS Bays.
- Termination of double transmission lines from Goedverwagting into 69 kV AIS Bays.

- Termination of a transmission line (L26) from Enmore/Victoria Substation into 69 kV AIS Bays.

ENMORE/VICTORIA 50 MVA 13.8/69 kV SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:
    (1) Four-breaker and ½ 69 kV switchgear.
    (2) 11 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (3) Two- 25 MVA 13.8/69 kV Transformers.
    (4) Five (5) 6 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.
- Termination of double transmission lines from Good Hope into 69 kV AIS Bays.
- Termination of double transmission lines from Columbia into 69 kV AIS Bays.

LBI 70 MVA 69/13.8 kV SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:
    (1) Four-breaker and ½ 69 kV switchgear.
    (2) 13 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (3) Two (2) 35 MVA 13.8/69 kV Transformers.
    (4) Four (4) new 5 km feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.
- Termination of a transmission line from Ogle Substation into 69 kV AIS Bay.
- Termination of a transmission line from Enmore/Victoria Substation into 69 kV AIS Bay.
- Termination of a transmission line from Goedverwagting Substation into 69 kV AIS Bay.

28.3.9 Region 4: East Bank Demerara

28.3.9.1 Generation Conventional & Renewable Projects

- Install 3 x 3.92 MWh 13.8 kV BESS at Golden Grove.

28.3.9.2 Transmission

New 230 kV Transmission Line

- HVL1, HV L1 P: ref Sect: 28.3.15.1.2

69 kV Transmission Line Upgrade

- Construction of 11.9 km of upgraded 69 kV transmission lines utilizing conductor type Rovinj ACCC (371 kcmil) between Garden of Eden and Golden Grove Substations- L1 Upgraded.
- Construction of 11.8 km of upgraded 69 kV transmission lines utilizing conductor type Rovinj ACCC (371 kcmil) between Garden of Eden and Golden Grove Substations- L3 Upgraded.

New 69 kV Transmission Line

- Construction of 15.7 km of double circuit 69 kV transmission lines utilizing conductor type Rovinj ACCC (371 kcmil) between Garden of Eden and Kuru Kururu Substations - L35, L35-P.
- Construction of 8.4 km of new transmission line utilizing conductor type Rovinj ACCC (371 kcmil) between Kuru Kururu and Yarrowkabra Substations- L36.
- L37 and L37P see Ref: Sect. 28.3.15.1.6)

28.3.9.3 Existing Substation

GOLDEN GROVE 20 MVA 13.8/69 kV SUBSTATION

- Installation of two (2) new 25 MVA 13.8/69 kV transformer to replace existing capacities.
- Replace the existing UniGear 550 12 cubicle 1250 A - 25 kA/3 Sec - 15 kV Class Metal Clad Switchgear with 16 cubicles rated at 2000 A - 40 kA/3 sec – 15 kV Class Metal Clad Switchgear.
- Upgrade of Station Use- Grounding Transformer combination of rating 1700 kVA-100 kVA for Station Use, 786 Amps 10 Sec rating with Neutral Earthing resistor taps 5-10 ohms.

GARDEN OF EDEN 33.4 MVA 13.8/69KV SUBSTATION

- Replace damaged Tx 1- Westinghouse 16.7 MVA 13.8/69 kV with Tx 1- ABB 16.8 MVA-13.8/69 kV from Old Sophia Substation.
- Decommission of Tx 2- Westinghouse 16.7 MVA-13.8/69 kV.
- Installation of one Tx 2 with 35 MVA 13.8/69 kV Campton Greeves transformer (relocated from Good Hope Substation).
- Replace two (2) disconnect switches with two AIS 69 kV bays to accommodate two (2) transformer – 1-16.7 MVA -ABB, 1-35 MVA Campton Greeves.
- Installation of one 15 kV Class Metal clad 9 Cubicle Switchgear.
- Renovation of the Control Room Building and switchgear facility.
- Upgrade of two (2) oil 69 kV circuit breaker with all relevant ancillary components (L1, B1B2-tie breaker).

- Installation of one (1) AIS 69 kV bus tie breaker (B2B3).
- Installation of two (2) AIS 69 kV bays to accommodate double transmission lines from New Kuru Kururu Substation (L35/L35P).
- Termination of double circuit transmission lines from Kuru Kururu Substation into AIS bays.
- Upgrade of 69 kV Relay Protection Scheme
- Integrate power plant and substation to GPL's SCADA System.

