ENERGY OUTLOOK

FOR GHANA

Demand and Supply Outlook

MID-YEAR REPORT

2024

2024 ENERGY OUTLOOK FOR GHANA

Demand and Supply Outlook

MID-YEAR REPORT

JULY 2024

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EXECUTIVE SUMMARY

The Energy Commission in fulfilment of its mandate under the Energy Commission Act (Act 541, 1997) Section 2 Sub-section 2c presents a mid-year review of the 2024 Energy Outlook for Ghana. The mid-year review provides a comprehensive analysis of the energy sector's performance and revised projections for the remainder of the year. The review covers the electricity, petroleum, and woodfuel sub-sectors, highlighting key trends, challenges, and adjustments to initial forecasts.

Electricity Sub-sector

The first half of 2024 witnessed a peak demand of 3,604 MW, which was 2.6% lower than the projected 3,697 MW. This discrepancy could be attributed to instances of load curtailments during the period, due to fuel supply contingencies. Despite this, there was a 1.2% increase compared to the peak demand in the first half of 2023. The total electricity consumption was 12,450 GWh, below the projected 12,719 GWh but marking a 4.4% increase from 2023, indicating growing demand. ECG and NEDCo consumption exceeded projections and showed significant growth from the previous year. However, the export market saw a huge reduction compared to projections and the previous year respectively.

Total electricity generation for the first half of 2024 was 12,450 GWh, with hydro contributing 39.7%, thermal 59.2%, renewables 0.8%, and imports 0.3%. Hydro generation saw a significant increase, with Akosombo and Kpong plants all exceeding their projected outputs. Thermal generation was however lower than projected, primarily due to fuel supply issues, while renewable sources met and exceeded projections.

The projected peak demand for the second half of 2024 has been revised downwards to 3,732 MW from the initial 3788 MW. This adjustment reflects a growth of 3.1% over the 2023 peak. The total projected electricity consumption for the second half is revised downwards to 12,132 GWh, representing a 4.4% increase from 2023. The decrease over the initial projection is due to an anticipated continued reduction in electricity export as observed in the first half of 2024

The generation sources for the second half of 2024 include existing hydro, thermal and renewable plants. The total installed capacity is 5,507.145 MW, with hydro and thermal plants

providing the bulk of dependable capacity. Renewable energy contributions are expected to remain steady, with no significant imports anticipated unless for emergencies.

Natural gas continues to be the predominant fuel for thermal electricity generation in Ghana. The revised projections for the 2nd half of 2024 estimate a total requirement of 63.5 TBtu of natural gas for power generation. The projected cost of natural gas for the 2nd half of 2024 remains significant, at a total cost of approximately US$510.32 million, averaging US$85.05 million per month. Additionally, the procurement of Heavy Fuel Oil (HFO) for the AKSA plant is projected at $9.03 million. Overall, the total cost of fuel for thermal power generation in the 2nd half of 2024 is estimated at $519.35 million.

The review identifies fuel supply sustainability as the most critical risk to reliable electricity supply in Ghana. Disruptions in gas supply due to planned maintenance could render several thermal plants inoperable, posing a threat to power supply reliability. Thus, proactive measures, such as increasing gas supply from N-gas or utilizing dual-fueled thermal plants with LCO and DFO, will be essential to mitigate these supply deficits during the period of gas infrastructure maintenance.

Petroleum Sub-sector

The first half of 2024 saw a significant increase in crude oil production in Ghana, driven primarily by extensive drilling activities in the Jubilee and TEN fields. A total of 20.69 million barrels of crude oil were produced, which is 11.7% higher than the same period in 2023 and 15.6% above the projected production for 2024. The Jubilee field's production rose by 9.96%, while production from the TEN and OCTP fields decreased slightly. The daily average crude oil production increased to 136,143 barrels per day.

Natural gas supply also saw an increase, with an average daily supply of 384 mmscfd, an 8% increase over the previous year. However, the supply was still slightly below the projected figures, leading to a deficit in natural gas supply for power and non-power consumption.

Petroleum product consumption in Ghana also increased significantly, with total consumption as of April 2024 reaching 1,641.95 kilotonnes, a 15.84% increase compared to the same period in 2023. Gasoil, gasoline, LPG, ATK, and premix fuel all saw notable increases in consumption.

The outlook for the second half of 2024 projects higher crude oil production as seen in the first half of the year due to the production from the new wells drilled in the last quarter of 2023. The total projected production is 32.47 million barrels, with Jubilee contributing 66%, TEN 11%, and OCTP 23%.

Crude oil prices are expected to average $85 per barrel, reflecting modest upward pressure due to OPEC+ production cuts and a slight decline in global oil inventories. This is an increase from the initial projection of $82.58 per barrel.

Natural gas production is also projected to increase as compared to the same period in 2023, with expected production reaching 158,601 mmscf for the second half of 2024. This increase is attributed to higher output from the Jubilee, TEN, and Sankofa fields.

The total supply of lean natural gas is expected to be slightly above the total demand for natural gas except during planned maintenance shutdowns on the nation's gas infrastructure.

The revised projections for petroleum products indicate a 9.7% increase in total consumption for 2024, with notable increases in gasoil, gasoline, and ATK consumption.

The first half of 2024 saw a significant increase in crude oil production in Ghana, driven primarily by extensive drilling activities in the Jubilee and TEN fields. A total of 20.69 million barrels of crude oil were produced, which is 11.7% higher than the same period in 2023 and 15.6% above the projected production for 2024. The Jubilee field's production rose by 9.96%, while production from the TEN and OCTP fields decreased slightly. The daily average crude oil production increased to 136,143 barrels per day.

Natural gas supply also saw an increase, with an average daily supply of 384 mmscfd, an 8% increase over the previous year. However, the supply was still slightly below the projected figures, leading to a deficit in natural gas supply for power and non-power consumption.

Woodfuel Sub-sector

The wood fuel sub-sector in Ghana plays a crucial role in fulfilling the energy needs of many households, especially in rural areas where access to modern energy sources is limited. Despite initiatives to promote the adoption of Liquefied Petroleum Gas (LPG) as an alternative, a significant portion of Ghanaian households continue to rely on wood fuel for

cooking and heating. This reliance is due to factors such as accessibility, affordability, and cultural preferences.

From 2000 to 2023, the total supply of wood fuel in Ghana exhibited fluctuations but generally showed an increasing trend, rising from 3,891 ktoe in 2000 to 3,944 ktoe in 2023. Charcoal supply increased significantly during this period, whereas firewood supply saw a decline due to factors like deforestation and regulatory measures.

Initial projections for 2024 anticipated a production of 1,740 ktoe for firewood and 2,370 ktoe for charcoal. However, mid-year revisions adjusted these figures to 1,498.9 ktoe and 2,459.6 ktoe respectively.

Initially projected at 2,618 Ktoe for 2024, residential wood fuel consumption has been revised down to 2,440 Ktoe. This reduction reflects a shift towards more efficient heating and cooking practices. Projections for wood fuel use in the service sector were adjusted from 112 Ktoe to 104 Ktoe, indicating slight operational efficiencies. The industrial sector's wood fuel demand saw a significant downward revision from 351 Ktoe to 279 Ktoe, suggesting a move towards alternative energy sources driven by regulatory changes and economic incentives.

During the first half of 2024, the average national price per kilogram of charcoal was GH₵ 2.42. The cost of useful energy from an LPG stove stands at GH₵ 600 per MMBtu, while traditional and improved cookstoves cost about GH₵ 394 and GH₵ 257 per MMBtu, respectively. This indicates substantial cost savings for households using traditional or improved cookstoves compared to LPG stoves.

PREFACE

ENERGY COMMISSION is mandated to prepare, review and update periodically indicative national plans to ensure that reasonable demands for energy are met sustainably. The Commission is also mandated to secure and maintain a comprehensive database for national decision-making for the efficient development and utilisation of energy resources available to the nation. The Commission's jurisdiction includes promoting and ensuring uniform rules of practice for the production, transmission, wholesale supply, distribution and sale of electricity and natural gas.

In fulfilment of its mandates, the Commission has been preparing an annual energy demand and supply outlook to provide guidelines to energy sector operators and potential investors as well as the wider business community wishing to operate in the country. The mid-year review of the 2024 Annual Energy Outlook is to give government, industry and business, indications of the levels/quantities of electricity, liquid and gaseous fuels that would be required to be provided by the energy producers for the remainder of the year.

The mid-year review of the 2024 Energy Outlook for Ghana provides an overview of the actual performance of the energy sector, specifically the electricity and petroleum industry performance as well as the woodfuel subsector of the 1st half of 2024 comparing actuals to projections. It continues to revise forecasts for the 2nd half of 2024 were necessary.

In this report, 'Demand' is used when referring to gross fuel or energy required by a demand sector, e.g., residential, commercial, or industry. 'Supply Requirement' is supply or generation/production plus transmission/transport losses.

Your comments and suggestions are most welcome.

Ing. Oscar Amonoo Neizer

Executive Secretary

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ABBREVIATION

AGPP	Atuabo Gas Processing Plant
ATK	Aviation Turbo Kerosene
BGS	Bui Generation Station
BPA	Bui Power Authority
BSPs	Bulk Supply Points
CEB	Communauté Electrique du Bénin
CIE	Compagnie Ivoirienne d'Électricité
COVID-19	Novel Coronavirus Disease
ECG	Electricity Company of Ghana
EIA	US Energy Information Administration
EMOP	Electricity Market Oversight Panel
ESD	Emergency Shutdown
FPSO	Floating Production Storage and Offloading
GDP	Gross Domestic Product
GNGC	Ghana National Gas Company
GNPC	Ghana National Petroleum Corporation
GRIDCo	Ghana Grid Company
GWh	Gigawatt hour
HFO	Heavy Fuel Oil
IPPs	Independent Power Producers
kg	Kilogram
km	Kilometer
Ktoe	Thousand Tonnes of Oil Equivalent
KTPP	Kpone Thermal Power Plant
kV	Kilovolt
kW	Kilowatt
LCO	Light Crude Oil
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MAF	Million Acre Feet
MGO	Marine Gas Oil
MMBtu	Million British Thermal unit
MMscf	Million Standard Cubic Feet
MVA	Megavolt Amperes
MVAr	Megavolt Ampere of Reaction Power
MW	Megawatt
MWp	Megawatts-peak

NEDCo	Northern Electricity Distribution Company
NG	Natural Gas
N-Gas	Nigeria Gas
NITS	National Interconnected Transmission System
NMS	Network Manager System
NPA	National Petroleum Authority
OCTP	Offshore Cape Three Point
OMCs	Oil Market Companies
ORF	On-shore Receiving Facility
PC	Petroleum Commission
PIAC	Public Interest and Accountability Committee
PPTC	Power Planning Technical Committee
PURC	Public Utilities Regulatory Commission
PV	Photovoltaics
RFO	Residual Fuel Oil
SAPP	Sunon Asogli Power Plant
SCADA	Supervisory Control and Data Acquisition
TAPCO	Takoradi Power Company
Tbtu	Trillion British Thermal Unit
TDS	Takoradi Distribution Station
TEN	Tweneboa, Enyenra, Ntomme
TICO	Takoradi International Company
TOR	Tema Oil Refinery
TT1PP	Tema Thermal Power Plant 1
TT2PP	Tema Thermal Power Plant 2
TTIP	Tema-Takoradi Interconnection Pipeline
TUF	Transformer Utilization Factor
US WTI	US West Texas Intermediate
VALCO	Volta Aluminium Company
VRA	Volta River Authority
WAGP	West Africa Gas Pipeline
WAGPCo	West Africa Gas Pipeline Company
WAPCO	West Africa Pipeline Company
WAPP	West African Power Pool

Chapter One: Introduction

1.1 Introduction

The 2024 Energy Outlook, published at the beginning of the year, presented an in-depth analysis of the projected demand and supply for electricity, petroleum and wood fuel in Ghana. The report was based on various assumptions about the country's energy demand and available resources. The dynamics of energy demand and supply in Ghana are influenced by a multitude of factors including weather conditions, economic growth, inflation and energy efficiency initiatives.

Economic growth is a significant driver of energy demand, particularly in the commercial and industrial sectors. At the start of 2024, Ghana's overall real GDP was projected to grow by approximately 2.8%, with non-oil real GDP growth forecasted at 2.1%. Following stronger-than-expected growth of 4.7% in the first quarter of 2024[1], the economic growth has been revised upward to 3.1%[2]. This anticipated economic expansion is expected to drive an increase in energy demand. Based on this development and other factors, this report presents a mid-year review of the 2024 Energy Outlook.

The mid-year review evaluates Ghana's energy system performance from January to June 2024 (1st half of 2024). It revises demand projections and the energy supply outlook for the 2nd half of 2024 (July to December), adjusting the initial assumptions where necessary. The review further highlights potential challenges to energy service delivery in Ghana for the remainder of the year and makes recommendations for actions necessary to mitigate these challenges and ensure reliable energy supply.

[1] International Monetary Fund (IMF): IMF Executive Board Completes the Second Review under the Extended Credit Facility Arrangement with Ghana https://www.imf.org/en/News/Articles/2024/06/28/pr24241-ghana-imf-exec-board-completes-2nd-rev-ecf-arr

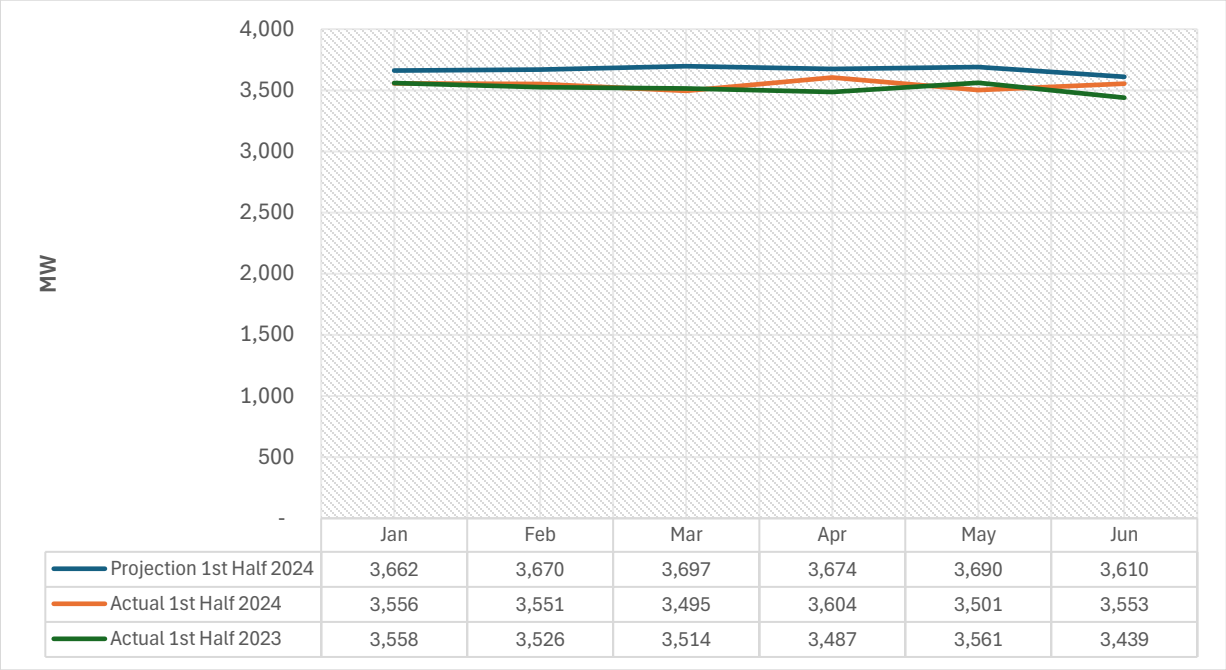
[2] Ghana Statistical Service: National Accounts - Annual GDP by Production Approach https://statsghana.gov.gh/nationalaccount_macros.php?Stats=MjkwMzA1NjI0LjE0MTU=/webstats/oq43q9p651

Chapter Two: Performance of Electricity Sub-sector 1st Half 2024

2.1 Electricity Demand

2.1.1 Peak Demand in 1st Half of 2024

The projected peak load for the 1st half of 2024 was 3,697 MW. The system, however, recorded a maximum coincident load of 3,604 MW on April 28, 2024, which is 2.6% lower than the forecasted peak load for the first half of 2024. The deviation from the projected peak load could be attributed primarily to some load curtailments recorded in the 1st half of the year due to fuel supply contingency. The peak load recorded also represents a 1.2% growth over the 1st half of 2023 peak load of 3,561 MW. The summary of projected and actual peak load as recorded over the period is shown in Figure 1.



	Jan	Feb	Mar	Apr	May	Jun
Projection 1st Half 2024	3,662	3,670	3,697	3,674	3,690	3,610
Actual 1st Half 2024	3,556	3,551	3,495	3,604	3,501	3,553
Actual 1st Half 2023	3,558	3,526	3,514	3,487	3,561	3,439

Figure 1: Monthly peak demand for 1st half of 2024

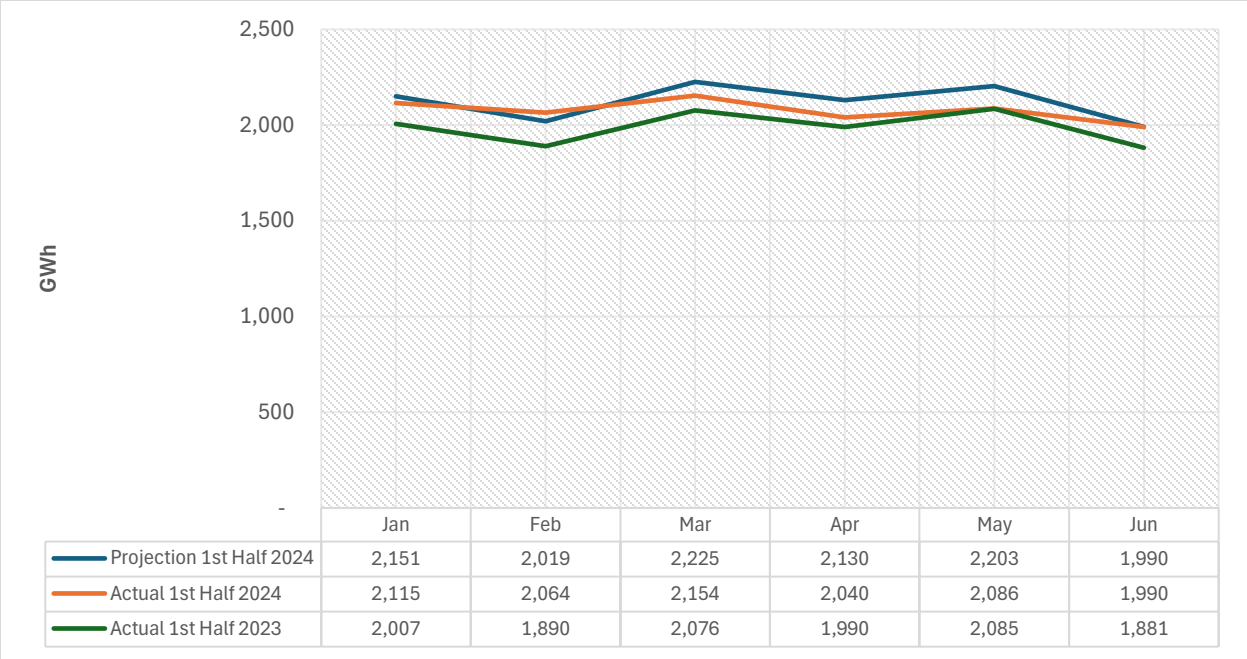
The projections for each month are consistently higher than the actual peak demand figures, indicating an overestimation in the initial forecast. The largest discrepancies between projected and actual values occur in March and May, where the projections (3,697 MW and 3,690 MW,

respectively) are significantly higher than the actual peak demand (3,495 MW and 3,501 MW). The consistently low actual peak demand is attributed to inadequate generation, mainly due to fuel supply challenges and maintenance issues, resulting in instances of load curtailment in the 1st half of 2024.

Some months show a higher demand in 2024 than in 2023, while others show a decrease. The actual peak demand figures for the first six months of 2024 show fluctuations, with the highest peak in April (3,604 MW) and the lowest in March (3,495 MW). There is a slight downward trend from January to March, followed by an increase in April and another dip in May, before rising again in June.

2.1.2 Electricity Consumption for 1st Half of 2024

The total electricity consumed, including losses as of the end of 1st half of 2024, was 12,450 GWh as against the projected total electricity consumption of 12,719 GWh. The actual electricity consumed was lower than the projected by 2.1%. A total of 11,930 GWh was consumed during the same period in 2023. There is a notable increase (4.4%) in total electricity consumption in the first half of 2024 compared to the first half of 2023, indicating growing demand. Monthly electricity consumption for the 1st half year is shown in Figure 2, comparing actual with projected.



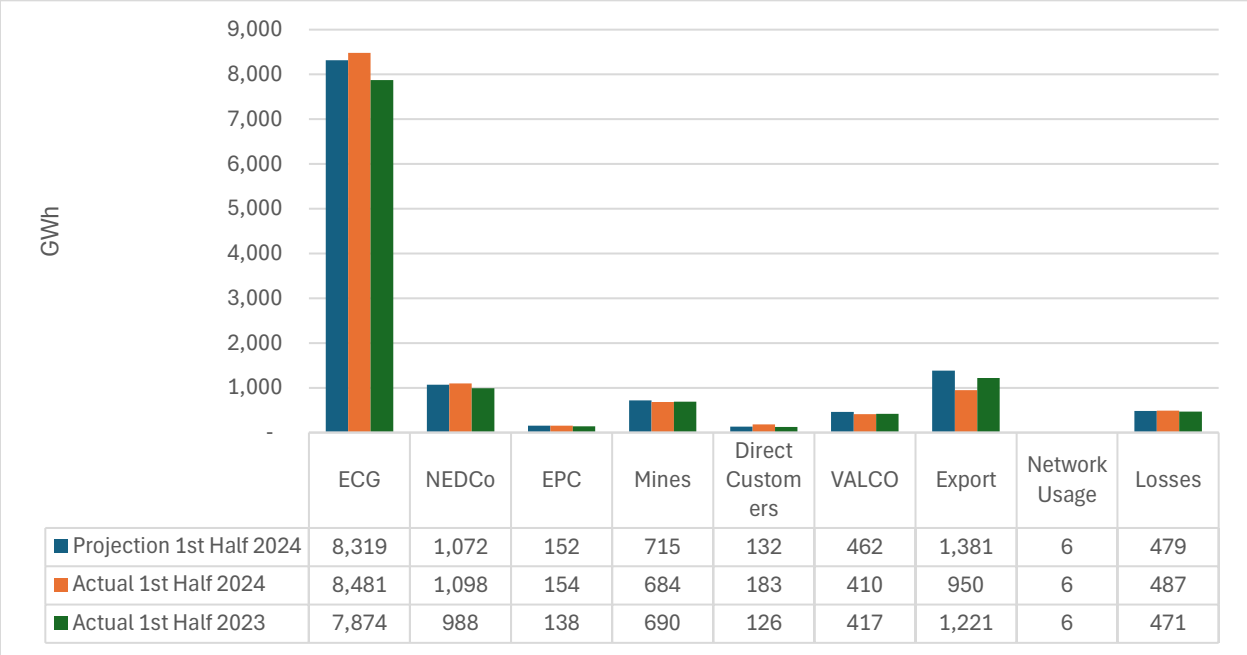
	Jan	Feb	Mar	Apr	May	Jun
Projection 1st Half 2024	2,151	2,019	2,225	2,130	2,203	1,990
Actual 1st Half 2024	2,115	2,064	2,154	2,040	2,086	1,990
Actual 1st Half 2023	2,007	1,890	2,076	1,990	2,085	1,881

Figure 2: Monthly energy consumption for 1st half of 2024

Except for February, the projections for the rest of the months are consistently higher than the actual consumption figures, indicating an overestimation in the initial forecast. The gap between projected and actual consumption is particularly notable in March, where the projection (2,225 GWh) is significantly higher than the actual consumption (2,154 GWh).

Comparing actual consumption between 2023 and 2024, there is a noticeable increase in the early months of 2024. January saw an increase from 2,007 GWh in 2023 to 2,115 GWh in 2024. February also saw an increase from 1,890 GWh in 2023 to 2,064 GWh in 2024. This trend suggests a general growth in electricity consumption year-over-year. The actual consumption figures for the first five months of 2024 show a fluctuating pattern, with a peak in March (2,154 GWh) and a dip in April (2,040 GWh). May's actual consumption (2,086 GWh) is slightly higher than in April but lower than that of March, indicating some variability in consumption. Consumption for the period indicates that while projections for the 1st half of 2024 anticipated higher electricity consumption, the actual usage fell short of these estimates. This could be due to various factors such as instances of load shedding, economic conditions, weather variations, and efficiency improvements. However, there is a clear increase in consumption compared to the same period in 2023, reflecting growing demand for electricity.

ECG and NEDCo consumed 8,481 GWh and 1,098 GW respectively in 1st half 2024. These figures are higher than the 8,319 GWh and 1,072 GWh estimated to be consumed. The ECG and NEDCo consumptions represent a 7.7% and 11.2% increase, respectively, from the same period in 2023. Consumption for other customers as of the first half of 2024 compared with 2023 is shown in Figure 3.



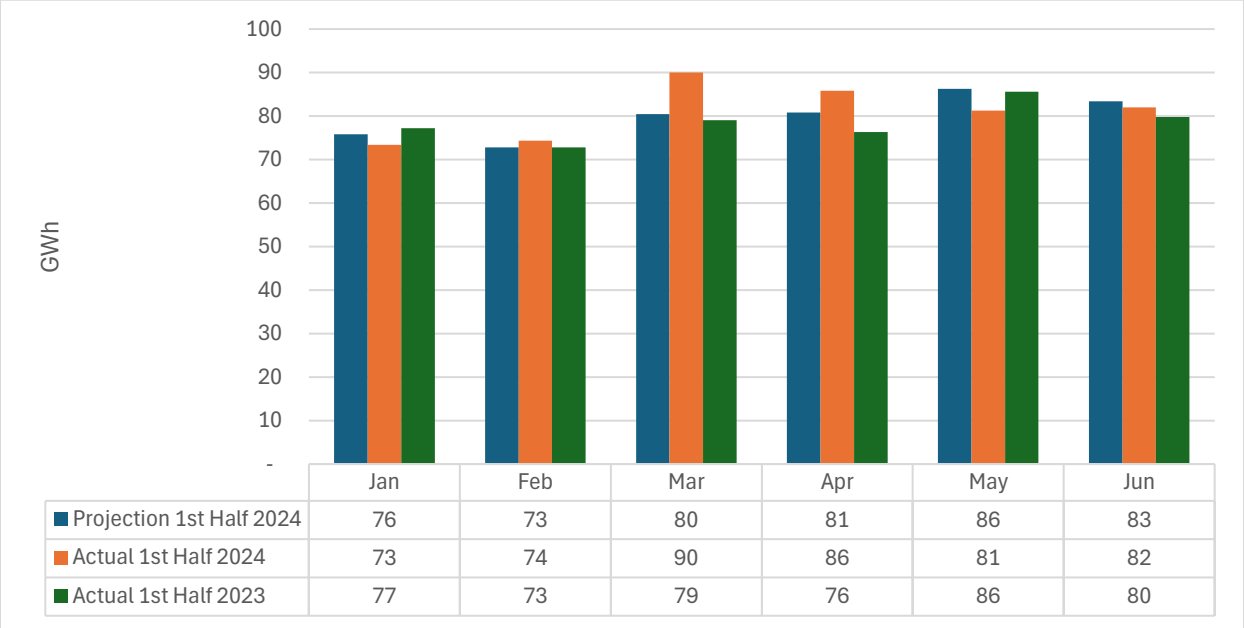
	ECG	NEDCo	EPC	Mines	Direct Customers	VALCO	Export	Network Usage	Losses
Projection 1st Half 2024	8,319	1,072	152	715	132	462	1,381	6	479
Actual 1st Half 2024	8,481	1,098	154	684	183	410	950	6	487
Actual 1st Half 2023	7,874	988	138	690	126	417	1,221	6	471

Figure 3: Electricity consumption by customer classes, network usage and losses for first half 2024

The actuals for most categories were reasonably close to projections, though there were significant deviations in the Direct Customers and Export categories. The Direct Customers category saw a substantial increase (38.2% and 44.4%) in actual consumption compared to projections and the previous year respectively, indicating possibly higher-than-expected growth or increased activity. The export category saw a significant reduction (31.2% and 22.2%) compared to projections and the previous year respectively, which reflects supply curtailment to the export market. There was an increase of 0.9% and 2.7% in network losses in 2024 compared to projections and the previous year respectively, suggesting some level of inefficiency in the NITS.

2.1.2.1 Transmission Loss in 1st Half of 2024

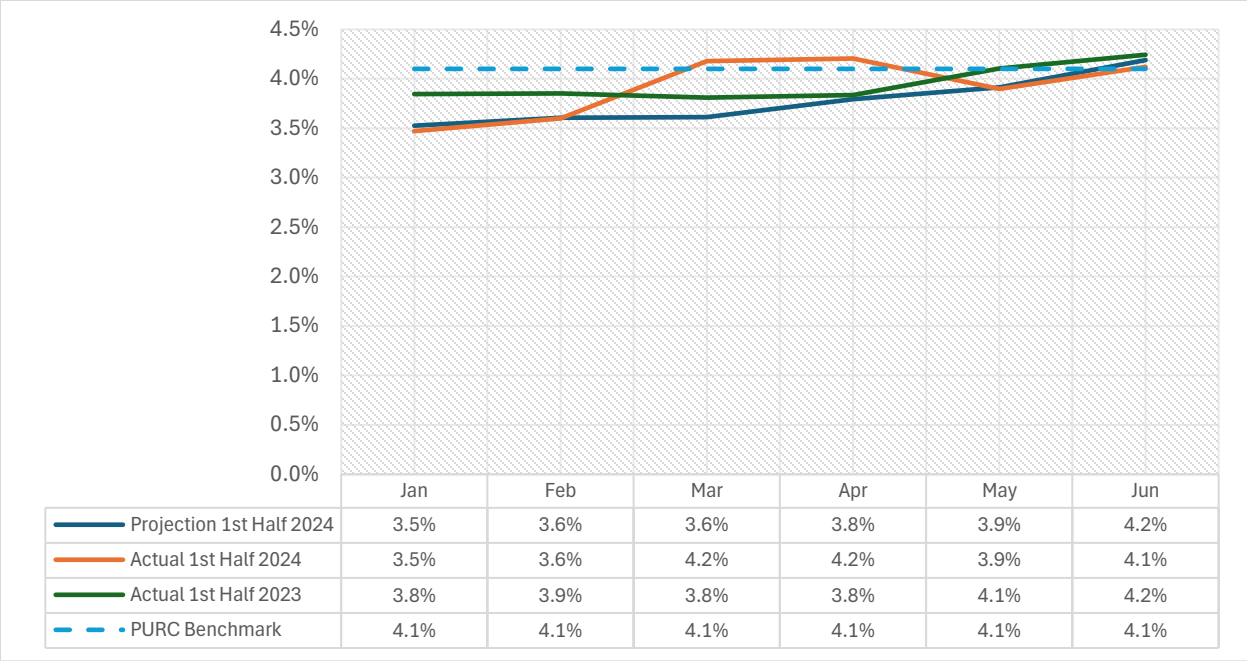
The projections for transmission losses were relatively accurate in January, February, and May, with minimal differences between projected and actual values. There were significant deviations in March and April, where actual transmission losses were higher than projected. Transmission losses were lower in January and May 2024 compared to the same months in 2023, indicating an improvement in those months. However, March and April 2024 saw much higher losses compared to 2023, highlighting potential issues during these months. The monthly breakdown of transmission losses recorded during the period is shown in Figure 4.



	Jan	Feb	Mar	Apr	May	Jun
Projection 1st Half 2024	76	73	80	81	86	83
Actual 1st Half 2024	73	74	90	86	81	82
Actual 1st Half 2023	77	73	79	76	86	80

Figure 4: Trend in transmission losses for 1st half of 2024

In the 1st half of 2024, the ratio of transmission losses stood at 3.9% of total electricity transmitted compared to a projected figure of 3.8%. This is below the PURC benchmark of 4.1%, suggesting overall compliance with regulatory standards. January and February 2024 showed particularly good performance with actual losses significantly below the benchmark (see Figure 5).



	Jan	Feb	Mar	Apr	May	Jun
Projection 1st Half 2024	3.5%	3.6%	3.6%	3.8%	3.9%	4.2%
Actual 1st Half 2024	3.5%	3.6%	4.2%	4.2%	3.9%	4.1%
Actual 1st Half 2023	3.8%	3.9%	3.8%	3.8%	4.1%	4.2%
PURC Benchmark	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%

Figure 5: Monthly percent transmission losses for 1st half of 2024

2.2 Electricity Supply

2.2.1 Electricity Generation for 1st half of 2024

The sources of electricity generation were hydro, thermal (fired using natural gas, light crude oil, heavy fuel oil and diesel) and renewables (solar and biogas) as well as import. The total electricity generated for the first half of 2024 was 12,450 GWh. This was made up of 4,942 GWh (39.7%) from hydro generation, 7,373 GWh (59.2%) from thermal generation, 96 GWh (0.8%) from renewable sources and 39 GWh (0.3%) from import. The actual energy generation was slightly below the projection by 2.1% but higher than the actual generation in the 1st half of 2023 by 3.8%, indicating an improvement year-over-year. Figure 6 shows the generation by sources for the 1st half of 2024.

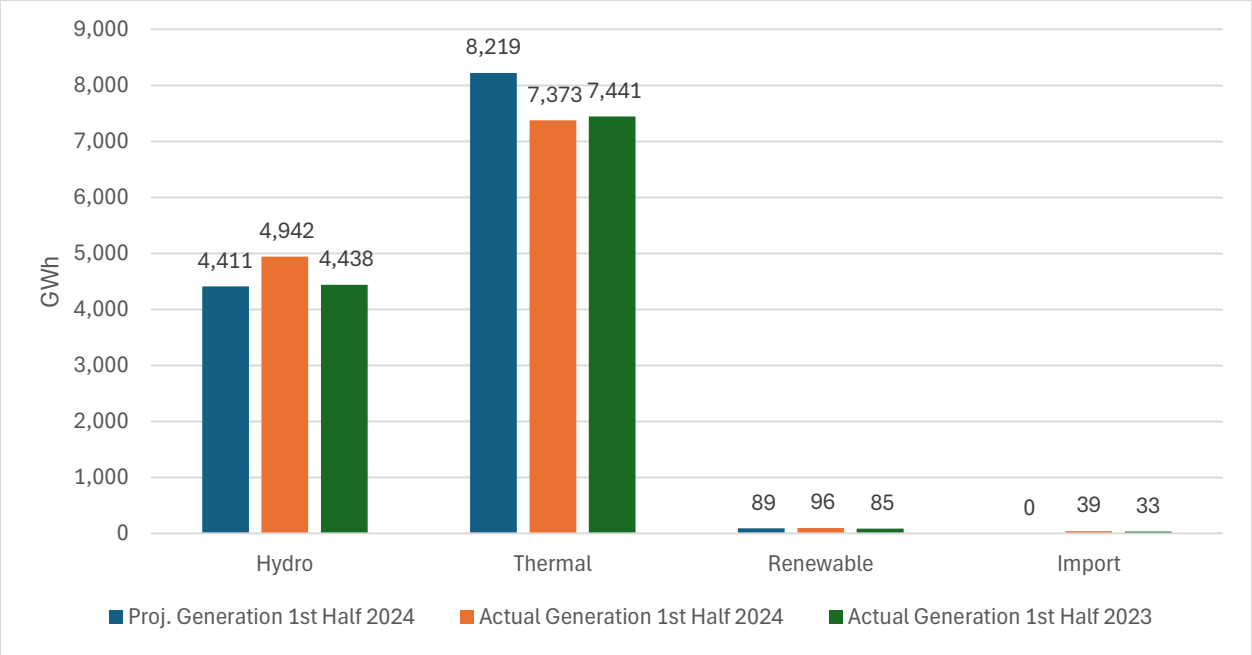


Figure 6: Projected versus Actual Energy Generation for 1st half of 2024

For the 1st half of 2024, actual hydro generation exceeded the projection by 12.0% and the previous year by 11.3%, indicating better-than-expected water availability for hydroelectric operations. Actual thermal generation was lower than projected by 10.3% and slightly lower than the same period in the previous year. This might suggest lower fuel availability, reduced demand, or higher reliance on other sources particularly hydro. Renewable energy generation slightly exceeded projections by 7 GWh, showing positive trends in renewable energy production. The actual import of 40 GWh indicates unplanned reliance on external sources. Figure 7 shows the projected versus actual monthly electricity generation for the 1st half of 2024.

	Jan	Feb	Mar	Apr	May	Jun
Proj. Generation 1st Half 2024	2,151	2,019	2,225	2,130	2,203	1,990
Actual Generation 1st Half 2024	2,115	2,064	2,154	2,040	2,086	1,990
Actual Generation 1st Half 2023	2,013	1,895	2,083	1,996	2,091	1,886

Figure 7: Projected versus actual monthly electricity generation for 1st half of 2024

The projections for the 1st half of 2024 generally overestimated the actual energy generation, except for February and June where the actual values were higher than or equal to the projected. The actual energy generation in 2024 consistently improved over 2023, except for May, which saw a slight decline. Monthly fluctuations in energy generation could be due to several factors, including changes in energy demand, or supply inadequacy.

2.2.2 Performance of Generation Sources in 1st Half of 2024

2.2.2.1 Hydro Generation Sources

Hydro generation marked a noteworthy ascent in the 1st half of 2024, recording 4,947 GWh, representing a substantial 11.5% increase compared to the 1st half of 2023. Table 1 and Figure 8 present monthly and total electricity generation from the three hydropower plants (Akosombo, Kpong and Bui) for the 1st half of 2024.

Table 1: Monthly hydro plants generation for 1st half 2024, projected versus actual, GWh

Month	Projection 1st Half 2024						Actual 1st Half 2024					
	Jan	Feb	Mar	Apr	May	Jun	Jan	Feb	Mar	Apr	May	Jun
Akosombo	544	506	550	551	576	461	598	621	671	645	658	582
Kpong	89	82	92	90	90	81	100	101	107	103	100	99
Bui	163	148	150	123	73	43	182	166	106	42	32	29
Total	**797**	**735**	**792**	**764**	**739**	**585**	**880**	**888**	**884**	**789**	**790**	**711**

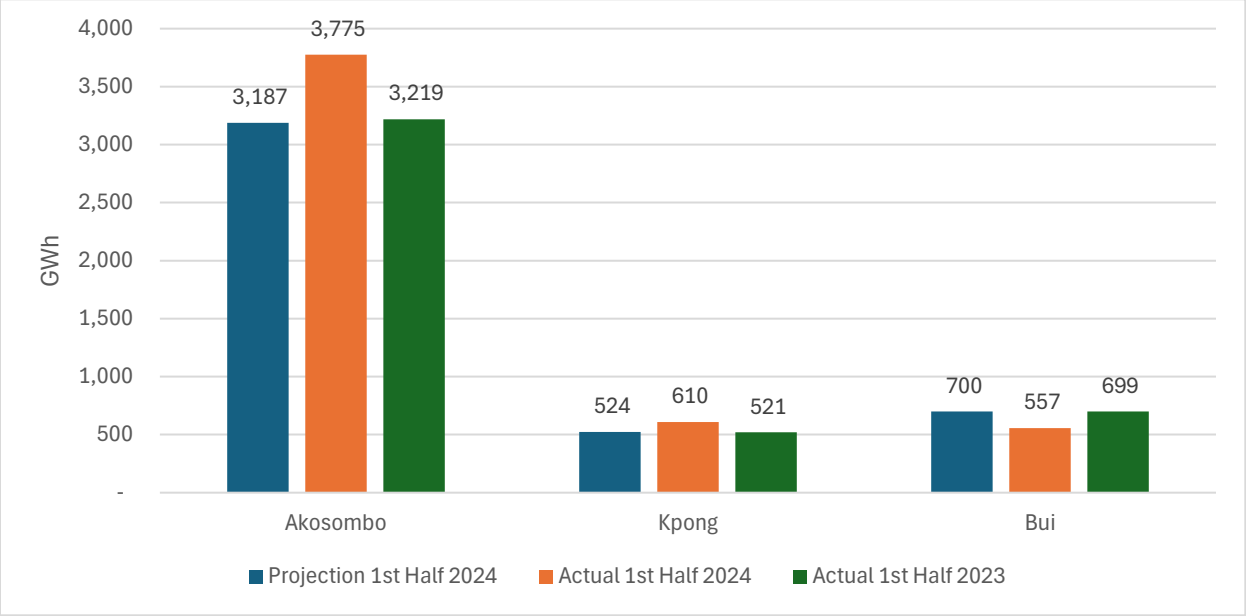


Figure 8: Projected versus actual hydro plants generation for first half of 2024

Actual generation from Akosombo for the 1st half of 2024 exceeded the projected by 18.4%. When compared to the same period in 2023, there was an increase of 17.3% in actual generation. This increase is attributed to higher inflows into the Akosombo dam. Similarly, Kpong's actual generation in the first half of 2024 surpassed the projected generation by 16.3%, showing a 17.1% increase over the same period in 2023. In contrast, Bui's actual generation in the first half of 2024 was 20.4% below the projected generation and decreased by 20.3% compared to the same period in 2023.

The Akosombo and Bui reservoir performances as of the end of June 2024 are shown in Table 2. The monthly average head water trajectories for Akosombo and Bui for the period are also shown in Figures 9 and 10 respectively.