28.3.9.4 13.8 kV Distribution Network

I. Golden Grove Distribution Expansion Plan

- Reconductoring of 89.1 km F1 feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Reconductoring of 14.8 km F3 feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.

II. Garden Of Eden Distribution Expansion Plan

- Construction of ring circuit network on GOE F2 linking Yarrowkabra with Airport Network.
- Reconductoring of 94.3 km F1 feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Reconductoring of 32.7 km F2 feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Reconductoring of 19.1 km F3 feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Construction of two (2) 3 km new priority feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.

28.3.9.5 New Substation

KURU KURURU 70 MVA 13.8/69 kV AIS SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:
    (5) Four (4) breaker and ½ 69 kV switchgear.
    (6) 13 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (7) Two - 35 MVA 13.8/69 kV Transformers.
    (8) Six (6) 7 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.

- Termination of double transmission lines from Garden of Eden Substation into 69 kV AIS Bays.
- Termination of transmission line from Yarrowkabra Substation into 69 kV AIS Bay.

YARROWKABRA 50 MVA 13.8/69 kV AIS SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:
    (1) Four (4) breaker and ½ 69 kV switchgear.
    (2) 13 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (3) Two - 25 MVA 13.8/69 kV Transformers.
    (4) Five (5) 6 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.
- Termination of double circuit transmission lines from Garden of Eden Substation into 69 kV AIS Bays.
- Termination of transmission line from Yarrowkabra Substation into 69 kV AIS Bay.

28.3.10 Region 4: Across Demographic Areas

28.3.10.1 Transmission

28.3.10.1.1 Georgetown - East Coast Mahaica

69 kV Transmission Line Splits into Ogle: -

- Establishment of 4.86 km of new transmission circuit that runs between New Sophia (Georgetown) and Ogle (East Coast) Substations- L16 - 1.
- Establishment of 4.86 km of new transmission circuit that runs between New Sophia (Georgetown) and Ogle (East Coast) Substations L16-1 P.

28.3.10.1.2 Georgetown - East Bank Demerara

69 kV Transmission Line Splits into Goedverwagting: -

- Establishment of 9.43 km of new transmission circuit that runs between New Sophia (Georgetown) and Goedverwagting (East Coast) Substations- L4-2.
- Establishment of 9.55 km of new transmission circuit that runs between Old Sophia (Georgetown) and Goedverwagting (East Coast) Substations L2-2.
- Establishment of 9.35 km of new transmission circuit that runs between Goedverwagting (East Coast) and Golden Grove (East Bank) Substations- L4-1.
- Establishment of 9.35 km of new transmission circuit that runs between Goedverwagting (East Coast) and Golden Grove (East Bank) Substations- L2-1.

28.3.11 Region 5: East Coast Mahaica to West Bank Berbice

28.3.11.1 Generation Conventional & Renewable Projects

- Installation of new 28.9 MW HFO Power Plant at Columbia
- Installation of 4 MWp Solar PV Plant at Trafalgar – to be integrated at Onverwagt Substation

28.3.11.2 Transmission

- Construction of 1.7 km of new 69 kV transmission line utilizing conductor type Canton AAAC 19 Strands (395 kcmil) and concrete poles to integrate Trafalgar 4 MWp Solar PV site West Coast Berbice with Onverwagt Substation.
- Construction of 37.5 km of redundant transmission line (L20P) between Columbia and Onverwagt Substation.
- L21 Upgraded Phase 1 & 2, (Ref: Sect 28.3.15.1.5).

69 kV Transmission Line Splits L21 Upgraded (Phase 1 & 2)/ L21P- into Rosignol Substation:

- Splitting of 69 transmission line that runs between Onverwagt (Region 5) and Canefield (Region 5) Substations into Rosignol Substation
- Splitting of 69 transmission line that runs between Onverwagt (Region 5) and Canefield (Region 5) Substations into Rosignol Substation.