Table 2: Akosombo and Bui reservoir average monthly elevations for 1st half 2024

Level	Akosombo Height (ft)	Bui Height (m)
Maximum elevation	278.0 (84.7m)	183.0
Average elevation in January 2024	273.4 (83.3m)	176.4
Average elevation in June 2024	264.8 (80.7m)	166.3
Minimum elevation	240.0 (73.2m)	168.0

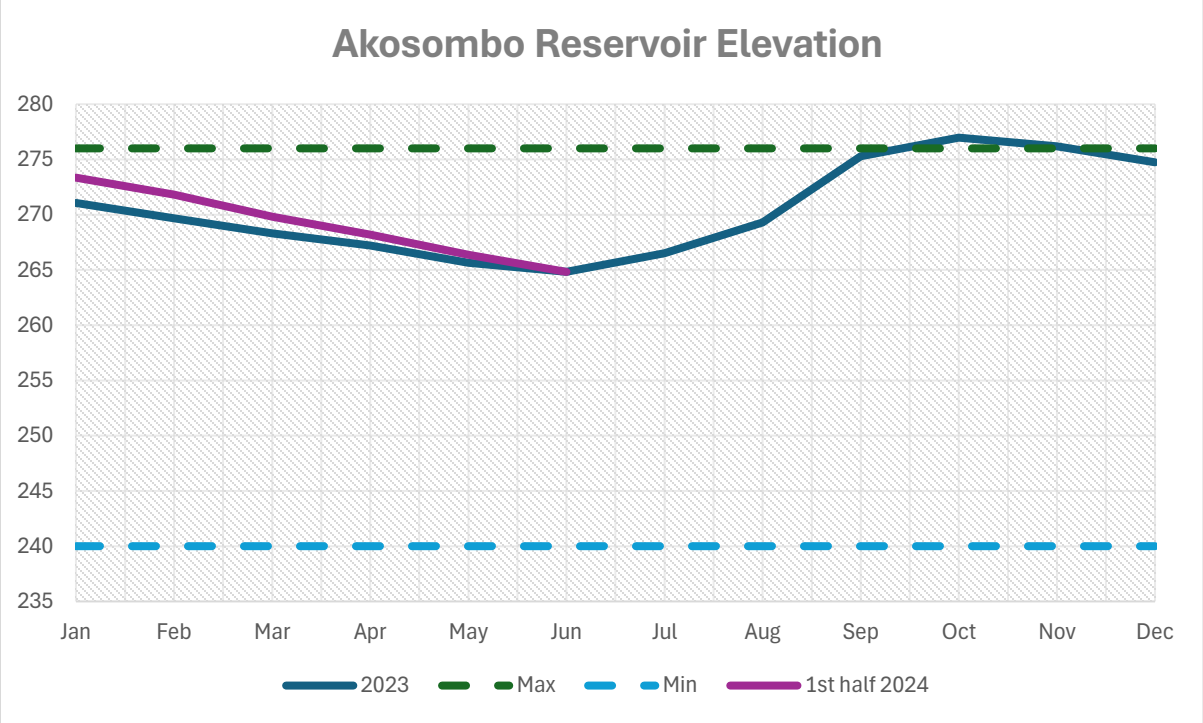


Figure 9: Monthly average Akosombo reservoir trajectory

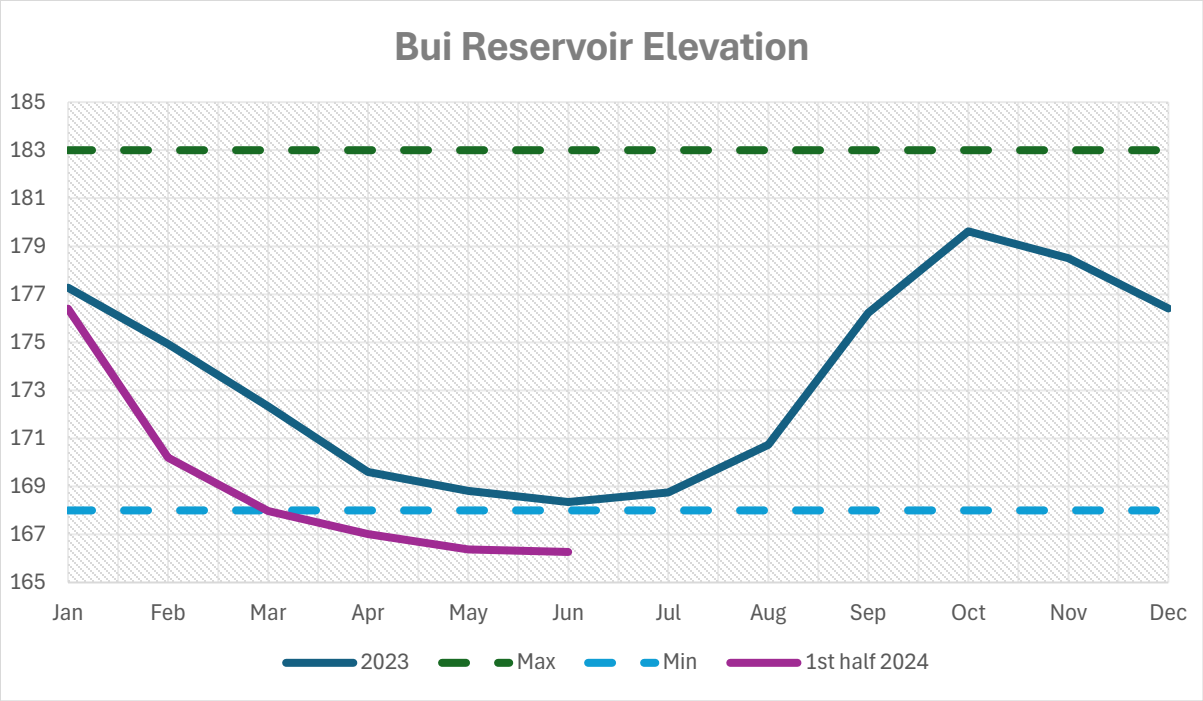


Figure 10: Monthly average Bui reservoir trajectory

2.2.2.2 Thermal Generation Sources

Total grid electricity generated in 2024 from thermal plants was 7,373 GWh, 10.3% less than what was projected for the year, and 0.9% higher than generation in 2023. Table 3 and Figure 11 present the monthly and total thermal generation in the first half of 2024, comparing actual generation against projections.

Table 3: Monthly thermal plants generation for 1st half of 2024, projected versus actual, GWh

Month	Projection 1st Half 2024						Actual 1st Half 2024					
	Jan	Feb	Mar	Apr	May	Jun	Jan	Feb	Mar	Apr	May	Jun
AKSA	23	37	49	23	199	31	65	50	55	36	48	25
Amandi	123	89	131	137	123	123	137	123	17	100	104	127
Anwomaso	-	-	-	-	-	-	-	-	-	31	96	97
CENIT	36	30	43	44	52	43	5	7	1	-	-	-
Cenpower	192	240	185	232	193	232	142	195	203	102	97	139
EarlyPower	79	59	64	67	66	57	16	0	17	59	39	88
Karpower	187	181	201	223	196	179	319	299	323	231	146	158
KTPP	62	16	64	23	69	27	38	25	22	65	70	16

SAPP	275	262	334	249	190	247	238	242	288	254	257	249
TAPCO	179	164	158	137	143	180	48	64	147	169	182	110
TICO	150	160	157	162	183	208	117	69	82	126	144	151
Import	-	-	-	-	-	-	6	4	9	7	8	5
TT1PP	30	28	24	41	23	56	74	68	73	41	67	71
TT2PP	3	3	6	12	12	12	-	-	-	-	-	-
Genser	-	-	-	-	-	-	13	16	19	13	21	27
Total	**1,339**	**1,270**	**1,417**	**1,351**	**1,449**	**1,394**	**1,213**	**1,157**	**1,246**	**1,226**	**1,271**	**1,259**

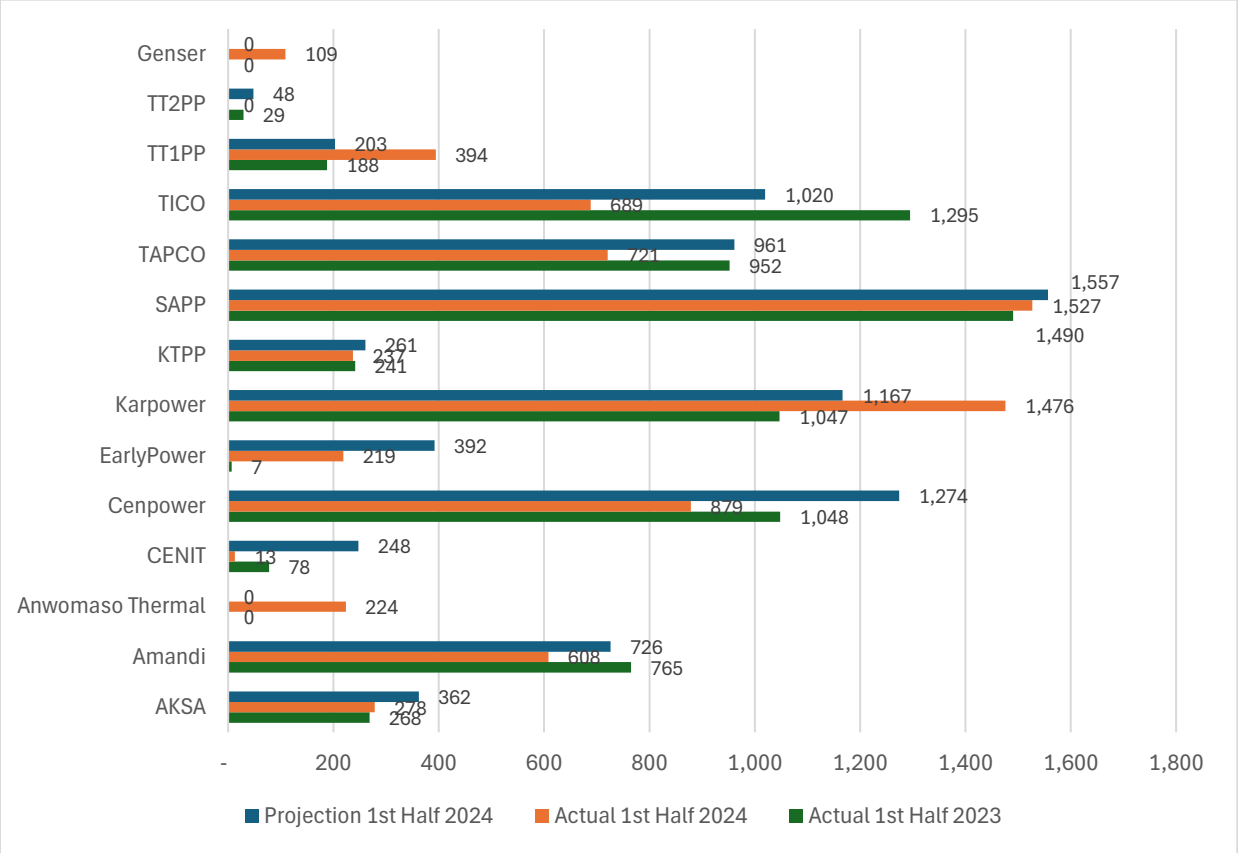


Figure 11: Projected versus actual thermal plants generation for 1st half of 2024

Karpower and TT1PP generated significantly more than projected, with increases of 26.5% and 94.3%, respectively. Compared to 2023, TT1PP had the highest generation delta of 109.6% of the projected. CENIT, Cenpower, and TICO fell significantly short of projections by 94.7%, 31.0%, and 32.5%, respectively. Compared to 2023, TICO showed the largest decrease at 46.8%. Anwomaso and Genser showed actual generation in 2024 with no projections or previous year

generation, indicating new operations on the NITS. This analysis highlights variability in thermal power generation, influenced by unavailability of fuels, maintenance, and other factors.

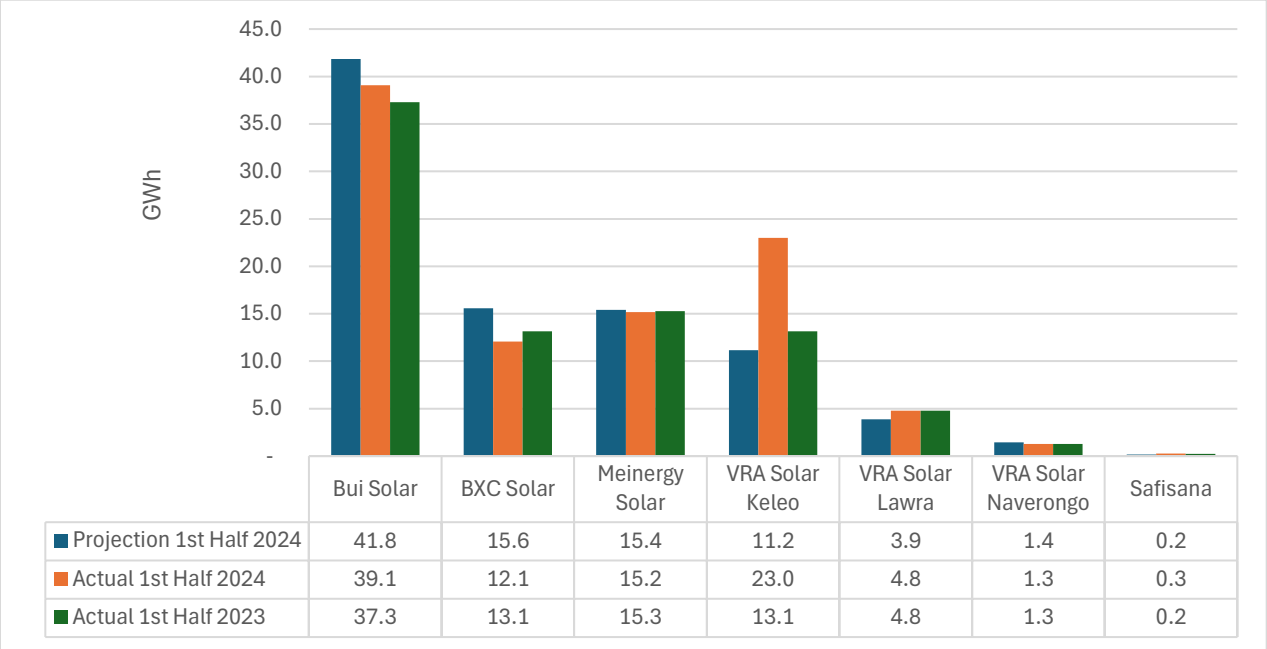
2.2.2.3 Renewable Generation Sources

The total renewable generation in the first half of 2024 is 97 GWh. VRA Solar Keleo generated more than projected and more than in 2023. The first half of 2024 generation profiles for BXC Solar, Meinergy Solar, VRA Solar Lawra, VRA Solar Naverongo, and Safisana were similar to the same period in 2023. Bui Solar, BXC Solar and VRA Solar Naverongo fell short of their projected generation, although Bui Solar still showed a year-on-year increase.

Overall, the renewable energy generation for the first half of 2024 shows a mix of overperformance and underperformance relative to projections, with several sources maintaining consistent output compared to the previous year. Monthly generation from renewable plants for first half of 2024, projected versus actual are shown in Table 4 and Figure 12.

Table 4: Monthly generation from renewable plants for first half of 2024, projected versus actual, GWh

Month	Projection 1st Half 2024						Actual 1st Half 2024					
	Jan	Feb	Mar	Apr	May	Jun	Jan	Feb	Mar	Apr	May	Jun
BuiSolar	7.9	7.2	8.2	6.2	7.1	5.2	7.2	6.6	4.7	7.6	7.0	6.0
BXCSolar	2.4	2.2	2.9	2.9	2.8	2.5	2.3	1.2	2.2	2.2	2.4	1.8
MeinergySolar	2.8	2.6	3.1	2.6	2.8	1.5	2.6	2.5	2.7	2.5	2.8	2.1
VRA Solar Keleo	1.3	1.4	1.9	2.8	2.1	1.6	3.7	3.7	4.0	4.0	3.9	3.6
VRA Solar Lawra	0.5	0.5	0.6	0.7	0.8	0.8	0.7	0.7	0.9	0.9	0.9	0.8
VRA Solar Naverongo	0.3	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1
Safisana	0.04	0.03	0.02	0.03	0.03	0.03	0.06	0.03	0.04	0.06	0.04	0.03
Total	**15.2**	**14.2**	**16.9**	**15.5**	**15.8**	**11.9**	**16.9**	**14.9**	**14.7**	**17.5**	**17.2**	**14.4**



	Bui Solar	BXC Solar	Meinergy Solar	VRA Solar Keleo	VRA Solar Lawra	VRA Solar Naverongo	Safisana
Projection 1st Half 2024	41.8	15.6	15.4	11.2	3.9	1.4	0.2
Actual 1st Half 2024	39.1	12.1	15.2	23.0	4.8	1.3	0.3
Actual 1st Half 2023	37.3	13.1	15.3	13.1	4.8	1.3	0.2

Figure 12: Projected versus actual thermal plants generation for 1st half of 2024

2.2.2.4 Electricity Import

Power import in the first half of 2024 was not anticipated. However, inadvertent energy exchanges on tie-lines resulted from transient flows of 40 GWh.

2.3 Fuel Supply

2.3.1 Fuel Consumption in the 1st Half of 2024

Most thermal plants depend on natural gas as the primary fuel source. The various fuels and their quantities consumed by the thermal plants for the first half of 2024 are shown in Tables 5 and 6.

Table 5: Natural Gas used by thermal plants in the 1st half of 2024, TBtu

	Projected 1st half 2024							Actual 1st half 2024						
Plant	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Total**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Total**
AKSA Gas	0.01	0.13	0.16	0.08	1.48	0.11	**1.97**	0.35	0.30	0.29	0.21	0.23	0.16	**1.55**
Amandi	0.95	0.69	1.02	1.07	0.96	0.96	**5.65**	1.01	0.89	0.13	0.76	0.81	1.53	**5.12**
Anwomaso Thermal	-	-	-	-	-	-	**-**	-	-	-	0.29	0.90	0.89	**2.09**

CENIT	0.41	0.35	0.51	0.51	0.61	0.50	**2.89**	0.06	0.08	0.01	-	-	-	**0.15**
Cenpower	1.51	1.89	1.45	1.82	1.52	1.82	**10.00**	1.09	1.45	1.39	0.72	0.62	0.71	**5.98**
EarlyPower	0.59	0.44	0.48	0.50	0.50	0.43	**2.94**	0.11	-	0.16	0.42	0.31	0.67	**1.67**
Karpower	1.58	1.54	1.71	1.89	1.66	1.52	**9.89**	2.43	2.19	2.46	1.79	1.14	1.17	**11.17**
KTPP	0.73	0.19	0.74	0.27	0.80	0.31	**3.03**	-	0.01	0.23	0.63	0.69	0.19	**1.75**
SAPP	2.60	2.48	3.17	2.36	1.80	2.33	**14.73**	1.79	1.77	2.16	1.89	1.95	1.80	**11.37**
TAPCO	1.51	1.39	1.34	1.16	1.21	1.53	**8.14**	0.54	0.72	1.61	1.66	1.74	1.16	**7.43**
TICO	1.19	1.26	1.24	1.28	1.44	1.64	**8.06**	1.18	0.67	0.83	1.31	1.49	0.90	**6.38**
TT1PP	0.34	0.32	0.28	0.47	0.26	0.64	**2.30**	0.89	0.83	0.90	0.50	0.88	0.89	**4.89**
TT2PP	0.04	0.04	0.07	0.14	0.14	0.14	**0.57**	-	-	-	-	-	-	**-**
Genser	-	-	-	-	-	-	**-**	-	-	-	-	-	-	**-**
Total	**11.5**	**10.7**	**12.2**	**11.6**	**12.4**	**11.9**	**70.2**	**9.5**	**8.9**	**10.2**	**10.2**	**10.8**	**10.0**	**59.5**

Natural gas used in the first half of 2024 for electricity generation was 59.5 TBtu, a 15.2% decrease from what was projected for the period. Though no DFO was projected for use in 2024, about 89,006 barrels were used in the operation of KTPP and Cenpower generation plants. These plants might have resorted to the use of DFO due to gas supply interruption. A total of 33,100 and 126,188 barrels of DFO were used by KTPP and Cenpower for power generation respectively. AKSA plant used 137,580 barrels of HFO, which was below the 206,345 barrels projected, for the period (see Table 6).

Table 6: Liquid fuel used by thermal plants in the 1st half of 2024

Plant		**KTPP**	**Cenpower**	**AKSA**
Projected 1st half 2024	**Liquid Fuel Type**	**DFO (bbl)**		**HFO (bbl)**
	Jan	-	-	33,939
	Feb	-	-	33,939
	Mar	-	-	46,647
	Apr	-	-	21,040
	May	-	-	42,832
	June	-	-	27,947
Total		**-**	**-**	**206,345**
Actual 1st half 2024	Jan	33,100	-	29,054
	Feb	-	-	21,321
	Mar	-	23,272	33,891
	Apr	-	13,548	16,538
	May	-	26,456	29,093
	Jun	-	62,913	7,683
Total		**33,100**	**126,188**	**137,580**

Chapter Three: Revised Electricity Outlook for 2nd Half 2024

As projected in the 2024 Energy Outlook (2024 EO)[3], the electricity demand and supply in the 1st half of 2024 showed significant growth over the same period in 2023. The actual demand and supply trend for the 1st half of the year was largely consistent with the 2024 EO projections. However, some of the assumptions underpinning the forecast have changed over the 1st half of 2024. Consequently, demand and supply projections for the 2nd half of the year have been revised.

3.1 Electricity Demand Outlook

3.1.1 Projected Peak Demand for 2nd Half of 2024

Due to challenges encountered in the 1st half of the year with regards to the ' unavailability of some power plants (largely due to inadequate fuel), the peak demand for 2024, which is expected to occur in the 2nd half of the year, has been revised. The projected coincident peak demand for Ghana has been reviewed downwards to 3,732 MW from the initial projection of 3,788 MW (2024 EO). The new peak demand projection represents a growth of 3.1% over the 2023 system peak of 3,618 MW. The peak demand is expected to occur in December 2024 (see Figure 13). This estimate is accompanied by a 95% confidence interval, with a lower bound of 3,340 MW and an upper bound of 4,123 MW.