New 69 kV Transmission Lines as a Result of: Splits into Rosignol Substation: -

- Establishment of 19.8 km of new transmission circuit that runs between Onverwagt and Rosignol Substations - L21 Upgraded – 1 and L21 P-1
- L21 Upgraded – 1 and L21 P-1 (Rosignol-Canefield), ref: Sect 28.3.15.1.5

28.3.11.3 Existing Substation

COLUMBIA 16.7 MVA 13.8/69KV SUBSTATION

- Installation of one AIS 69 kV bay to accommodate one new transmission line (L18- Bypass) from Enmore/Victoria Substation.
- Termination of L18- Bypass into 69 kV AIS Bay.
- Installation of one AIS 69 kV bay to accommodate one new transmission line (L20P) from Onverwagt Substation.
- Termination of L20P into 69 kV AIS Bay.
- Installation of one new 16.7 MVA 13.8/69 kV transformer.
- Installation of three (3) AIS 69 kV bays to accommodate one new 16.7 MVA Transformer, Bus Tie and Bus Coupler.

- Installation of one (1) AIS 69 kV bay to accommodate one new transmission line from the 28.9 MW Power plant.
- Installation of one 15 kV Class Metal clad 6 Cubicle Switchgear.
- Construction of new control room building to installed additional cubicles, ancillary services and substation equipment for all new projects listed above.

COLUMBIA 15 MVARS DETUNED STATIC COMPENSATOR

- Installation of 15 MVAr detuned static compensator bank.
- Expansion of Columbia 69 kV substation by installing three AIS 69 kV bay to facilitate the interconnection of the 15 MVAr Detuned Static Compensator.

ONVERWAGT 16.7 MVA 13.8/69KV SUBSTATION

- Installation of one AIS 69 kV bay to accommodate one transmission line (L21 -1 -P) from Rosignol Substation.
- Termination of transmission line from Rosignol Substation L21-1-P into 69 kV AIS Bay.
- Termination of upgraded transmission line from Rosignol L21 Upgraded into 69 kV AIS Bay.
- Installation of one AIS 69 kV bay to accommodate one new transmission line (L20P) from Columbia Substation.
- Termination of transmission line from Columbia substation L20P into 69 kV AIS Bay.
- Replacement of one 16.7-MVA 13.8/69 kV Dachi transformer with a 25 MVA 13.8/69 kV transformer.
- Installation of 6 cubicle 15 kV Metal-clad enclosed switchgear.
- Installation of one AIS 69 kV bay to accommodate interconnecting lines from Trafalgar 4 MW Solar PV Project.
- Termination of transmission line from Trafalgar 4 MW Solar PV Project into 69 kV AIS Bay.
- Installation of one AIS 69 kV bay to accommodate one new 25 MVA 13.8/69 kV Transformer.
- Installation of one new 25 MVA 13.8/69 kV transformer into new AIS 69 kV bay.

28.3.11.4 13.8 kV Distribution Network

I. Columbia Distribution Expansion Plan

- Construction of two (2) 8 km new feeder circuits utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Construction of two (2) 8 km new priority feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.

II. Onverwagt Distribution Expansion Plan

- Reconductoring from No. 7 W.C.B to Ithaca utilizing conductor type Cosmos AAC 19 strands 477 MCM and wallaba poles structures.
- Integrate power plant and feeders to GPL's SCADA System.

28.3.11.5 New Substation

ROSIGNOL 50 MVA 13.8/69 kV SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:
    (1) Three breaker and ½ 69 kV switchgear.
    (2) 13 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (3) Two- 25 MVA 13.8/69 kV Transformers.
    (4) Four (4) 6 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.
- Termination of transmission line from Onverwagt substation L21P-1 into 69 kV AIS Bay.
- Termination of transmission line from Canefield substation L21P-2 into 69 kV AIS Bay.

28.3.12 Region 6: Canje /East Coast /Corentyne Coast - Berbice

28.3.12.1 Generation Conventional & Renewable Projects

- Installation of 3 MWp Solar PV Plant at East Coast Berbice - Prospect - to be integrated at Hyundai F1 switchgear cubicle.
- Installation of 3 MWp Solar PV Plant at East Coast Berbice - Hampshire to be integrated into Canefield F3 13.8 kV distribution circuit approximately 1 km away from Canefield Power plant.

28.3.12.2 Transmission

- Relocation of 21.12 km of transmission line (L23P) between No. 53. Village and Skeldon Substations.
- Construction of 21.12 km of redundant transmission line (L23P) between No. 53. Village and Skeldon Substations.
- Construction of 6.71 km of redundant transmission line (L22-1a-P) between Canefield and Crab Island Substations.
- Construction of 20.2 km of redundant transmission line (L22-1b-P) between Crab Island and Williamsburgh Substations.