[3] Energy Outlook for Ghana (2024): Demand and Supply Outlook, https://www.energycom.gov.gh/newsite/index.php/planning/sub-codes#

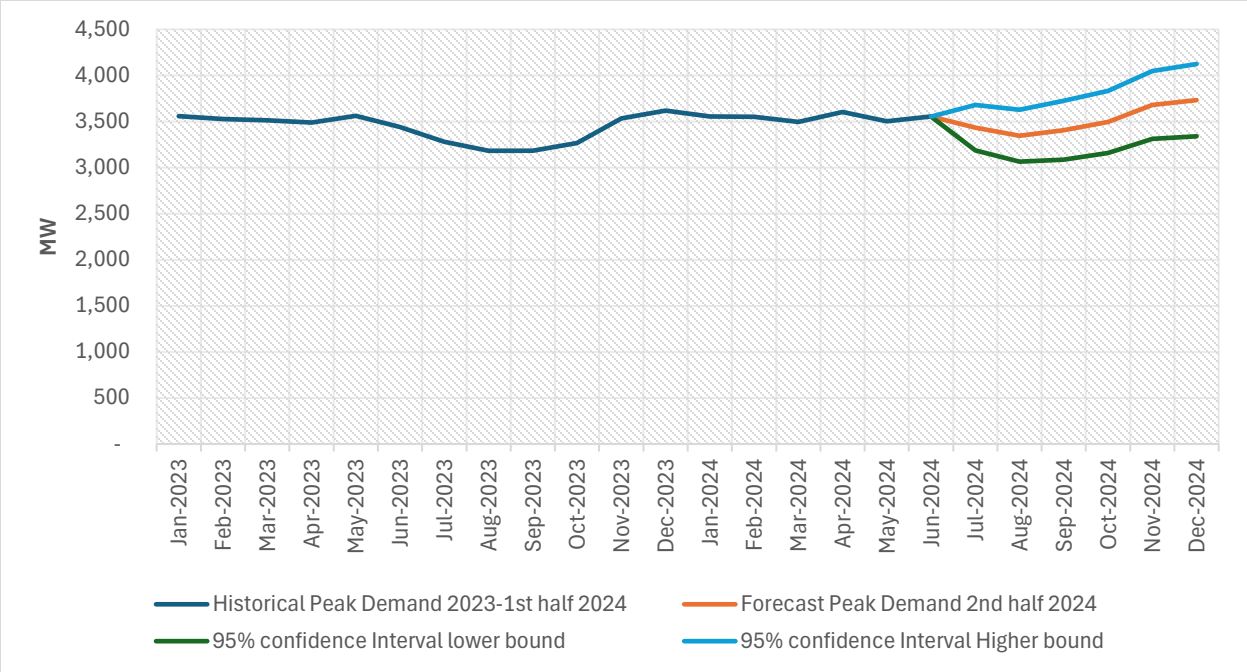


Figure 13: Monthly projected peak demand for 2nd half of 2024 with 95% confidence interval

3.1.2 Projected Electricity Consumption

The second half of 2024 initial projected electricity consumption has been revised downward from 12,278 GWh to 12,132 GWh. The revised projection represents a 4.4% increase in consumption in the same period in 2023. This estimated electricity consumption for the second half of 2024 falls within a 95% confidence interval, with a lower bound of 11,014 GWh and an upper bound of 13,249 GWh (see Figure 14).

Accordingly, the 2024 annual (Jan–Dec) projected electricity required has been revised downwards to 24,601 GWh, (including transmission losses of 907 GWh - ie., 3.7% of total projected energy supply) from the initial projection of 24,997 GWh. The decrease over the initial projection is due to an anticipated continue reduction in electricity export as observed in the first half of 2024. The revised projection for 2024 energy consumption represents an increase of 4.5% over the 2023 consumption of 23,551 GWh.

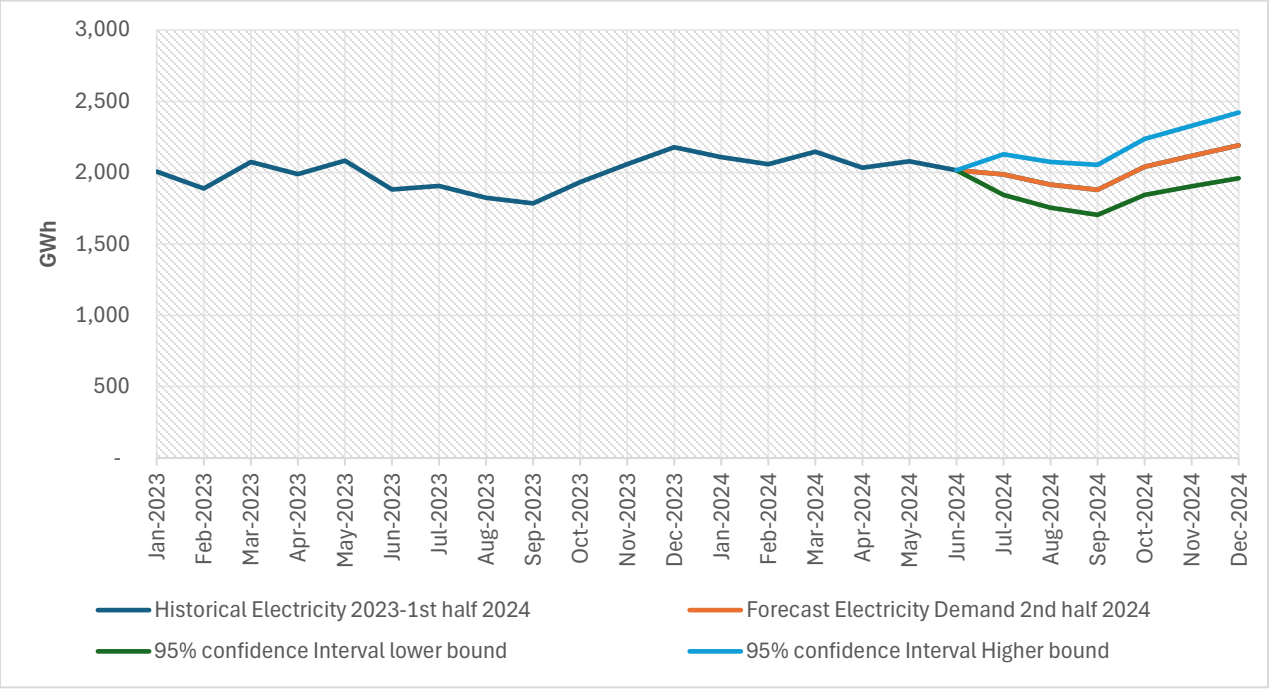
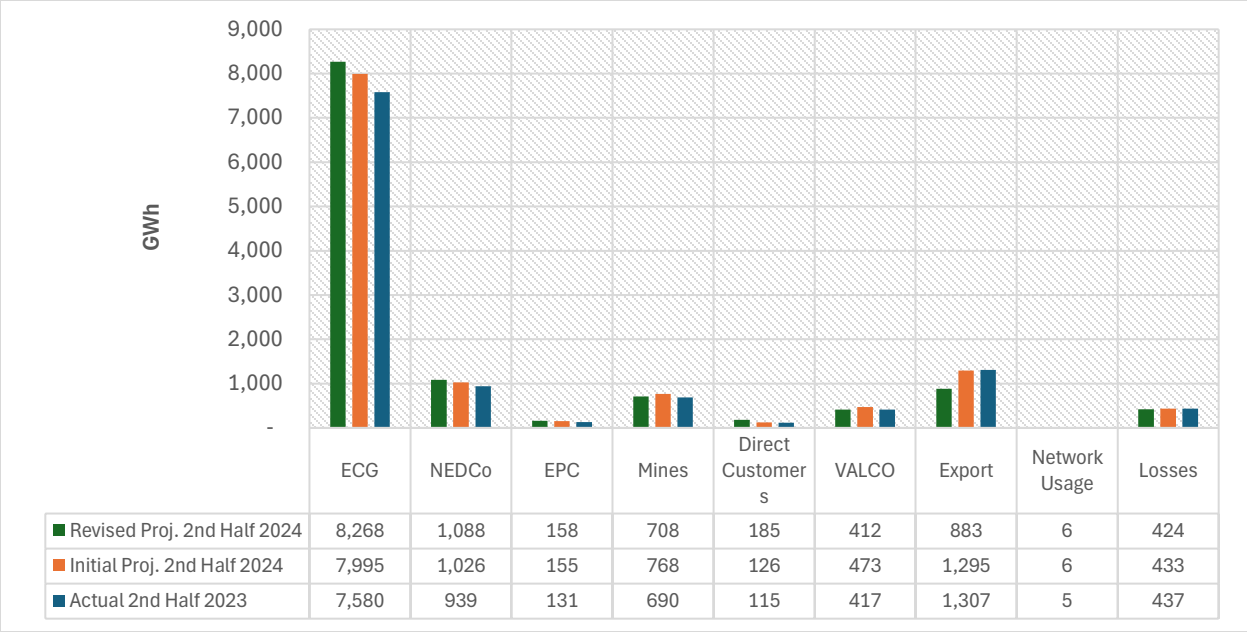


Figure 14: Projected monthly energy for 2nd half of 2024 with a 95% confidence interval

In the 2nd half of 2024, projected ECG and NEDCo consumption is revised upwards to 8,268 GWh and 1,088 GWh, representing a 9.1% and 15.9% increase from the same period in 2023 respectively. Forecasts for other customers for the 2nd half of 2024 are shown in Figure 15.



	ECG	NEDCo	EPC	Mines	Direct Customers	VALCO	Export	Network Usage	Losses
Revised Proj. 2nd Half 2024	8,268	1,088	158	708	185	412	883	6	424
Initial Proj. 2nd Half 2024	7,995	1,026	155	768	126	473	1,295	6	433
Actual 2nd Half 2023	7,580	939	131	690	115	417	1,307	5	437

Figure 15: Revised projected consumption for 2nd half of 2024 by customer classes

ECG's share of electricity consumption will constitute 68.3% of the total projected electricity consumption for the second half of 2024. Export (to Togo/Benin, Côte d'Ivoire and SONABEL) is expected to constitute 7.3% of total consumption. NEDCo and Mines are projected to consume 9.0% and 5.8% of total electricity consumption, respectively. Electricity losses will represent 3.5% of the total electricity supply.

3.2 Electricity Supply Outlook

3.2.1 Generation Sources for 2nd Half of 2024

The sources of generation considered for the 2nd half of 2024 are mainly the existing hydro, thermal and renewable energy plants (Solar and Biogas). Table 7 shows the full complement of power plants and shares of installed and dependable capacities by generating sources.

Table 7: Installed generation capacity for 2nd half of 2024, MW

Power Plant	Fuel Type	Installed Capacity (Nameplate)	% Share	Dependable Capacity	% Share
Hydro Power Plants					

Akosombo	Hydro	1,020		900	
Bui	Hydro	404		371	
Kpong	Hydro	160		140	
	Sub-total	**1,584**	**28.8%, *30.1%**	**1,411**	**27.9% *29.1%**
Thermal Power Plants					
Takoradi Power Company (TAPCO)	Oil/NG	330		315	
Takoradi International Company (TICO)	Oil/NG	340		330	
Sunon–Asogli Power (SAPP)	NG	560		530	
Tema Thermal Plant1 (TT1P)	Oil/NG	110		100	
Tema Thermal Plant2 (TT2P)	Oil/NG	80		70	
CENIT Energy Ltd (CEL)	Oil/NG	110		100	
Kpone Thermal Power Plant (KTPP)	Oil/NG	220		200	
Anwomaso Thermal	NG	250		230	
Karpower	NG/HFO	470		450	
AKSA	HFO/NG	370		330	
Cenpower	Oil/NG	360		340	
Amandi	Oil/NG	210		201	
Early Power	NG/LPG	200		190	
Genser (grid)	NG/LPG	66		58.8	
	Sub-total	**3,676**	**69.9%**	**3,444.8**	**70.9%**
Genser (embedded)	NG/LPG	115		99	
Sub–total (incl. embedded gen.)		**3,791**	**68.8%**	**3,544.8**	**70.0%**
Renewables (excl. large hydro)					
VRA Solar (Navrongo)	Solar	2.5		2	
Meinergy Solar	Solar	20		16	
BXC Solar	Solar	20		16	
VRA Solar (Lawra)	Solar	6.5		5.2	
VRA Solar (Kaleo)	Solar	28		22	
Tsatsadu Hydro	Hydro	0.045		0.045	
Bui Solar	Solar	55		44	
Safisana Biogas	Biogas	0.1		0.1	
Sub – total		**132.145**	**2.4%**	**105.345**	**2.1%**
Total (incl embedded gen.)		**5,507.145**		**5,060.345**	
Total (excl embedded gen.)		**5,260**		**4,855.8**	

*Capacity share excluding embedded generation capacity

In the 2nd half of 2024, all six units of Akosombo hydropower will be available for power generation, given an operating capacity of up to 900 MW. Also, the Kpong hydropower plant (downstream of Akosombo) will have all four of its units available. Bui hydropower plant is

expected to continue to operate one unit off-peak and a maximum of two units at peak. In critical situations, all three units will be dispatched to meet demand.

Total dependable capacity to be made available from thermal generation amounts to 3,444.8 MW. It is worth noting that two thermal plants, namely CENIT and TT2PP will not be available throughout the second half of 2024.

The total renewable dependable capacity is expected to be 105 MW. Since most of these renewable sources are solar PV without storage, their dependable capacity will be zero during peak periods and nights. The Volta River Authority (VRA) contributes a total of 29 MW from three solar plants. The Bui Power Authority (BPA) adds substantial contributions through its Bui Solar PV farm and a floating solar facility. There are also private players including BXC and Meinergy contributing substantially to the renewable dependable capacity.

Power imports are not anticipated throughout this period. However, inadvertent energy exchanges on tie-lines could result from transient flows. Emergency imports may be necessitated because of short-term capacity shortages caused by faults or fuel supply contingencies.

3.2.2 Demand-Supply Balance for 2nd Half of 2024

The electricity demand-supply balance for the second half of 2024 and the aggregation (actual 1st half and 2nd half) for full year 2024 are presented in Table 8. It should be noted that in instances where there is a supply surplus, some plants would not be dispatched.

Table 8: 2024 Projected electricity demand/supply balance, GWh

Customer Class	Actual 1st Half of 2024	Revised Projection 2nd Half of 2024							Revised Projection for 2024
		Jul	Aug	Sep	Oct	Nov	Dec	Total (Jul-Dec)	
Domestic	**11,147**	1,757	1,702	1,682	1,828	1,900	1,967	**10,837**	**21,983**
VALCO	**409**	69	68	66	71	65	73	**412**	**821**
Export	**914**	160	145	131	142	152	152	**883**	**1,796**
Proj. Energy Consumption	**12,469**	**1,987**	**1,915**	**1,880**	**2,041**	**2,117**	**2,191**	**12,132**	**24,601**
Generation Sources									

Akosombo	**3,778**	584	582	568	576	568	617	**3,494**	**7,273**
Kpong	**611**	103	99	90	94	83	93	**563**	**1,174**
Bui	**557**	54	78	179	189	176	148	**822**	**1,380**
AKSA	**279**	28	28	27	28	53	56	**220**	**499**
Amandi	**608**	127	117	103	117	123	127	**715**	**1,323**
Anwomaso Thermal	**224**	76	76	73	138	141	146	**649**	**874**
CENIT	**13**	-	-	-	-	-	-	**-**	**13**
Cenpower	**879**	146	141	133	141	133	141	**835**	**1,715**
EarlyPower	**227**	70	36	30	25	53	74	**288**	**514**
Karpower	**1,480**	162	149	98	132	135	142	**819**	**2,299**
KTPP	**238**	-	63	-	53	-	53	**170**	**408**
SAPP	**1,527**	228	218	210	218	220	228	**1,321**	**2,849**
TAPCO	**718**	146	149	148	149	172	173	**937**	**1,655**
TICO	**689**	158	140	134	143	155	153	**882**	**1,571**
Imports	**39**	-	-	-	-	-	-	**-**	**39**
TT1PP	**395**	70	-	51	-	61	-	**183**	**577**
TT2PP	**0**	-	-	-	-	-	-	**-**	**0**
Genser	**109**	23	23	20	20	23	24	**134**	**243**
Bui Solar	**39**	4	5	5	8	8	8	**38**	**77**
BXC Solar	**13**	2	2	2	3	3	2	**15**	**28**
Meinergy Solar	**15**	2	2	1	3	3	3	**14**	**29**
VRA Solar Keleo	**23**	4	4	4	5	4	4	**25**	**48**
VRA Solar Lawra	**5**	2	2	1	1	1	1	**6**	**11**
VRA Solar Naverongo	**1**	0.2	0.2	0.2	0.3	0.3	0.2	**1.4**	**3**
Safisana	**0.2**	0.04	0.04	0.03	0.04	0.04	0.04	**0.2**	**0.5**
Total Supply	**12,469**	**1,987**	**1,915**	**1,880**	**2,041**	**2,117**	**2,191**	**12,132**	**24,601**

Hydro generation in the 2nd half of 2024 has been revised upward to 4,879 GWh, signifying a 2.8% increase from the same period generation in 2023. The envisaged increase in hydro generation is attributed to continuing high inflows into the Akosombo dam.

The forecast for the 2nd half of 2024 has been revised to a total generation of 7,153 GWh, reflecting a 5.3% increase over the same period generation in 2023 (see Figure 9). Generation from renewable sources is expected to be 100 GWh in the 2nd half of 2024, up from 63 GWh in the same period in 2023 (see Figure 16).

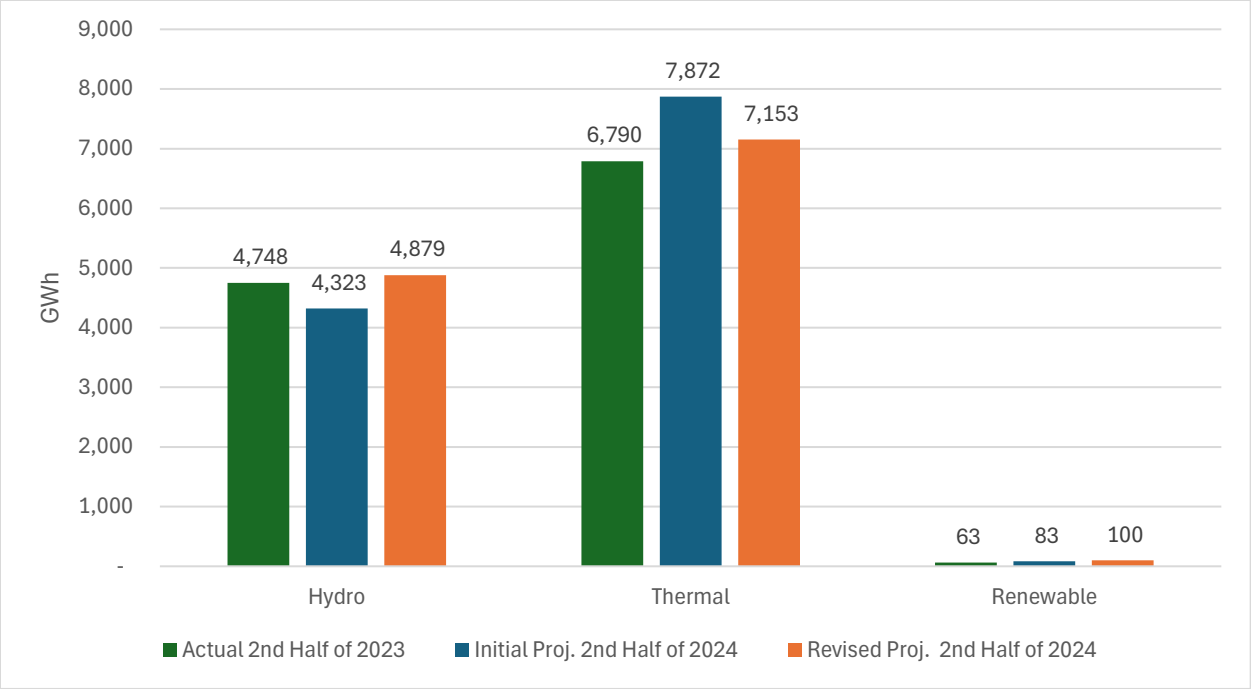


Figure 16: Projected electricity generation by generation source for second half of 2024

Thermal generation and hydro generation would constitute 64.4% and 34.9% of total generation in the second half of 2024. Generation from renewable sources (solar PV and Biogas) would constitute 0.7%.

3.3 Fuel Supply Outlook

3.3.1 Fuel Requirements

The dominance of thermal generation in the overall generation mix highlights the crucial importance of fuel availability to the thermal plants for ensuring power supply reliability and supply security in the Ghana power system.

Natural gas will continue to be the primary fuel for thermal electricity generation in 2024. Based on the revised projected electricity supply from thermal sources for the second half of 2024, the total natural gas requirement for power generation is projected to be 63.5TBtu (see Table 8). The monthly fuel requirement for each thermal plant is shown in Figure 17 and Table 9.

Table 9: Revised natural gas requirements by thermal plants for Second half of 2024

Plant	Actual 1st Half of 2024	Revised Projection 2nd Half of 2024							Revised Projection (Jan-Dec) for 2024
		Jul	Aug	Sep	Oct	Nov	Dec	Total (Jul-Dec)	
AKSA Gas	**1.5**	0.2	0.2	0.2	0.2	0.5	0.5	**1.9**	**3.4**
Amandi	**5.1**	1.0	0.9	0.8	0.9	1.0	1.0	**5.6**	**10.7**
Anwomaso Thermal	**2.1**	0.9	0.9	0.8	1.6	1.6	1.6	**7.3**	**9.4**
CENIT	**0.1**	-	-	-	-	-	-	**-**	**0.1**
Cenpower	**6.0**	1.1	1.1	1.0	1.1	1.0	1.1	**6.6**	**12.5**
EarlyPower	**1.7**	0.5	0.3	0.2	0.2	0.4	0.6	**2.2**	**3.8**
Karpower	**11.2**	1.4	1.3	0.8	1.1	1.1	1.2	**6.9**	**18.1**
KTPP	**1.7**	-	0.7	-	0.6	-	0.6	**2.0**	**3.7**
SAPP	**11.4**	2.2	2.1	2.0	2.1	2.1	2.2	**12.5**	**23.9**
TAPCO	**7.4**	1.2	1.3	1.3	1.3	1.5	1.5	**7.9**	**15.4**
TICO	**6.4**	1.2	1.1	1.1	1.1	1.2	1.2	**7.0**	**13.4**
TT1P	**4.9**	0.8	-	0.6	-	0.7	-	**2.1**	**7.0**
TT2P	**-**	-	-	-	-	-	-	**-**	**-**
Genser	**-**	0.3	0.3	0.2	0.2	0.3	0.3	**1.6**	**1.6**
Total	**59.5**	**10.8**	**10.1**	**9.1**	**10.4**	**11.3**	**11.7**	**63.5**	**123.0**

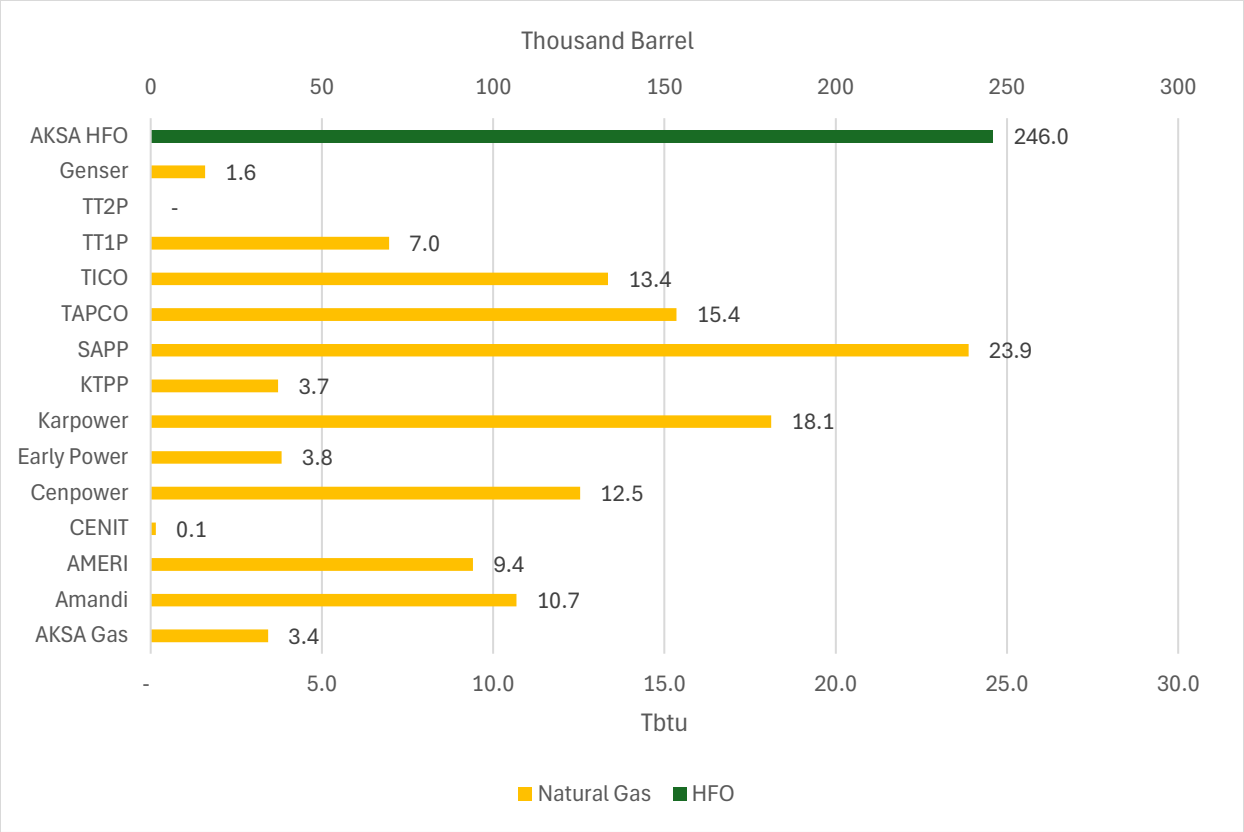


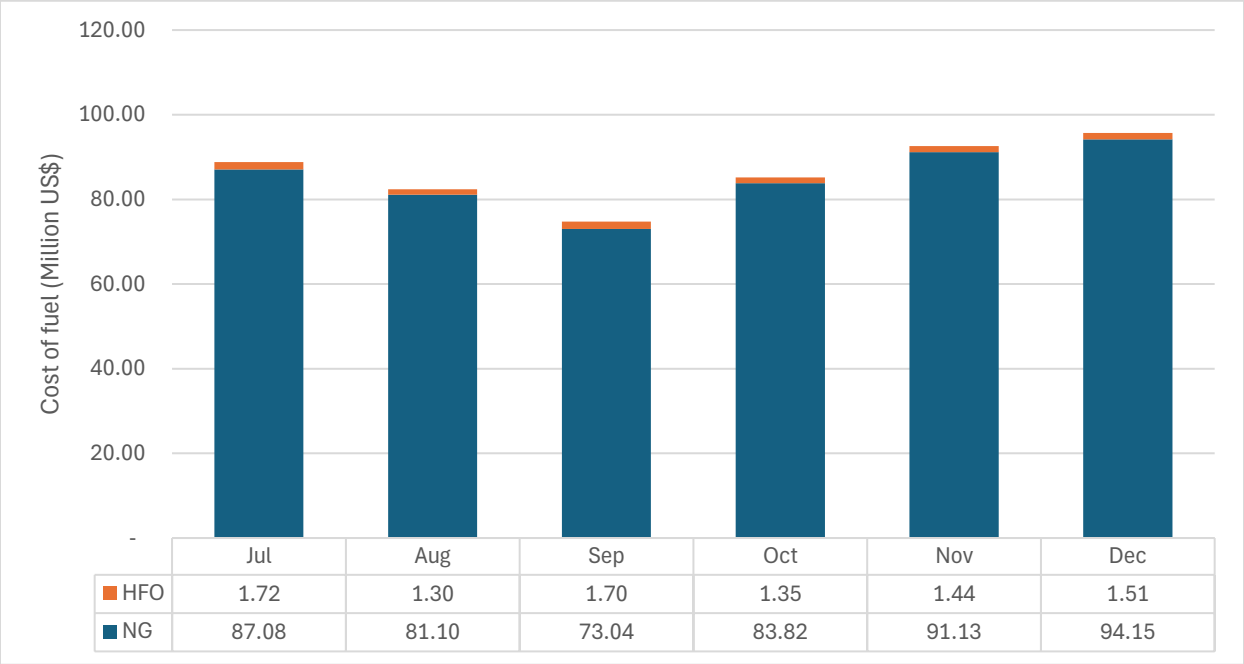
Figure 17: Revised thermal plants' fuel requirements for 2024

The AKSA plant fuels some of its units using HFO and is expected to continue to operate them as a standby in the 2nd half of 2024. The plant will require a total of 246,047 barrels for the period. Light crude oil (LCO) and diesel would be required as backup fuels for some plants because of anticipated gas supply outages.

2.3.2 Fuel Price and Cost

Assuming a Weighted Average Cost of Gas (WACOG) of US$8.04/MMBtu, about US$ 510.32 million would be needed for gas procurement in the second half of 2024. This translates to a monthly average of US$ 85.05 million. HFO for the running of the AKSA plant would be procured at an expected delivery price of US$78.19/barrel and about $9.03 million will be required to procure HFO. Overall, an amount of US$ 519.35 million is required to purchase fuel for thermal

power generation in the second half of 2024. Figure 18 presents the monthly total cost of natural gas and HFO.



	Jul	Aug	Sep	Oct	Nov	Dec
HFO	1.72	1.30	1.70	1.35	1.44	1.51
NG	87.08	81.10	73.04	83.82	91.13	94.15

Figure 18: Expected monthly total cost of natural gas and HFO for thermal plants in second half of 2024

3.4 Electricity Supply Challenges

3.4.1 Fuel Supply Challenges in the 2nd Half of 2024

Fossil Fuel Risk

Currently all thermal power plants in Ghana (except some units of the AKSA plant) run on natural gas as their primary fuel. About 80.0% of the thermal plants are dual-fueled with their secondary fuel being liquid fuels (LCO and DFO). These plants provide strategic options for generation in instances where gas supply interruptions occur due to planned and unplanned maintenance of gas facilities.

In the 2nd half of 2024, significant gas supply challenges are expected due to major planned maintenance activities (see Section 5.2.5). Consequently, it will be essential to either increase gas supply from import and available domestic source (Sankofa or AGPP) or procure liquid fuels to

ensure the continued operation of the dual-fueled thermal plants during these maintenance periods.

Chapter Four: Performance of Petroleum Sub-sector 1st Half 2024

4.1 Crude Oil

4.1.1 Crude Oil Production 1st Half of 2024

As of May 2024, a total of 20.69 million barrels of crude oil was produced by the three main oil fields in Ghana which was 11.7% higher than the 2023 production of 15.53 million barrels over the same period. The 2024 production was 15.6% higher than the projected production of 17.91 million barrels (See Figure 19). The increase in 2024 production is driven by Tullow Oil's extensive drilling campaign at Jubilee and TEN in 2023[4]. Figure 19 presents the projected vs actual crude oil production.

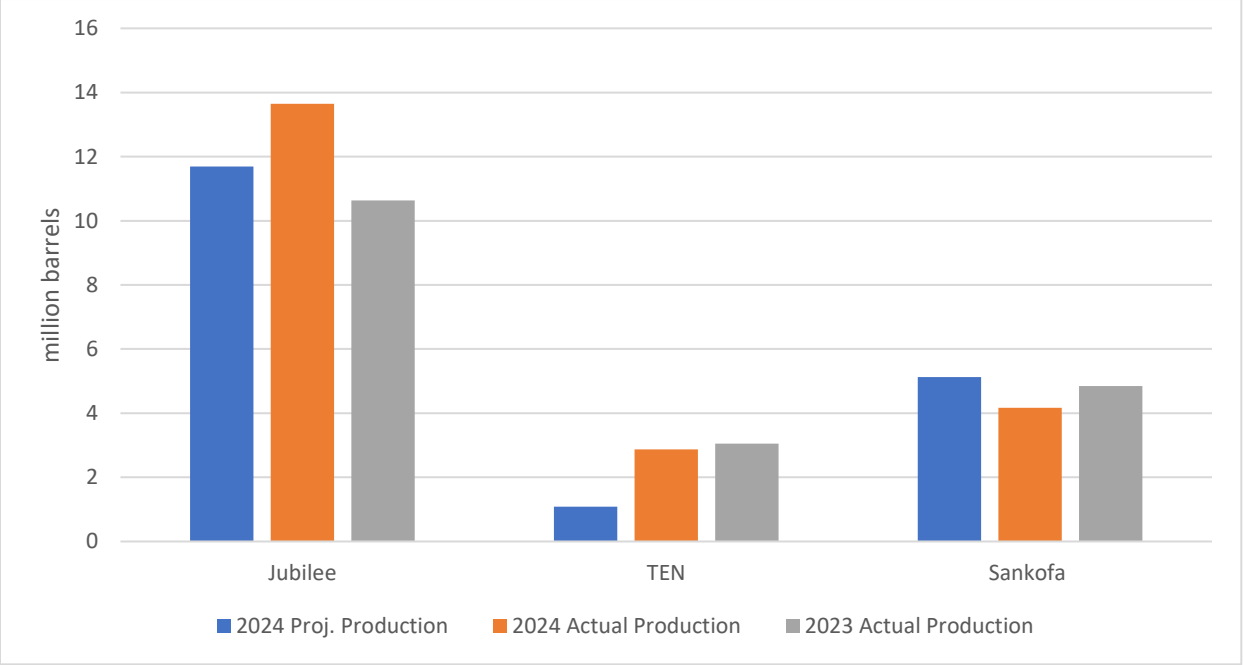


Figure 19: Projected vs Actual Crude oil production (Jan-May)

Production from Jubilee field increased from 10.64 million barrels in 2023 to 11.7 million barrels in 2024, an increase of about 9.96%. However, production from the TEN and OCTP decreased

[4] https://www.myjoyonline.com/ghanas-oil-production-to-rebound-in-2024-growing-by-5-fitch-solution/

by 5.85% and 13.83% respectively. Production from TEN and OCTP reduced from 3.05 million barrels and 4.84 million barrels in 2023 (Jan-May) to 2.87 million and 4.17 million barrels in 2024 (Jan-May) respectively. Therefore, the 2024 daily average crude oil production in Ghana increased to 136,143 barrels per day as compared to the daily average of 122,682 barrels produced in 2023. Figure 20 displays the crude oil production from the various fields in Ghana from January to May 2024.

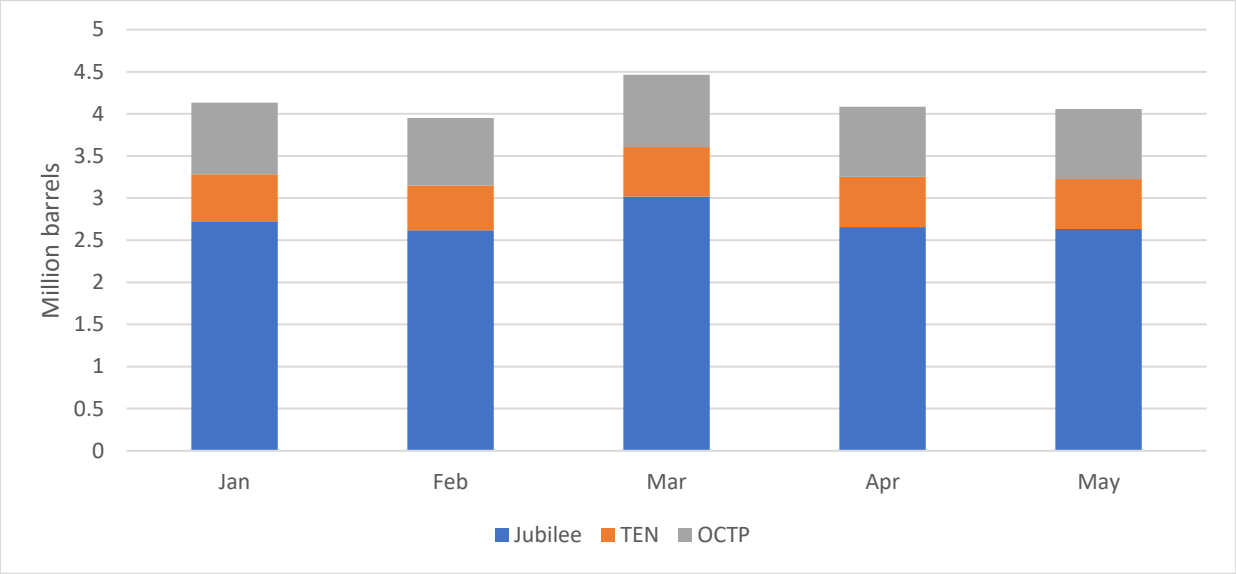


Figure 20: Monthly crude oil Production (Jan-May)

4.2 Natural Gas

4.2.1 Natural Gas Production

A total of 93,194 mmscf of associated and non-associated natural gas was produced by the three main fields as of April 2024. In 2024, production was 4% lower than the projected figure of 97,348 mmscf. Nevertheless, the 2024 production exceeded the 2023 production of 78,062 mmscf by 19%. Figure 21 shows the actual natural gas produced in 2024 as against the 2023 production and 2024 projections.

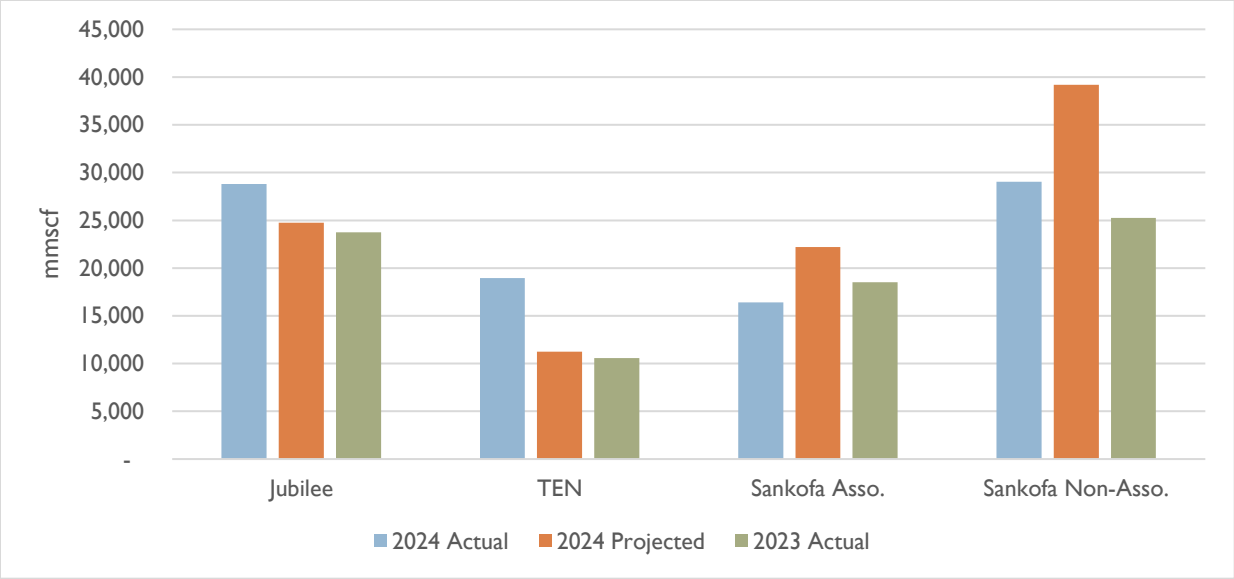


Figure 21: Projected vs Actual Natural gas Production in 2024 (Jan-April)

The natural gas export in 2024 (Jan-April) increased to 39,642 mmscf from 34,861 mmscf exported in 2023. The 2024 export was made up of 11,946 mmscf from Jubilee/TEN to the Atuabo GPP and 27,696 mmscf from Sankofa to the ORF. Figure 22 displays the monthly natural gas exported from the fields as of April 2024.

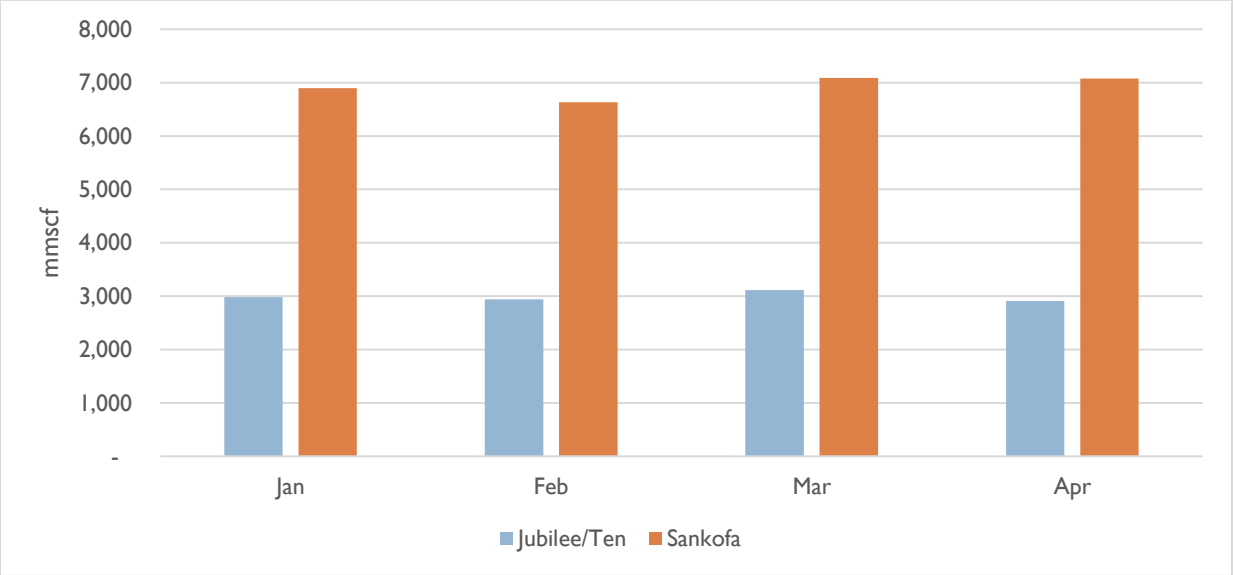


Figure 22: 2024 Monthly Natural gas export

4.2.2 Lean Natural Gas Supply

The three main sources of indigenous natural gas continue to supply gas for power and non-power purposes as well as imports from Nigeria. As of May 2024, the daily natural gas consumed in the country was 384 mmscfd an increase of 7.3% over the 2023 consumption of 358 mmscfd over the same period.

The daily average of lean gas produced from the Atuabo GPP was 91.85 mmsfd as against the projected 100 mmscfd. Over the same period (Jan-May), the 2024 production was 7.1% lower than the 2023 production of 98.9 mmscfd.

Lean gas produced from the OCTP as of May 2024 averaged 231 mmscfd as against the projected 235 mmscfd. The 2024 production was however higher (15%) than the 2023 production of 201 mmscfd.