- Construction of 34.3 km of redundant transmission line (L22-2-P) between Crab Island and Williamsburgh Substations.

69 kV Transmission Line Splits- into Williamsburg Substation:

- Upgrading and splitting of 69 kV transmission lines that runs between Canefield Canje and No. 53 Village East Corentyne Substations L22 & L22 P – into Williamsburg Substation.

69 kV Transmission Line Splits- into Crab Island Substation:

- Splitting of 69 kV transmission lines that runs between Canefield Canje and No. 53 Village East Corentyne Substations L22 & L22 P – into Crab Island Substation.

69 kV Transmission Line Splits- into Bushlot Substation:

- Splitting of 69 kV transmission lines that runs between Canefield Canje and No. 53 Village East Corentyne Substations L22 & L22 P – into Bushlot Substation.

230 kV Transmission Lines

- Construction of 22.34 km of 230 kV Double Circuit Transmission Lines considering two (2) wire per phase utilizing conductor type Rovinj ACCC (371 kcmil) between 230 kV Crab Island Substations (East Coast Berbice – Region 6) and Williamsburg (Corentyne Road Berbice – Region 6), HVL6, HV L6 P.
- HV L5, HV L5P (230 kV Crab Island- Goedverwagting- Region 4), ref: Sect 28.3.15.1.4

28.3.12.3 Existing Substation

CANEFIELD 16.7 MVA 13.8/69KV SUBSTATION

Old Power Plant Upgrade:

- Installation of one new 60 MVA 13.8/69 kV transformer to replace existing 16.7 MVA capacity.
- Upgrade of existing ITE 15 kV class Switchgear panels with 9 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
- Upgraded of Grounding Transformer and Station use capacities.
- Integrate power plant and feeders into GPL’s SCADA System.

New Power Plant- EPC 25 MW HFO

- Installation of new 60 MVA 13.8/69 kV transformer.
- Installation of one AIS 69 kV bay to accommodate 60 MVA 13.8/69 kV transformer.
- Installation of 15 kV class metal-clad enclosed switchgear with all relevant ancillary component, full specification to be determined by EPC contractor.

69 kV Substation Expansion

- Installation of one AIS 69 kV bay to accommodate one new transmission line (L21-2-P) from Rosignol Substation.
- Termination of redundant transmission line from Rosignol (L21-2-P) into 69 kV AIS bay.
- Termination of upgraded 69 kV transmission line from Rosignol (L21 Upgraded) into 69 kV AIS bay.
- Installation of one AIS 69 kV bay to accommodate one new transmission line (L22P) from Crab Island Substation.
- Termination of redundant transmission line from Crab Island (L22 P) into 69 kV AIS bay.
- Termination of upgraded transmission line from Crab Island (L22) into 69 kV AIS bay.
- Installation of One (1) Busbar Breaker Bay (69 kV Compass);
- Installation of One (1) Metering and Protection Bay (69 kV Compass);
- Installation of One (1) Sectional Busbar Metering and Protection panel;
- Installation of One (1) Disconnector on the existing Transformer Bay between the GCB and Standby Bus.
- Installation of One (1) Disconnector on the proposed Transformer Bay between the GCB and Standby Bus.

NO. 53 VILLAGE 40 MVA 13.8/69 kV UPGRADED SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:
    (1) Two (2) breaker and ½ 69 kV switchgear.
    (2) 13 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (3) Two- 20 MVA 13.8/69 kV Transformers.
    (4) Three (3) 3 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.
- Termination of redundant transmission line from Canefield (L22 P) into 69 kV AIS bay.
- Termination of upgraded transmission line from Canefield (L22) into 69 kV AIS bay.
- Termination of redundant transmission line from Skeldon (L23) into 69 kV AIS bay.
- Termination of existing transmission line from Skeldon (L23) into 69 kV AIS bay.

NO. 53 VILLAGE 50 MVA 13.8/69KV UPGRADED SUBSTATION

- Installation of 15 MVAR Detune Static Compensator.
- Installation of one breaker and ½ bay AIS 69 kV bay to accommodate 15 MVAR Detune Static Compensator.