The contracted volumes from N-gas is 123 mmscfd out of which the first 90 mmscfd is take or pay. However, the flow rate has historically been below the take-or-pay threshold. The 2024 (Jan-May) flow rate of N-gas averaged 61.3mmscfd as against the projected flow of 60 mmscfd. The 2024 flow rate is, however, higher than that of 2023 flows of 58.3 mmscfd.

The average daily lean gas from the indigenous sources as well as imports as of May 2024 was 384.2 mmscfd, an increase of 8% over 2023 average daily export over the same period. The 2024 actual lean gas export volumes were however, 4% lower than the projected natural gas exports for 2024. Figure 23 presents the average daily export of gas from the three fields as well as imports from Nigeria through the WAGP in 2024 (Jan-May).

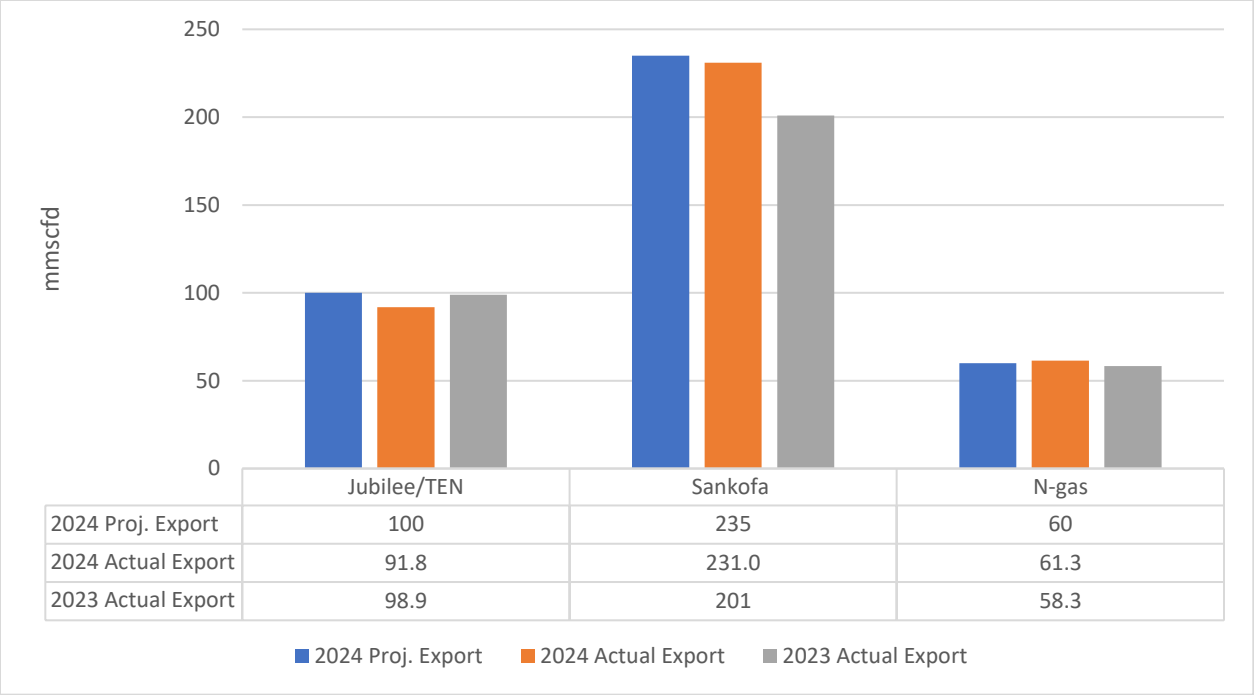


Figure 23: Projected vs Actual lean gas production/export in 2024 (Jan-May)

4.2.3 Non-Power Natural Gas Consumption

The industries that consume natural gas in Ghana are mostly ceramics industries and Sentuo refinery. As of May 2024, a total of 4,110.4 mmscf of natural gas was consumed by industries in Ghana. Figure 24 shows the non-power gas consumption in 2024 (Jan-May). Sentuo refinery was offline from March to May 2024 due to crude oil unavailability. This resulted in a significant drop in non-power natural gas consumption.

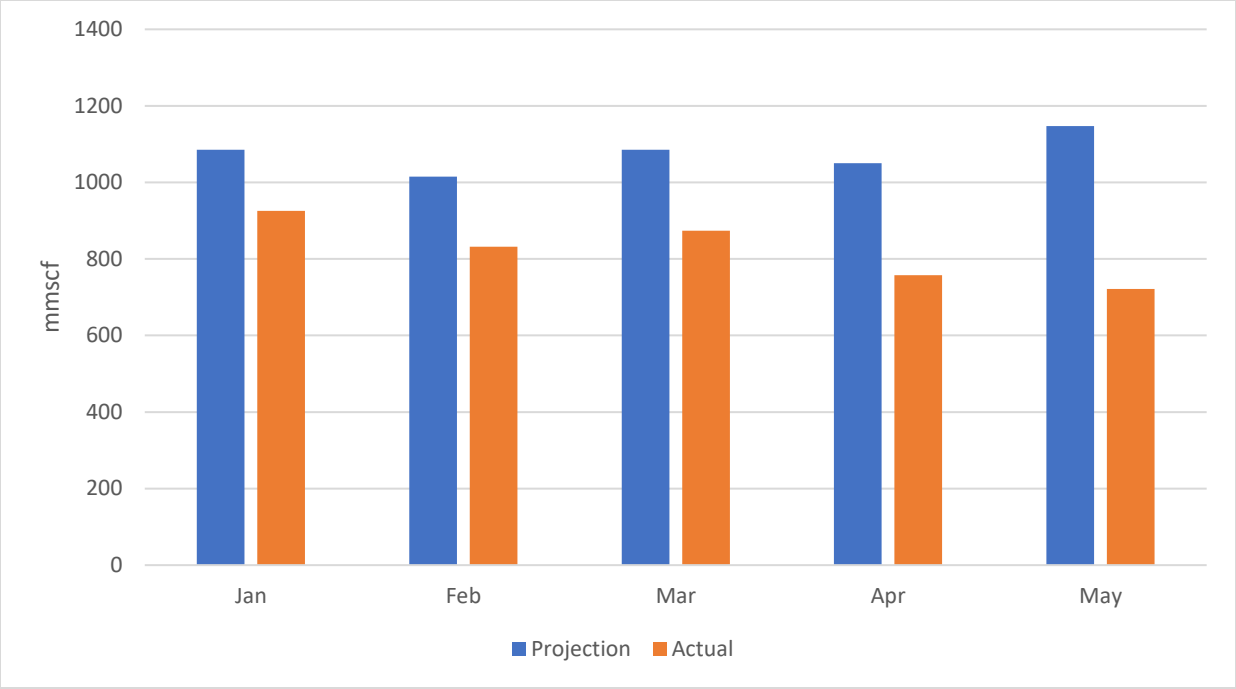


Figure 24: Non power gas consumption in 2024 (Jan-May)

Keda (Twyford) consumed about 1,914 mmscf for the period which was about 46.67% of the total consumption of 4, 110.4 mmscf. Sentuo refinery has not been refining crude oil since March. This has resulted in the reduction of natural gas consumption from March to May 2024. Figure 25 shows the monthly non power consumption of natural gas.

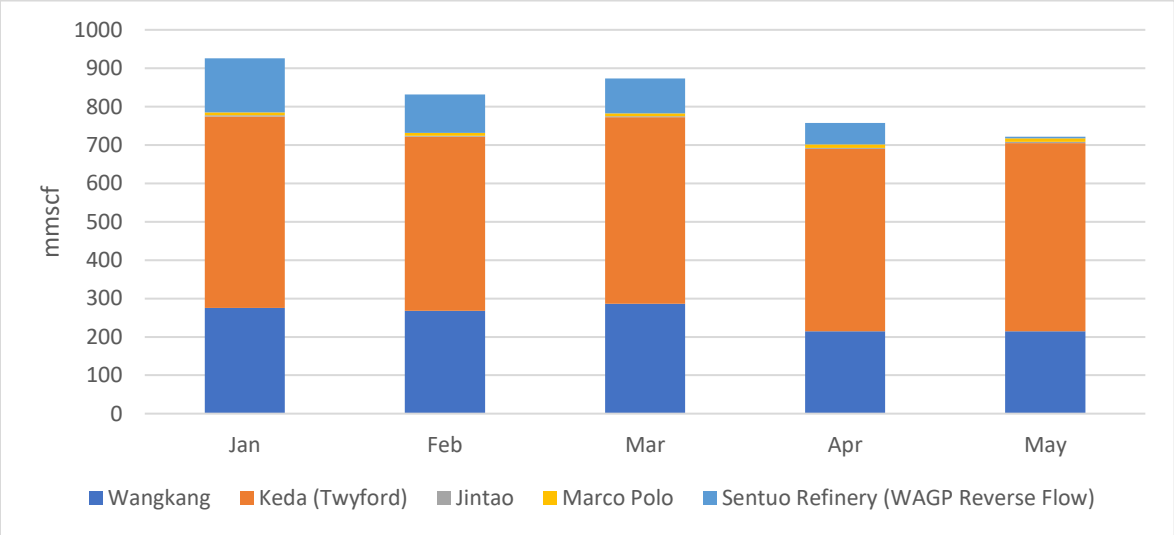


Figure 25: Monthly non power consumption of natural gas in 2024 (Jan-May)

Source: GNGC

4.2.4 Natural Gas Demand-Supply Balance

As of May 2024, a total of 58,396.95 mmscf was supplied for both power generation and industrial consumption as against a projected supply of 60,040 mmscf over the same period. The actual gas supply was about 2.7% less than the projected flows for the period under consideration. However, the actual supply consistently increases over the months and exceeds the projected supply from March onwards (see Figure 26).

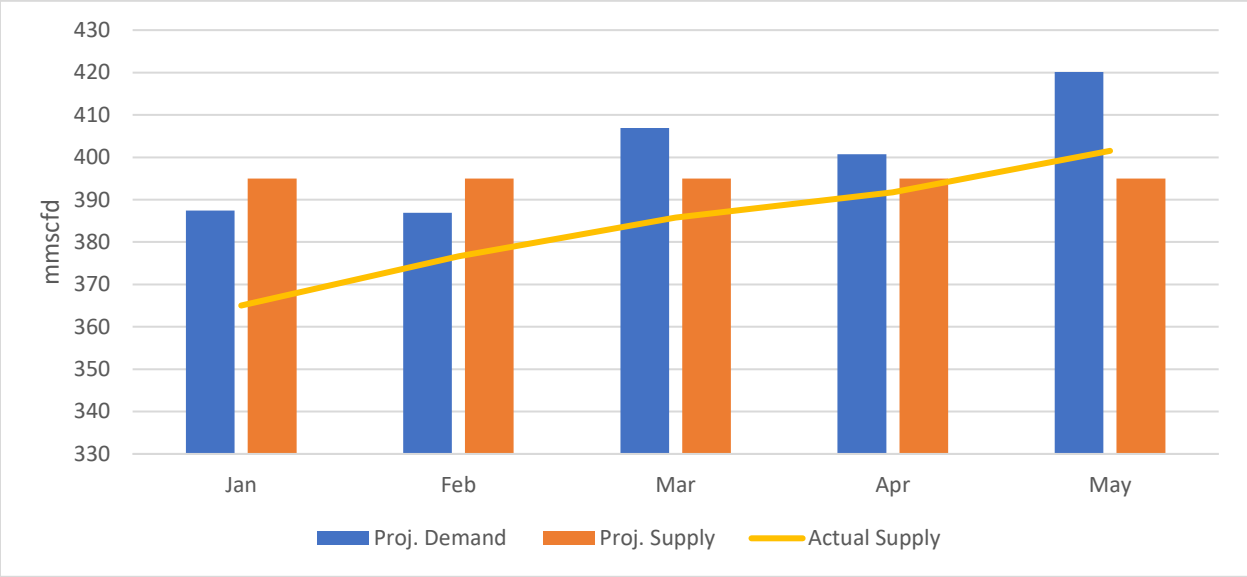


Figure 26: Projected vs Actual Natural gas demand-supply balance for 2024 (Jan-May)

By April, actual supply outstrips the projected demand, suggesting an improving supply situation over time. Clearly, the natural gas supplied from January-May 2024 was inadequate for both power and non-power consumption, which led to power generation deficit especially during the first quarter of the year. The average deficit in natural gas supply during this period was about 20-25 mmscfd.

4.3 Petroleum Products

As of April 2024, a total of 1,641.95 kt of petroleum products was consumed in Ghana as against the projected consumption of 1,561.47. The 2024 consumption was 15.84% higher than the 2023 consumption of 1,417.41 over the same period.

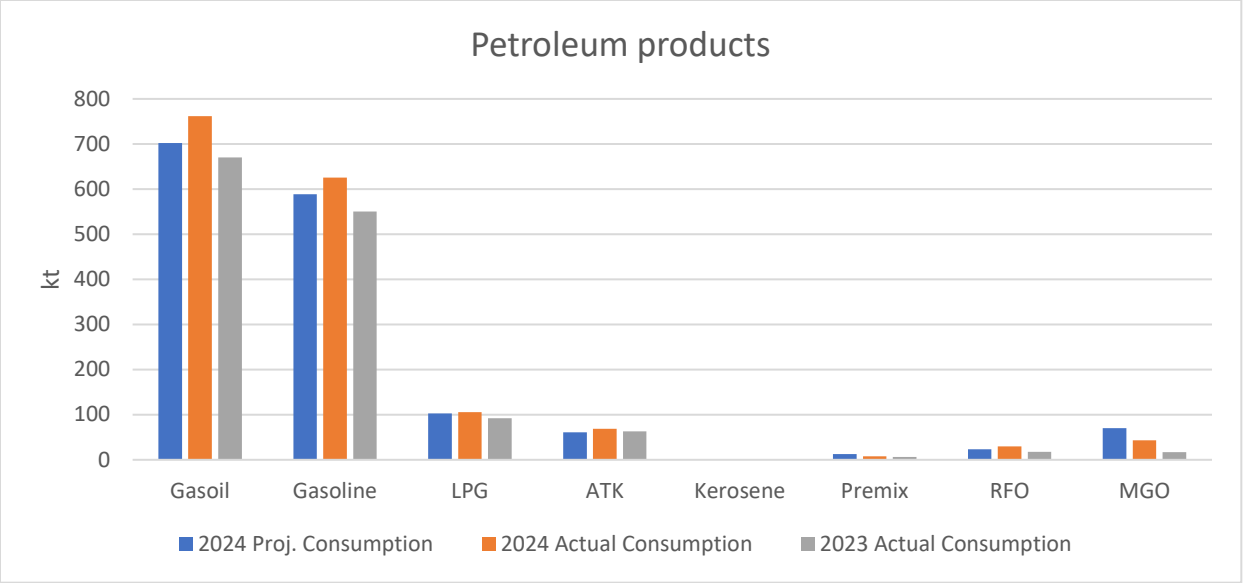


Figure 27: Projected verses actual consumption of major petroleum products in 2024 (Jan-April)

Gasoil consumption as of April 2024 was 761.5 kilotonnes, an increase of 13.6% over 2023 consumption of 670.3 kilotonnes and a deviation of 8.4% in projected consumption of 702.2 kilotonnes over the same period in 2024. Similarly, gasoline consumption from January to April 2024 was 625.4 kilotonnes, up from 550.3 kilotonnes over the same period in 2023. The consumption of gasoline in 2024 was up by 6.3% from the projected consumption of 588.5 kilotonnes (Figure 27). LPG, ATK, and premix consumptions also increased by 14.1%, 8.3%, and 20.8% respectively from their 2023 consumptions.

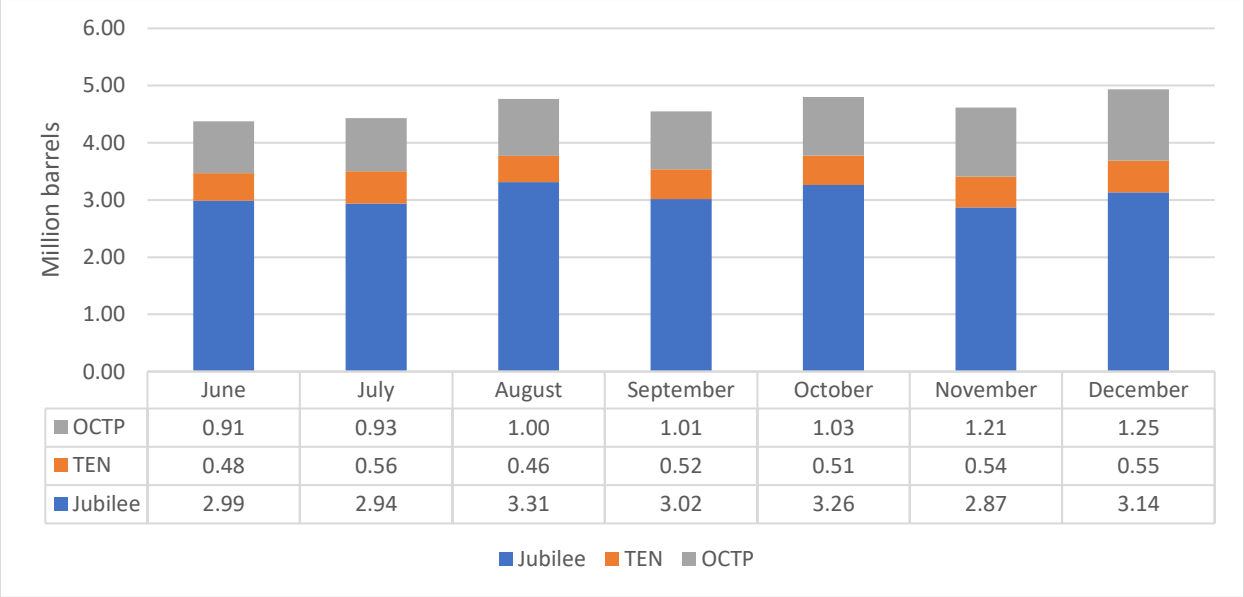
Chapter Five: Revised Petroleum Outlook 2nd Half 2024

5.1 Outlook for Crude Oil

5.1.1 Crude Oil Production

Crude oil production in 2024 is expected to be higher than 2023 due to the new wells drilled in the Jubilee and TEN fields. This mid-year review considers this new development in the upstream oil sector to revise our initial crude oil production figures.

A total of 32.47 million barrels is projected to be produced for the second half of 2024 with Jubilee contributing 66% of the total production. TEN and OCTP will contribute 11% and 23% of the projected crude oil production respectively. Figure 28 presents the expected monthly volumes of crude oil production from the three fields for the second half of 2024.



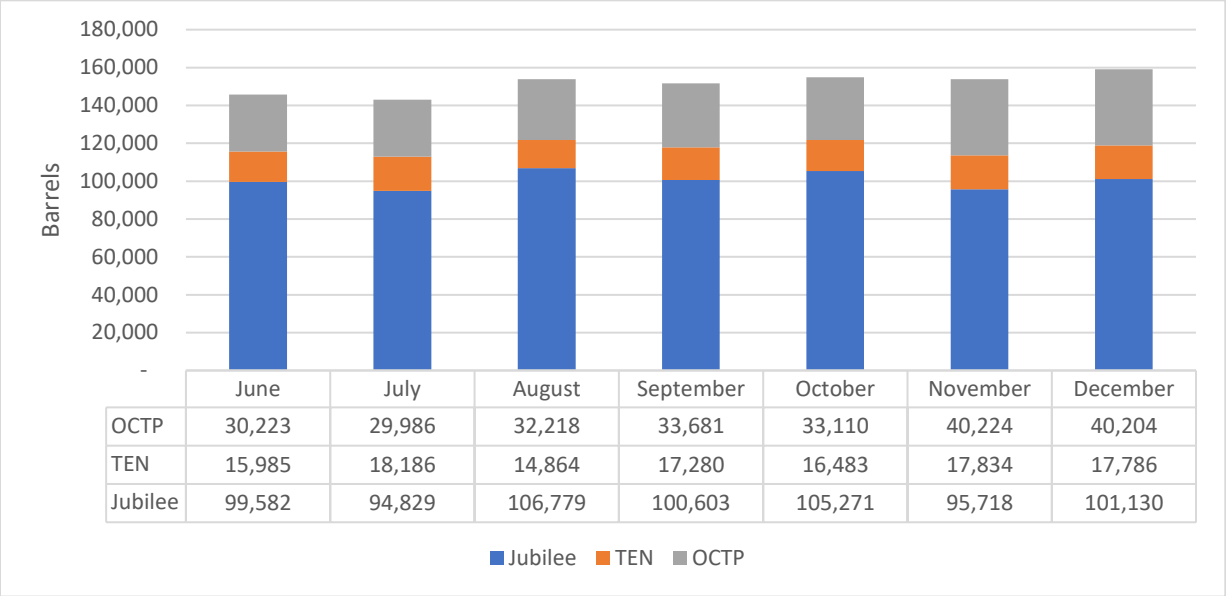
	June	July	August	September	October	November	December
OCTP	0.91	0.93	1.00	1.01	1.03	1.21	1.25
TEN	0.48	0.56	0.46	0.52	0.51	0.54	0.55
Jubilee	2.99	2.94	3.31	3.02	3.26	2.87	3.14

Figure 28: Monthly crude oil production outlook for the second half of 2024.

Source: Energy Commission

Production from Jubilee field is expected to be 21.53 million barrels from June to December 2024. Also, production from Sankofa and TEN is expected to be 3.62 and 7.32 million barrels for the second half of 2024.

Average daily production from the three fields combined for the remainder of the year is expected to be 151,711 barrels per day. Figure 29 presents the expected monthly average daily production of crude oil in 2023.