SKELDON 69KV UPGRADED SUBSTATION

- Installation of one AIS 69 kV bay to accommodate one new transmission line (L23P) from No. 53 Village Substation.
- Termination of redundant transmission line from No. 53 (L23) into 69 kV AIS bay.
- Installation of 69 kV 2-busbars with bus-tie circuit breaker to accommodate one new transmission line (L23P).
- Integration of Skeldon power plant and substation into GPL's SCADA System.

28.3.12.4 13.8 kV Distribution Network

I. Canefield Distribution Expansion Plan

- Construction of 1 km new 13.8 kV distribution network utilizing conductor type Tulip AAC 19 Strand- 336.4 kcmil and concrete poles to integrate Prospect 3 MWp Solar PV at Canefield Hyundai 13.8 kV switchgear cubicle.
- Construction of 1 km new 13.8 kV distribution network utilizing conductor type Tulip AAC 19 Strand- 336.4 kcmil and concrete poles to integrate Hampshire 3 MWp Solar PV with the existing Canefield F3 – Hampshire East Coast Berbice.
- Reconductoring of 28 km F3 feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Relocation of 1.4 km F1 feeder Canje river crossing circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM, submarine cable and concrete pole structures.
- Relocation of 1.4 km F4 feeder Canje river crossing circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM, submarine cable and concrete pole structures.
- Construction of three (3) 4 km new priority feeder circuits utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Construction of two (2) 4km new feeder circuits utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures

II. No. 53 Village Distribution Expansion Plan

- Reconductoring of 47.747 km F2 feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Reconductoring of 47.747 km F3 feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.
- Construction of one (1) 3 km new priority feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.

- Construction of two (2) 3 km new feeder circuit utilizing conductor type Cosmos AAC 19 strands 477 MCM and concrete pole structures.

28.3.12.5 New Substation

CRAB ISLAND 334 MVA 69/230 kV AIS SUBSTATION

- Construction of one new AIS 230 kV substation by installing:
    (1) Seven (7) double bus single breaker 230 kV bays.
    (2) 1 bus tie single breaker 230 kV bays.
    (3) Two (2) 167 MVA 69/230 kV Power Transformers
- Termination of double circuit 230 kV transmission lines from Goedverwagting 230 kV Substation into HVL5, HV L5 P AIS 230 kV bays.
- Termination of double circuit 230 kV transmission lines from Williamsburg 230 kV Substation HVL6, HV L6 P into AIS 230 kV bays.

CRAB ISLAND 70 MVA 13.8/69 kV SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:
    (1) Five (5) breaker and ½ 69 kV switchgear.
    (2) 15 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (3) Two - 35 MVA 13.8/69 kV Transformers.
    (4) Seven (7) 5 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.
- Termination of two (2) incoming tie lines from two 167 MVA 69 kV/230 kV transformers into AIS 69 kV Bays.
- Termination of double transmission lines from Canefield into 69 kV AIS Bays.
- Termination of double transmission lines from Williamsburg Substation into 69 kV AIS Bays.

WILLIAMSBURG 200 MVA 69/230 kV AIS SUBSTATION

- Construction of one new AIS 230 kV substation by installing:
    (1) Five (5) double bus single breaker 230 kV bays.
    (2) 1 bus tie single breaker 230 kV bays.
    (3) Two (2) 100 MVA 69/230 kV Power Transformers
- Termination of double circuit 230 kV transmission lines from Crab Island 230 kV Substation HVL6, HV L6 P into AIS 230 kV bays.

WILLIAMSBURG 50 MVA 13.8/69 kV SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:
    (1) Five breaker and ½ 69 kV switchgear.
    (2) 11 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (3) Two- 25 MVA 13.8/69 kV Transformers.
    (4) Five (5) 7 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.
- Termination of two (2) incoming tie lines from two 100 MVA 69 kV/230 kV transformer into AIS 69 kV Bays.
- Termination of double circuit transmission lines from Crab Island Substation into 69 kV AIS Bays.
- Termination of double circuit transmission lines from No. 53 Village Substation into 69 kV AIS Bays.