	June	July	August	September	October	November	December
OCTP	30,223	29,986	32,218	33,681	33,110	40,224	40,204
TEN	15,985	18,186	14,864	17,280	16,483	17,834	17,786
Jubilee	99,582	94,829	106,779	100,603	105,271	95,718	101,130

Figure 29: Projected daily average crude oil production for the second half of 2024

Source: Energy Commission

The average daily production from the Jubilee, TEN and Sankofa fields will be 100,559, 16,917 and 34,235 bpd respectively.

5.1.2 Crude Oil Price

The Brent crude oil spot price averaged $82 per barrel in May 2024, down by $8/b from April 2024 spot price of $90 per barrel. Daily spot prices also initially fell following the OPEC+ announcement on June 2, closing at $78/b on 6 June 2024. For the second half of 2024, the US Energy Information Administration (US EIA) and Goldman Sachs forecasts crude oil to average $85/b[5]. This modest upward oil price pressure in the coming months reflects a slight decline in global oil inventories. The extension of OPEC+ cuts through third quarter of 2024 is expected to reduce OPEC+ oil production for the rest of 2024. Less OPEC+ production for the rest of

[5] https://www.eia.gov/outlooks/steo/pdf/steo_full.pdf

this year will cause Brent prices to rise to an average of $85/b during the second half of 2024[6] up from the initial projected price of $82.58. Figure 28 displays the actual crude oil price from January to June 2024, as well as the projected crude oil prices per barrel for the second half of 2024.

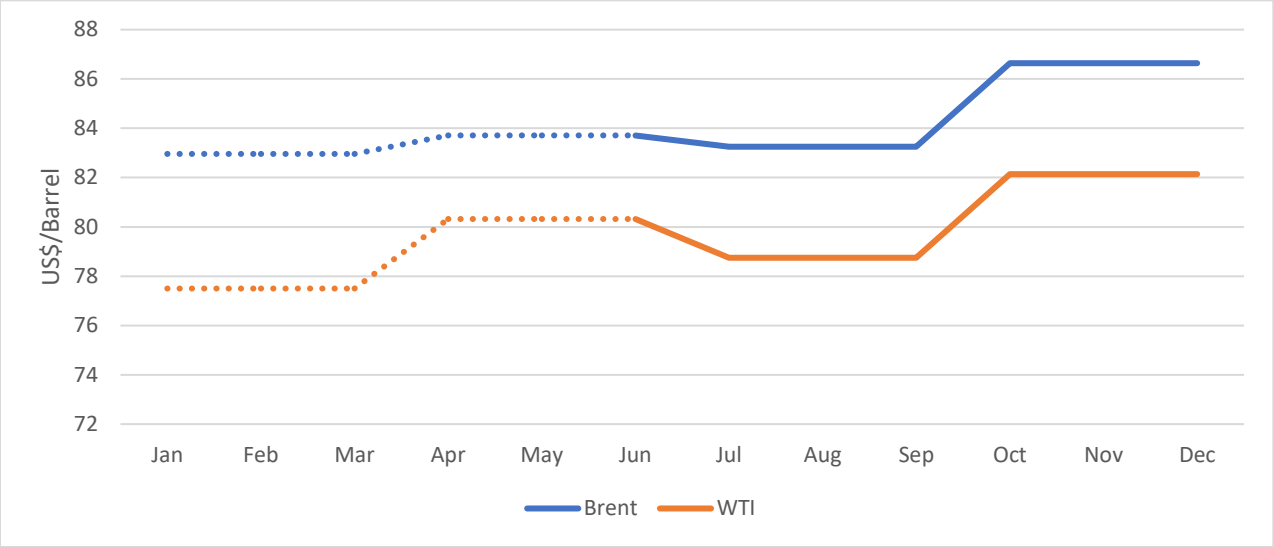


Figure 30: Actual & Projected monthly international benchmark crude oil prices for 2024

Source: US Energy Information Administration, Goldman Sachs

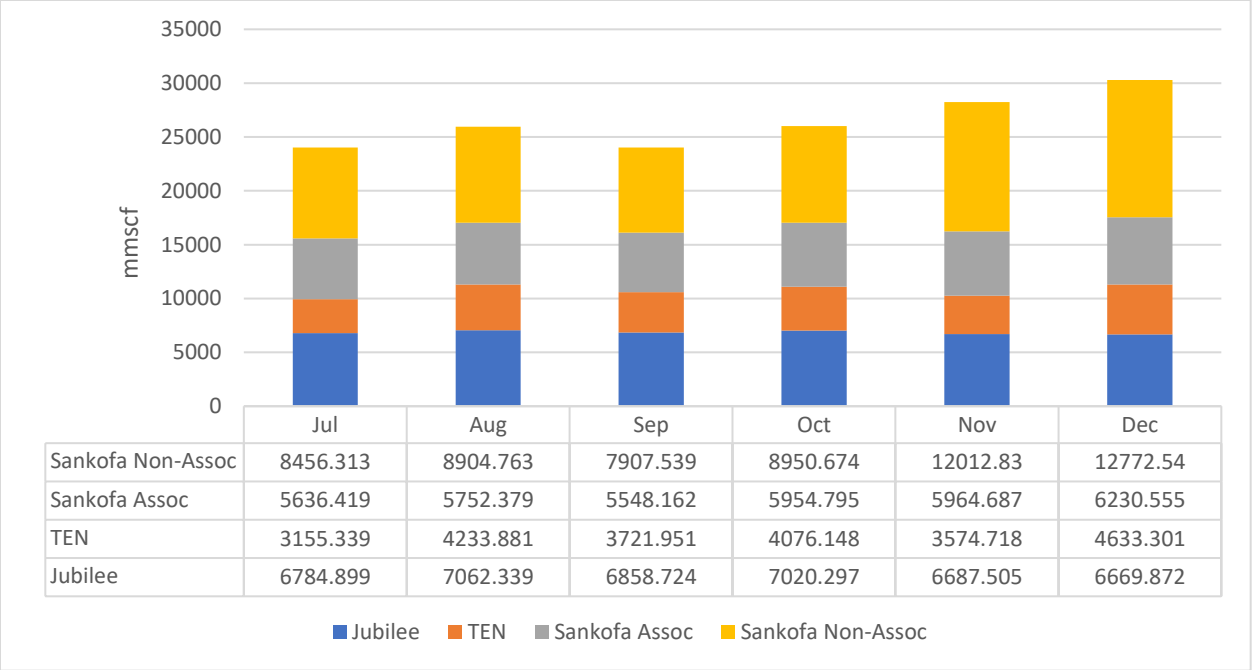
Ghana's crude oil price will therefore follow the international benchmark price. As such, it is expected that the market price of crude oil from Ghana's fields – Jubilee, TEN and Sankofa will average around US$85 per barrel for the second half of 2024.

5.2 Outlook or Natural Gas

5.2.1 Natural Gas Production Outlook

The expected natural gas production from the three fields for the second half of 2024 is expected to reach 158,601 up from 125,107 mmscf recorded in 2023. Figure 31 displays the monthly gas production from the three fields in Ghana.

[6] https://www.reuters.com/business/energy/opec-seen-prolonging-cuts-2024-into-2025-two-sources-say-2024-06-02/#:~:text=On%20Sunday%2C%20OPEC%2B%20agreed%20to,October%202024%20to%20September%202025.

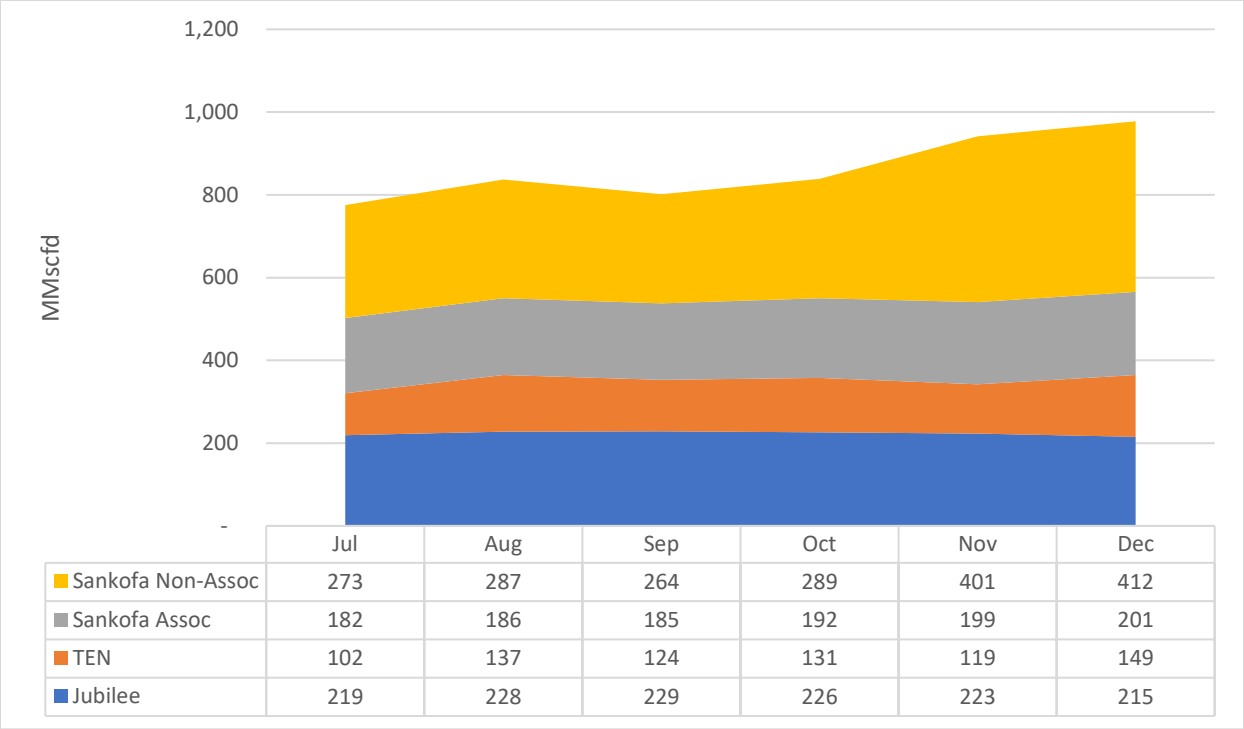


	Jul	Aug	Sep	Oct	Nov	Dec
Sankofa Non-Assoc	8456.313	8904.763	7907.539	8950.674	12012.83	12772.54
Sankofa Assoc	5636.419	5752.379	5548.162	5954.795	5964.687	6230.555
TEN	3155.339	4233.881	3721.951	4076.148	3574.718	4633.301
Jubilee	6784.899	7062.339	6858.724	7020.297	6687.505	6669.872

Figure 31: Expected natural gas production for 2024

Gas production from the Jubilee, and TEN fields for the rest of 2024 are expected to be 41,084 mmscf, 23,395 mmscf respectively, while Sankofa production from associated and non-associated sources are expected to be 35,087 mmscf and 59,005 mmscf respectively.

Daily production from the three fields combined is expected to be high in 2024, averaging 824 mmscf/day. Figure 32 presents the expected monthly average daily production of gas in 2024.



	Jul	Aug	Sep	Oct	Nov	Dec
Sankofa Non-Assoc	273	287	264	289	401	412
Sankofa Assoc	182	186	185	192	199	201
TEN	102	137	124	131	119	149
Jubilee	219	228	229	226	223	215

Figure 32: Projected daily average gas production for the second half of 2024

Source: GNGC

5.2.2 Natural Gas Export from Production Fields

For the second half of 2024, raw gas export from Jubilee/TEN (associated) to the AGPP is expected to be about 17,112 mmscf for processing. For the second half of the year, there are three major planned shutdowns of gas infrastructure. There is a planned 10-Day FPSO and ORF Maintenance in September and a 14-Day inline pigging inspection in Q4, 2024 by ENI. As well as a 14-day maintenance of the Atuabo GPP from 1st-15th August 2024.

In total Sankofa (non-associated gas) export to the ENI ORF is projected to increase to 38,400 mmscf as compared to 32,912 mmscf exported in the second half of 2023. In all, a total of 55,522 mmscf lean gas will be exported in the second half of 2024 (Figure 33). On average, Sankofa is expected to increase its capacity to supply up to 240 mmscfd, while Jubilee and TEN together are expected to supply about 93 mmscfd.

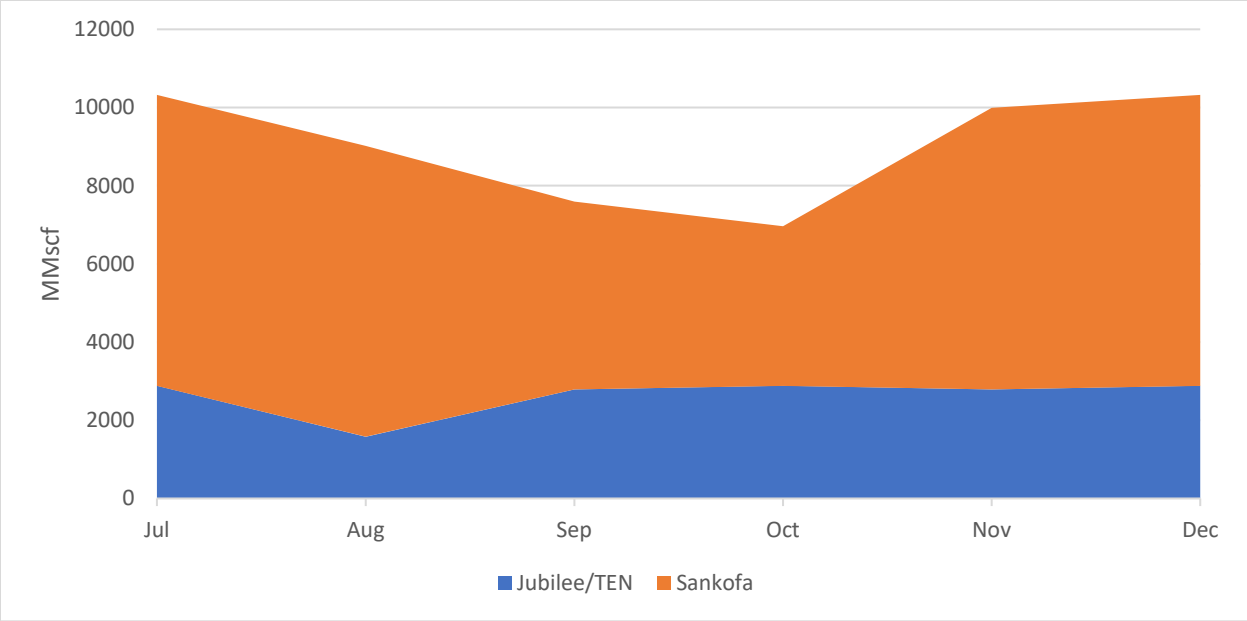


Figure 33: Expected natural gas export from production fields for the second half of 2024

Source: GNGC

5.2.3 Natural Gas Import

Natural gas import from Nigeria is expected to be about 60 mmscfd for the rest of the year. The Tema LNG is yet to be commissioned which means, no LNG imports are expected for the rest of the year.

5.2.4 Non-Power Natural Gas Consumption

Demand for natural gas for industrial purposes is mainly used as a heating fuel in the production of ceramics. Twyford, Wankang, Plot Enterprise, Marco Polo Gh Ltd, Jintao, and Sentuo all in the Western enclave as well as Sentuo refinery in Tama use natural gas in their industrial processes.

For the rest of 2024, a total 6,313.5 mmscf of natural gas is projected to be consumed by industries in Ghana with an average daily rate of 34.5 mmscf (See Figure 34).

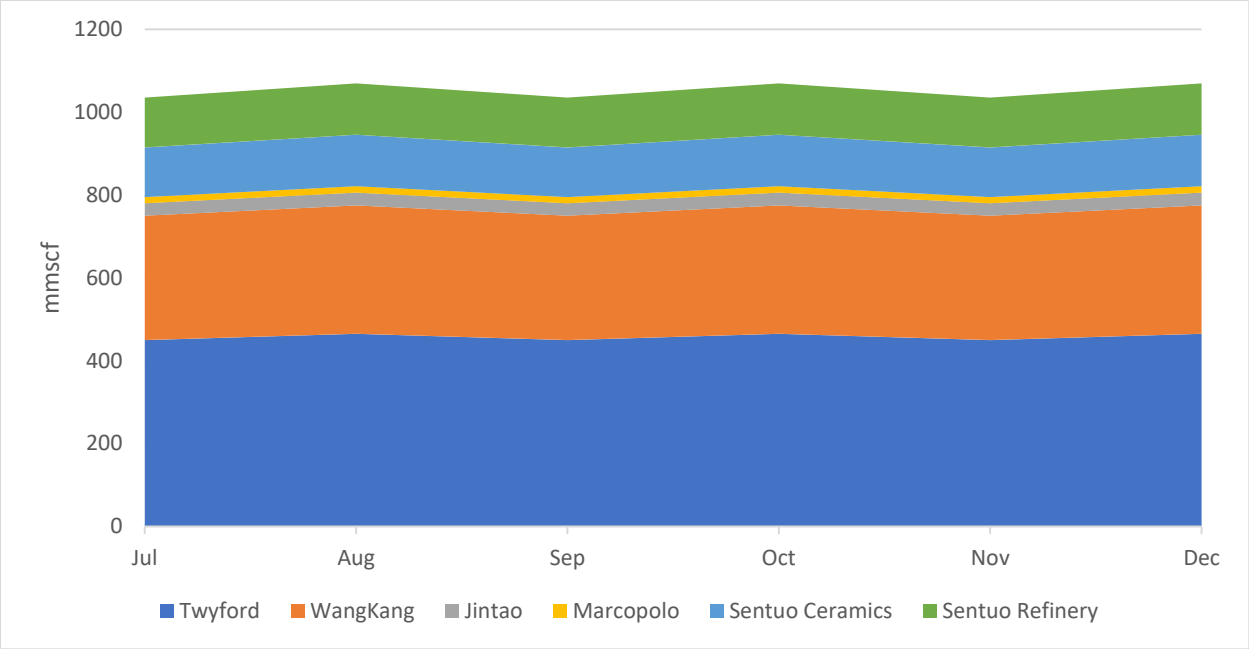


Figure 34: Non-power natural gas demand in 2024

Source: GNGC

5.2.5 Natural Gas Demand Supply Balance

A total of 57,321.9 mmscf of natural gas is required for grid thermal generation in the second half of 2024, averaging 341 mmscfd. Embedded thermal power plants are expected to use approximately 5,156.3 mmscf, translating to 28.2 mmscfd. This brings the total projected gas demand for power generation to 62,478.2 mmscf, averaging 369.2 mmscfd. Non-power demand is projected at 62.7 mmscfd. The total supply from both indigenous and imports is projected at 393 mmscfd which is made up of 240 mmscfd from Sankofa, 93 mmscfd from Jubilee/Ten and 60 mmscfd from N-gas. There are three major planned shutdowns of gas infrastructure for maintenance activities in the second half of the year.

1. Maintenance on GNGC's Takoradi Distribution Station (TDS) for 17 days from 1st -17th August 2024
2. Maintenance on Sankofa FPSO and ORF for 10 days in September 2024
3. ENI scheduled for 14-day inline pigging exercise in October 2024

As illustrated in Figure 35, the nominated gas supply for the second half of 2024 is generally sufficient to meet demand under normal conditions but is vulnerable to the foregoing planned maintenance activities. The planned maintenance shutdowns in August, September and October will lead to significant supply shortfalls, and the demand in November and December will exceed the supply.