28.3.13 Region 7: Bartica

Existing:

1. Bartica 3.3 MW 13.8 kV 60 Hz LFO Power Plant
2. Bartica 1.6 MW 13.8 kV 60 Hz LFO Mobile Units
3. Bartica 1.5 MWp Solar Photovoltaic Plant / 0.75 MWh BESS – located 2.2 km away from Bartica Power Plant.
4. Bartica 13.8 kV Distribution System- Feeder 1
5. Bartica 13.8 kV Distribution System- Feeder 2
6. Bartica 13.8 kV Distribution System- Feeder 3

28.3.13.1 Generation Conventional & Renewable

- Installation of one new 1.12 MW additional HFO generation unit.
- Installation of one new 2 MW additional HFO generation unit.

28.3.13.2 13.8 kV 60 Hz Power Plant Upgrade

28.3.13.3 13.8 kV Distribution System Upgrade

Bartica Distribution Expansion Plan

- Procuring and installation of two (2) smart capacitor banks of capacities of 300 kVAr on selected distribution networks.

- Procuring and Installation of three (3) auto reclosers on selected feeders.
- Procuring and Installation of Six (6) feeder FCIs on selected feeders.
- Circuit load balancing to be conducted on three (3) selected feeders.

28.3.14 Region 10: Linden

Existing:

1. Linden Power Company- IPP BOSAI 13.8 kV 60 Hz HFO/LFO Power Plant

Linden Electricity Company Inc - East Side of Demerara River within McKenzie:

2. Linden Electricity Company Inc: 13.8 kV Power Distribution Facility
3. Linden 4.16 kV Distribution System- Village Feeder
4. Linden 13.8 kV Distribution System- Mines Feeder
5. Linden 13.8 kV Distribution System- Richmond Hill Feeder
6. Linden 13.8 kV Distribution System- Amalia's Ward Feeder

Linden Utility Corp Society - West Side of Demerara River within Wisma:

7. Linden 13.8 kV Distribution System- Wisma Feeder

28.3.14.1 Generation Conventional & Renewable Projects

- Installation of 11 MWh BESS at the LECI 13.8 kV Power Distribution Facility.
- Installation of 4 MWp Solar PV Plant at Block 37- Linden.
- Installation of 8 MWp Solar PV Plant at Block 37- Linden.
- Installation of 3 MWp Solar PV Plant at Dacoura- Linden.

28.3.14.2 13.8 kV 60 Hz Power Distribution Facility

- Upgrade of existing Power Distribution Facility with new 15 kV Metal Clad 12 Cubicle Switchgear.

28.3.14.3 13.8 kV Distribution System Upgrade

I. Linden Solar PV Interconnection Plan

- Construction of 3.9 km new 13.8 kV distribution network utilizing conductor type Cosmos AAC 19 Strand- 477 kcmil and concrete poles to integrate 4 MWp Solar PV Plant at Block 37- Linden with existing Amalia's Ward Feeder- T connection.

- Construction of 8 km new express 13.8 kV distribution network utilizing cables 2 x 1000 kcmil AAC and concrete poles to interconnect 8 MWp Solar PV Plant at Block 37- Linden at the 13.8 kV Power Distribution Facility, McKenzie.
- Construction of 1.2 km new 13.8 kV distribution network utilizing conductor type Tulip AAC 19 Strand- 336.4 kcmil and concrete poles to integrate 3 MWp Solar PV Plant at Dacoura with existing Wisma Feeder- T connection.

II. Linden Distribution Expansion Plan

- Procuring and installation of one (1) smart capacitor banks of capacities of 450 kVAr on selected distribution networks.
- Procuring and Installation of six (6) auto reclosers on selected feeders.
- Procuring and Installation of four (4) feeder FCIs on selected feeders.
- Circuit load balancing to be conducted on six (6) selected feeders.

28.3.14.4 Transmission

- L37-1 & L37-1-P Ref: Sect. 28.3.15.1.6 28.3.15.1.6
- Construction of a new 8.62 km 69 kV transmission line utilizing conductor type Rovinj ACCC (371 kcmil) between McKenzie and Bamia Substations - L37-2.

28.3.14.5 Substation

MCKENZIE SUBSTATION 33.4 MVA 13.8/69 kV SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:
    (1) Three (3) breaker and ½ 69 kV switchgear,
    (2) 11 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (3) Two (2) 16.7 MVA 13.8/69 kV Transformers.
    (4) Six (6) 6 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.
- Termination of transmission lines from Bamia Substation into 69 kV AIS Bays.

BAMIA SUBSTATION 33.4 MVA 13.8/69 kV SUBSTATION

- Construction of one new AIS 13.8/69 kV substation by installing:
    (1) Three (3) breaker and ½ 69 kV switchgear,
    (2) 11 cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (3) Two (2) 16.7 MVA 13.8/69 kV Transformers.

(4) Four (4) 5 km new feeder circuits utilizing Cosmos AAC 19 strands 477 MCM conductor type and concrete pole structures.

- Termination of transmission line from McKenzie Substation into 69 kV AIS Bay.
- Termination of double circuit transmission lines from Goedverwagting Substation (Region 4) into 69 kV AIS Bays.

28.3.15 Cross-Geographic Areas

28.3.15.1 Transmission Lines

28.3.15.1.1 Region 2 - Region 3

- No Line to be built within the planning period of the D&E.

28.3.15.1.2 Region 3 - Region 4

- Replacing the 2.56 km 69 kV LS6 Submarine Cable with a double circuit OHL using lattice towers (L6 & L6-P).
- Construction of 24.79 km of 230 kV Double Circuit Transmission Lines considering two (2) wire per phase utilizing conductor type Rovinj ACCC (371 kcmil) between Wales 300 MW 13.8/69/230 kV NG GSU (West Coast Demerara- Region 3) and 230 kV Goedverwagting (East Coast Demerara- Region 4), Substations HVL1, HV L1 P.

28.3.15.1.3 Region 4 - Region 5

New 69 kV Transmission Lines as a Result of: L17/L17P Splits into Enmore: -

- Construction of 16.9 km of 69 kV transmission line utilizing conductor type Rovinj ACCC (371 kcmil) with steel poles and concrete foundation between Enmore/Victoria (East Coast Demerara- Region 4) and Columbia (East Coast Demerara- Region 5) Substations (L18).
- Construction of 16.9 km of redundant 69 kV transmission line utilizing conductor type Rovinj ACCC (371 kcmil) with steel poles and concrete foundation between Enmore/Victoria (East Coast Demerara- Region 4) and Columbia (East Coast Demerara- Region 5) Substations (L18-P).

28.3.15.1.4 Region 4 - Region 6

- Construction of 120 km of 230 kV Double Circuit Transmission Lines considering two (2) wire per phase utilizing conductor type Rovinj ACCC (371 kcmil) between 230 kV Goedverwagting (East Coast Demerara- Region 4) and 230 kV Crab Island Substations (East Coast Berbice – Region 6), HVL5, HV L5 P.

28.3.15.1.5 Region 5 - Region 6

L21 – Upgraded (Phase 1):

- L21- Upgraded Partly from 22 km away from Onverwagt Substation at Blairmont Ferry Terminal- Cable Crossing- Diversion:

  i. Splitting of the existing transmission line between Onverwagt (Region 5) and Canefield (Region 6) Substations at Blairmont- 22 km away from Onverwagt Substation.

  ii. Construction of overhead section 1.1 km of new 69 kV transmission line utilizing conductor type Canton AAAC 19 Strands (395 kcmil) and concrete poles between the point of split location at Blairmont up to submarine crossing- New L21 OH section 1.

  iii. Installation of 1.6 km of 240 mm^2 submarine cable departing Blairmont Ferry Terminal into the Berbice river crossing- New L21 Submarine section 1.

  iv. Construction of overhead section 2.26 km of new 69 kV transmission line utilizing conductor type Canton AAAC 19 Strands (395 kcmil) and concrete poles between the point of crossing at New Amsterdam Ferry Terminal up to Canje River submarine crossing- New L21 OH section 2.

  v. Installation of 0.31 km of 240 mm^2 submarine cable across the Canje River- New L21 Submarine section 2.

  vi. Construction of overhead section 1.41 km of new 69 kV transmission line utilizing conductor type Canton AAAC 19 Strands (395 kcmil) and concrete poles between Canje River submarine crossing into Canefield Substation - New L21 OH section 3.

- L21 – Upgraded (Phase 2): Between Onverwagt (East Coast Demerara- Region 5) and Blairmont Ferry terminal (West Bank Berbice- Region 5): Ref Sect 28.3.11.2

- Construction of 28.45 km of redundant 69 kV transmission line utilizing a combination of OH and Cables traversing the exact path as the L21 Upgraded (Phase 1, Phase 2 as previously described interconnecting Onverwagt (East Coast Demerara- Region 5) and Canefield (Canje - Region 6)- Substation – L21 P.

New 69 kV Transmission Lines as a Result of Rosignol Substation (West Coast Berbice- Region 5 and East Bank, East Canje Berbice Region 6): -

- Establishment of 8.65 km of parallel transmission circuit that runs between Rosignol (Region 5) and Canefield (Region 6) Substations utilizing conductor and cable describe in the L21 Upgraded OH and Submarine configuration route L21 Upgraded - 2, L21-P-2.

- L21 Upgraded, L21-P-1 Rosignol-Onverwagt, Ref. Sect: 28.3.11.2:

28.3.15.1.6 Region 4 - Region 10

- Construction of a new 214.14 km 230 kV Double Circuit Transmission Lines considering two (2) wire per phase utilizing conductor type Rovinj ACCC (371 kcmil) between 230 kV Goedverwagting Substation (East Coast Demerara – Region 4) and Bamia Substation (Region 10), L37-1 and L37-1-P.

28.3.15.2 Mobile Substations

Mobile 35 MVA 13.8/69 kV Substation

- Procurement of five (5) new containerise 13.8/69 kV substation which includes the following:

    (1) One double bus single breaker 69 kV switchgear.
    (2) Four cubicle 15 kV class metal-clad enclosed switchgear with all relevant ancillary component.
    (3) One - 35 MVA 13.8/69 kV Transformers.

28.3.15.3 SCADA and Smart Grid and Distribution System Automation

- Construction of Guyana National Control Centre with a Modern SCADA system and Smart Grid Integration to be built at Goedverwagting in the vicinity of the Goedverwagting 13.8/69/230 kV Substation facility:

Phase 1:
Phase -1 GNCC/Smart Grid: Preparation of RFP Package

I. Phase -1 GNCC/Smart Grid: Integration of Auto Reclosers into GNCC
II. Phase -1 GNCC/Smart Grid: New SCADA – GMS - EMS (Transmission level) and associated components for dispatch of electricity
III. Phase -1 GNCC/Smart Grid: Construction of GNCC Building
IV. Phase -1 GNCC/Smart Grid: Design of GNCC Building (architectural & civil engineering design works)
V. Phase -1 GNCC/Smart Grid: Prepare RFP Package for GNCC Building

Phase 2:

I. Phase 2-GNCC/Smart Grid: Preparation of RFP Package
II. Phase 2-GNCC/Smart Grid: Phase 2-GNCC/Smart Grid: Implementation of SCADA (Distribution level in DBIS/Isolated Systems), Automated Metering Infrastructure (AMI) and Transmission and Distribution (T&D) Network Supervision and Automation

28.3.15.3.1 AMI Meters

- Procuring and installation of 80 000 AMI meters throughout the Demerara – Berbice 13.8 kV distribution networks.

- Integration of 80 000 AMI meters that is to be installed throughout the Demerara – Berbice 13.8 kV distribution networks into the into the proposed SCADA/ SMART Grid infrastructure.

28.3.15.3.2 Auto Reclosers, FCIs and Sectionaliser

- Procuring and Installation of 200 auto reclosers throughout the Demerara – Berbice 13.8 kV distribution networks.
- Integration of all auto reclosers into the SCADA/SMART Grid monitoring infrastructure.
- Installation of 400 sectionalisers in the Demerara – Berbice 13.8 kV distribution networks,
- Installation of 300 FCIs in the Demerara – Berbice 13.8 kV distribution networks,

28.3.15.3.3 13.8 kV SMART Capacitor Banks

- Procuring and installation of 50 smart capacitor banks of capacities of 150kVAr, 300 kVAr, 450 kVAr, 600 kVAr and 1050 kVAr throughout the Demerara – Berbice 13.8 kV distribution networks.
- Integration of 50 smart capacitor banks that is to be installed throughout the Demerara – Berbice 13.8 kV distribution networks, into the proposed SCADA/ SMART Grid infrastructure.

28.3.15.3.4 Circuit Load Balancing

- Circuit load balancing to be conducted on all feeders throughout the Demerara – Berbice 13.8 kV distribution networks.
- This activity will be conducted utilizing the proposed SCADA/ SMART Grid infrastructure.

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of
Development and Expansion Programme
2024-2028