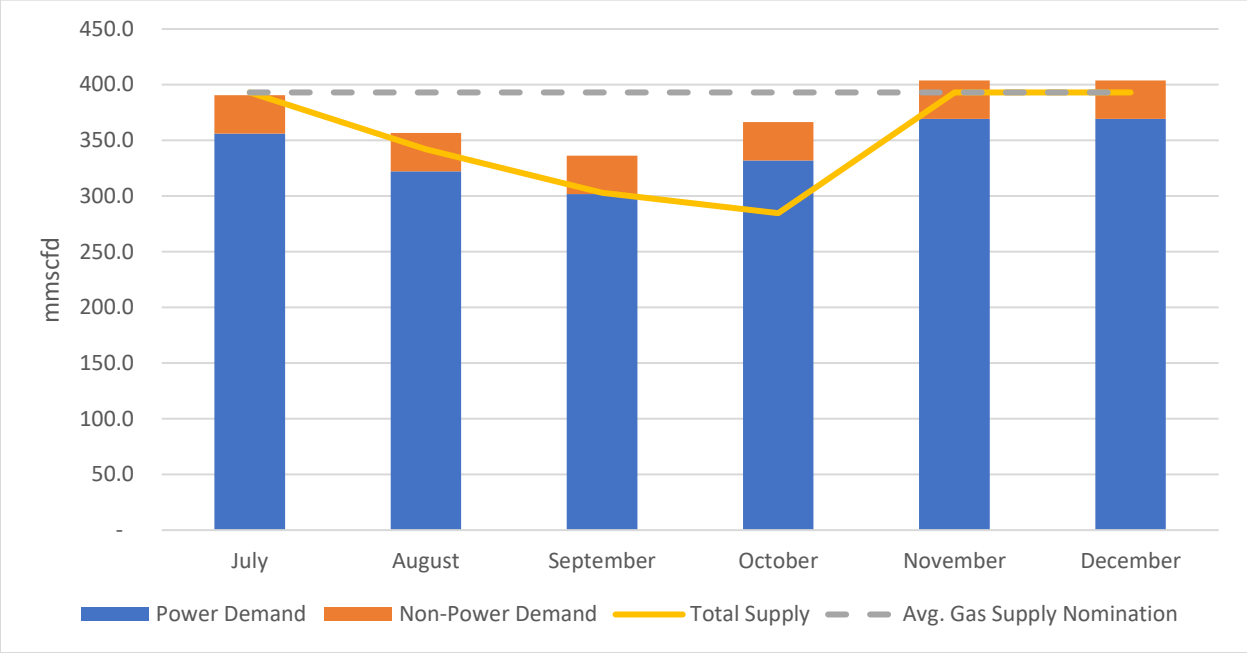


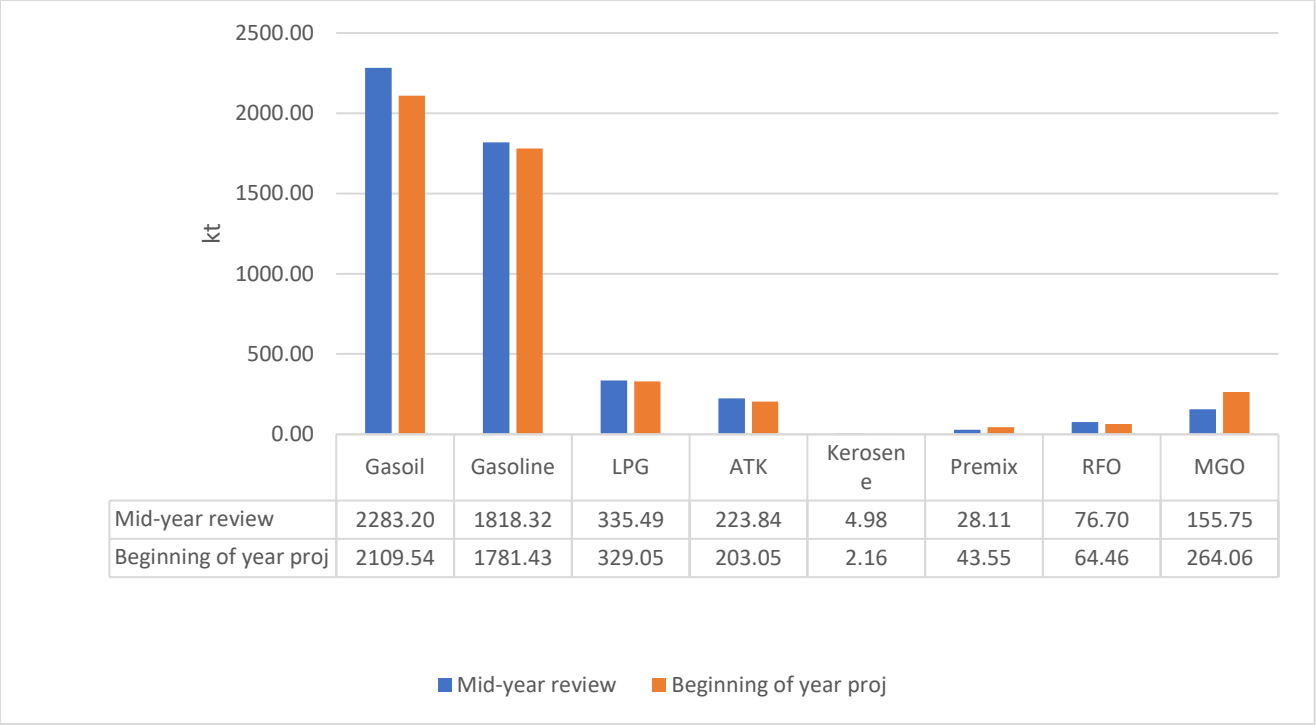
Figure 35: Natural gas demand-supply balance for the second half of 2024.
Source: EC

5.3 Outlook for Petroleum Products

5.3.1 Petroleum Products Outlook

Total petroleum products consumption for 2024 has been revised to 4,926.4 kt a 9.7% increase over the 2023 consumption and a 2.7% increase to the beginning of year projection of 4,797.32 kt. This is mainly due to an increase in the first half of 2024 consumption levels because of economic growth[7]. Figure 36 shows the beginning-of year projections and the mid-year revised projections.

[7] https://www.graphic.com.gh/news/general-news/ghana-news-economy-grows-4-7-first-quarter.html



	Gasoil	Gasoline	LPG	ATK	Kerosene	Premix	RFO	MGO
Mid-year review	2283.20	1818.32	335.49	223.84	4.98	28.11	76.70	155.75
Beginning of year proj	2109.54	1781.43	329.05	203.05	2.16	43.55	64.46	264.06

Figure 36: Revised petroleum product demand

The projected total petroleum product requirements for the second half of 2024 is projected to be 2,479.4 kilotonnes, an increase of 7.5% over 2023 consumption (July-December). Figure 37 presents the monthly forecast for petroleum products consumption for the second half of 2024.

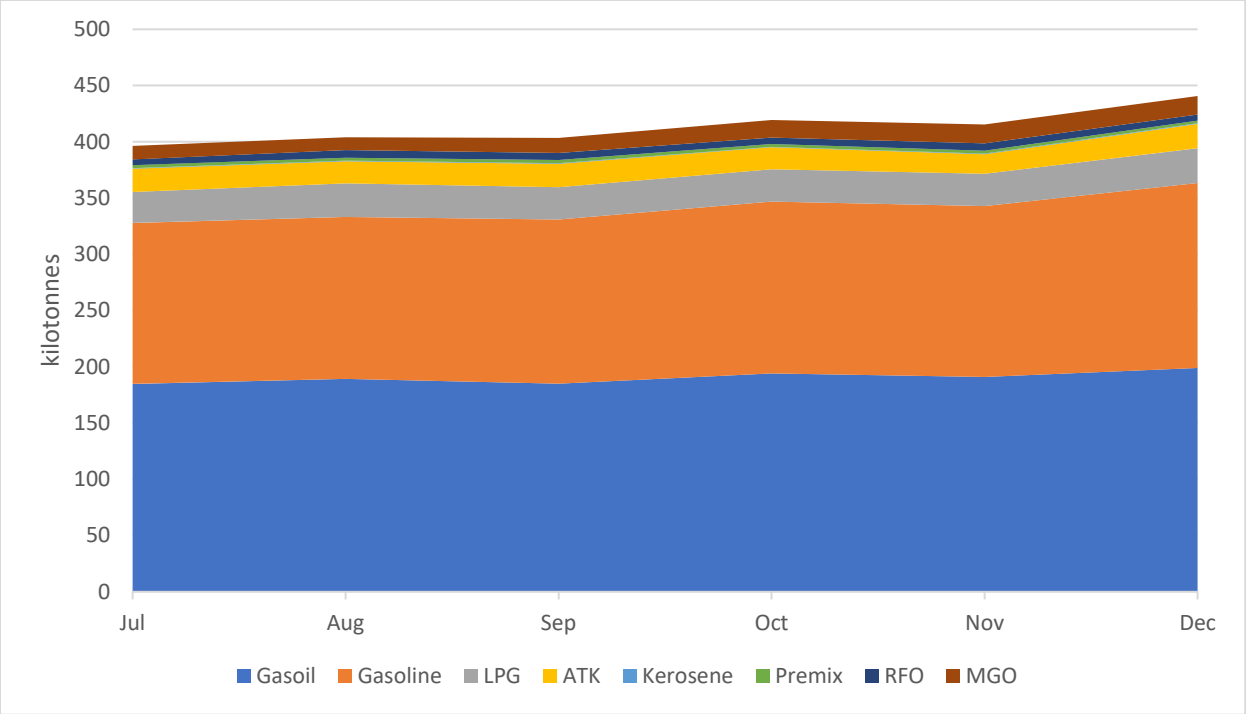


Figure 37: Monthly outlook for petroleum product consumption

Source: Energy Commission

Gasoil consumption is projected to be about 1,143.2 kilotonnes for the second half 2024, an increase of about 3.7% over the second half of 2023 consumption. The projected gasoline consumption for the second half of 2024 is 902 kilotonnes, also up by 3.9% from the 2023 consumption. LPG is expected to increase by 2.6%, from 170.13 kilotonnes in 2023 to about 174.63 kilotonnes in 2024. ATK consumption is expected to increase by 17.3% in 2024 second half to 119.56 kilotonnes. Consumption of other petroleum products such as Kerosene, Premix and MGO is expected to increase to 3 kilotonnes, 15.71 and 85.66 kilotonnes respectively.

However, the consumption RFO is projected to decline in the second half of 2024 as power plants switch to clean fuels. Comparing the second half of 2024 projected consumption to the actual 2023 RFO consumption, RFO consumption is expected to decrease to 35.64 kilotonnes in 2024 from 46.77 kilotonnes in 2023.

Chapter Six: Update on Wood Fuel Sub-sector

The wood fuel subsector in Ghana plays a significant role in meeting the energy needs of its population, particularly in rural and peri-urban areas where access to modern energy sources is limited. While the wood fuel subsector plays a crucial role in Ghana's energy landscape, sustainable management and policy interventions are essential to address environmental concerns and promote balanced economic development. In view of this, extensive initiatives have been deployed to encourage the adoption of Liquefied Petroleum Gas (LPG) as an alternative energy source, yet a substantial proportion of Ghanaian households persist in utilizing wood fuel for their thermal energy requirements, particularly cooking and heating. The wood fuel sub-sector is integral to the local economy, underpinning a diverse array of industrial activities, including thermally intensive processes such as bread-baking, oil-palm processing, local brewing, traditional textile production, artisanal soap manufacturing, fish smoking, and local catering services.

Several factors contribute to the enduring reliance on wood fuel. Firstly, wood fuel is readily accessible, particularly in rural and peri-urban regions where forest resources are abundant and harvesting practices are well-established. Secondly, wood fuel is generally more affordable than LPG, presenting a more viable option for low-income households and small businesses. The initial costs associated with LPG infrastructure, such as gas cylinders and compatible stoves, also pose a significant barrier.

Additionally, cultural preferences and traditional cooking practices play a crucial role in sustaining wood fuel usage. Many Ghanaian dishes are traditionally prepared using wood fuel, which imparts a distinctive flavour and aroma that is highly valued. The sensory qualities of food cooked over woodfire are difficult to replicate with LPG, further entrenching wood fuel's popularity.

6.1 Wood Fuel Production and Consumption

6.1.1 Wood Fuel Production

The overall trend in total supply of wood fuel showed a general increasing trend from 2000 to 2023. Starting at 3,891 ktoe in 2000, the total supply experienced fluctuations but gradually increased over the years to reach 3,944 ktoe in 2023.

Between the years from 2000 to 2010, the total supply of wood fuel mostly decreased. In 2000, the total was 3,891 ktoe, and it decreased to 3,237 ktoe in 2010. This period saw a gradual decline, reflecting a reduction in the supply of both firewood and charcoal, with a notable decrease in firewood supply over these years.

There was a marked increase in the total supply starting from 3,256 ktoe in 2011, the supply rose consistently, reaching a peak of 4,177 ktoe in 2017. This period was characterized by significant increases in the supply of charcoal, which contributed to the overall increase. The firewood supply also showed slight fluctuations but remained stable compared to the more significant rise in charcoal supply.

In the last few years, the total supply of wood fuel showed some variability. It peaked at 4,115 ktoe in 2019 and then declined to 3,944 ktoe by 2023. This recent decrease could be attributed to a reduction in firewood supply, despite a continued rise in charcoal supply until 2023.

The rising trend in charcoal supply could be due to increased demand for charcoal as an energy source, driven by its higher efficiency when using an improved cookstove and its widespread use in urban areas. On the other hand, the decline in firewood supply may be attributed to factors such as deforestation, stricter regulations on wood cutting, and a shift in consumer preference towards other energy sources like charcoal and cleaner fuels. Additionally, efforts to conserve forests and promote sustainable practices are reducing the availability of firewood.

In effect, the projected value reflects ongoing trends in energy consumption, regulatory impacts, and shifts in resource availability, leading to a nuanced change in the total supply of wood fuel for 2024.

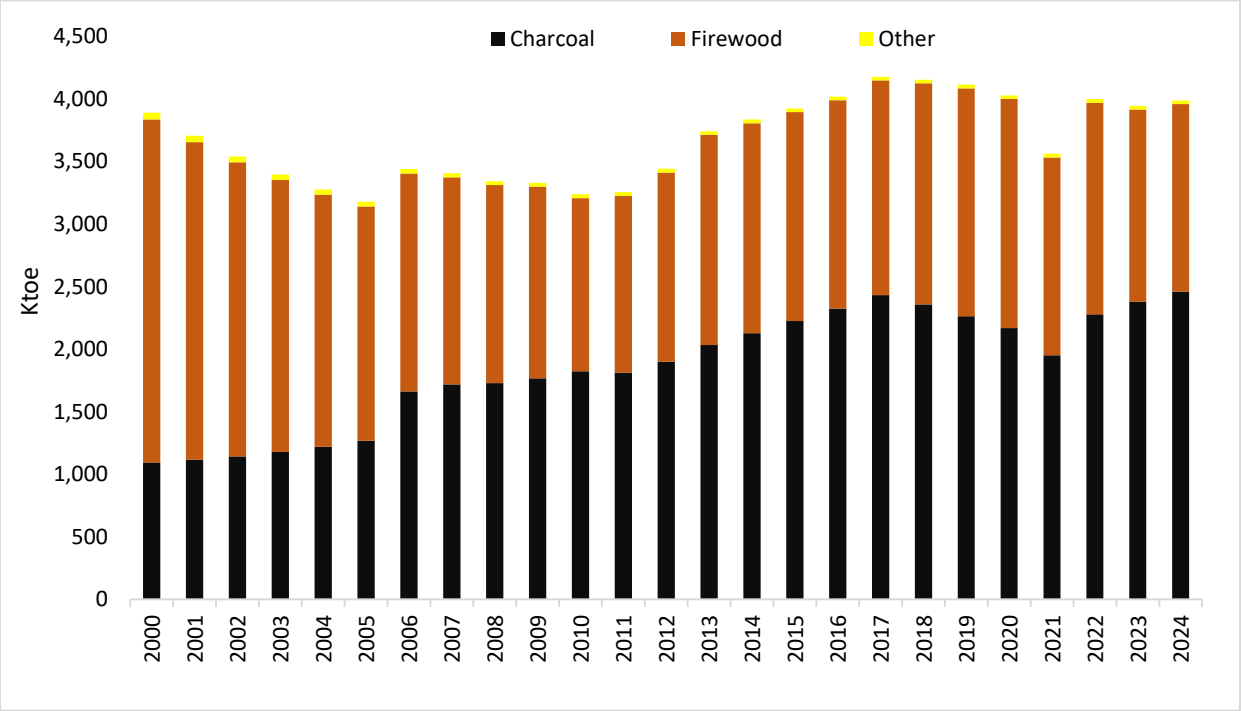


Figure 38: Wood fuel production

6.1.2. Mid-Year Review of Wood Fuel Production Trends

Wood for Firewood

The production of firewood in 2023 was recorded at 1,537 ktoe, indicating a stable demand despite a slight decrease compared to earlier trends. Initial projections for 2024 anticipated production at 1,740 ktoe, but projections after the first half of 2024 have revised it downwards to 1,498.9 ktoe. This adjustment suggests a decrease in firewood production, particularly in residential sectors, which could be influenced by improved efficiency in cooking technologies or economic factors.

Wood for Charcoal

Charcoal production in 2023 totaled 2,378 ktoe, maintaining a steady level of demand compared to previous years. Initial projections for 2024 anticipated a production of 2,370 ktoe, but current estimates that is first half of 2024 have revised this figure slightly upwards to 2,459.6 ktoe. This indicates a potential increase in charcoal production, driven by economic trends or regulatory changes encouraging the use of charcoal in industrial and urban settings.

6.2. Wood and Charcoal Consumption

This section of the report examines the trends and growth rates of energy consumption across the residential, service, and industry sectors in Ghana from 2000 to 2024, with a specific focus on the growth rate from 2014 to 2023 and the projected consumption for 2024.

Residential Sector Analysis

The residential sector has experienced fluctuations in energy consumption over the period, with a general downward trend. In 2000, residential energy consumption was 3,127 ktoe, which gradually declined to 2,614 ktoe in 2020. A notable low point was reached in 2021, with 2,300 ktoe. By 2023, consumption slightly rebounded to 2,466 ktoe, representing a moderate recovery. The growth rate from 2014 (2,508 ktoe) to 2023 (2,466 ktoe) shows a slight decrease of approximately 1.67%.

Service Sector Analysis

The service sector has shown a stable yet gradually increasing trend in woodfuel consumption. Starting at 75 ktoe in 2000, the sector's consumption saw fluctuations, peaking at 147 ktoe in 2017. From 2014 (113 ktoe) to 2023 (103 ktoe), there was a slight decrease of about 1.1%, reflecting some variability in service sector activities.

Industry Sector Analysis

The industry sector demonstrates a clear upward trend in energy consumption, reflecting increased industrial activities over the years. From 230 ktoe in 2000, consumption peaked at 331

ktoe in 2019. Between 2014 (232 ktoe) and 2023 (277 ktoe), the sector experienced a growth rate of approximately 1.99%, indicating marginal industrial expansion.

6.2.1. Wood Fuel Consumption Trends: Mid-Year Review

The mid-year review of wood fuel consumption trends from 2000 to 2024 reveals significant insights into Ghana's energy landscape, particularly within the residential, service, and industrial sectors.

Residential Sector

Initial projections aimed at 2,618 Ktoe for 2024 have been revised down to 2,440 Ktoe. This adjustment reflects an expected decrease in residential wood fuel demand, influenced by technological advancements or shifts in heating and cooking practices.

Service Sector

Initial projections of 112 Ktoe have been adjusted to 104 Ktoe, indicating a slight reduction in wood fuel use within service industries, potentially due to operational efficiencies.

Industrial Sector

Initially projected at 351 Ktoe, the current projection is 279 Ktoe, marking a substantial reduction. This suggests a significant shift away from wood fuel in industrial processes, possibly driven by regulatory changes or adoption of alternative energy sources.

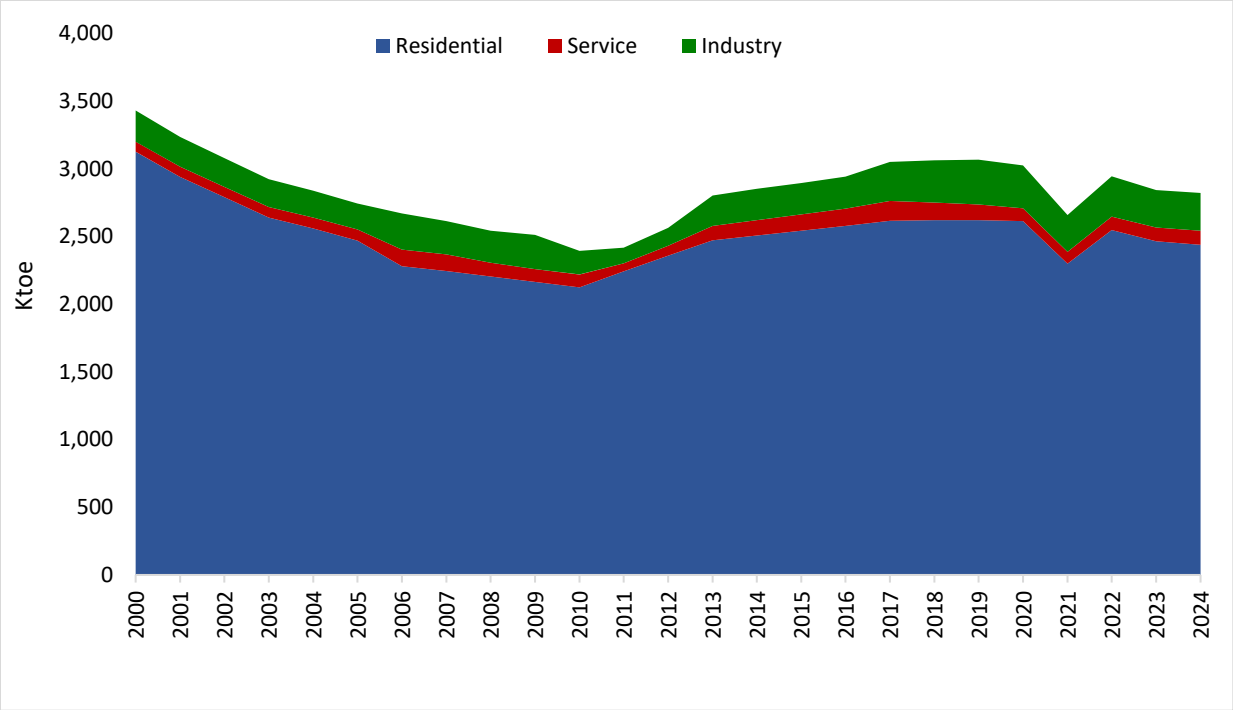


Figure 39: Biomass consumption by sectors

6.3. Analysis of Charcoal Price in Ghana for the First Half of 2024

In Ghana, charcoal is sold by volume rather than by weight. However, for comparison with alternative fuels such as LPG, which is priced per kilogram, the charcoal price was analyzed per weight in all the markets visited, as depicted in Figure 40. During the first half of 2024, the average national price per kilogram of charcoal stood at GH₵ 2.42. Cape Coast reported the highest price per kilogram at GH₵ 5.41, followed by Koforidua (GH₵ 3.81) and Takoradi (GH₵ 3.59). Conversely, Ho recorded the lowest price per kilogram at GH₵ 0.92, followed by Mim at GH₵ 1.14, and then Nalerigu at GH₵ 1.36.

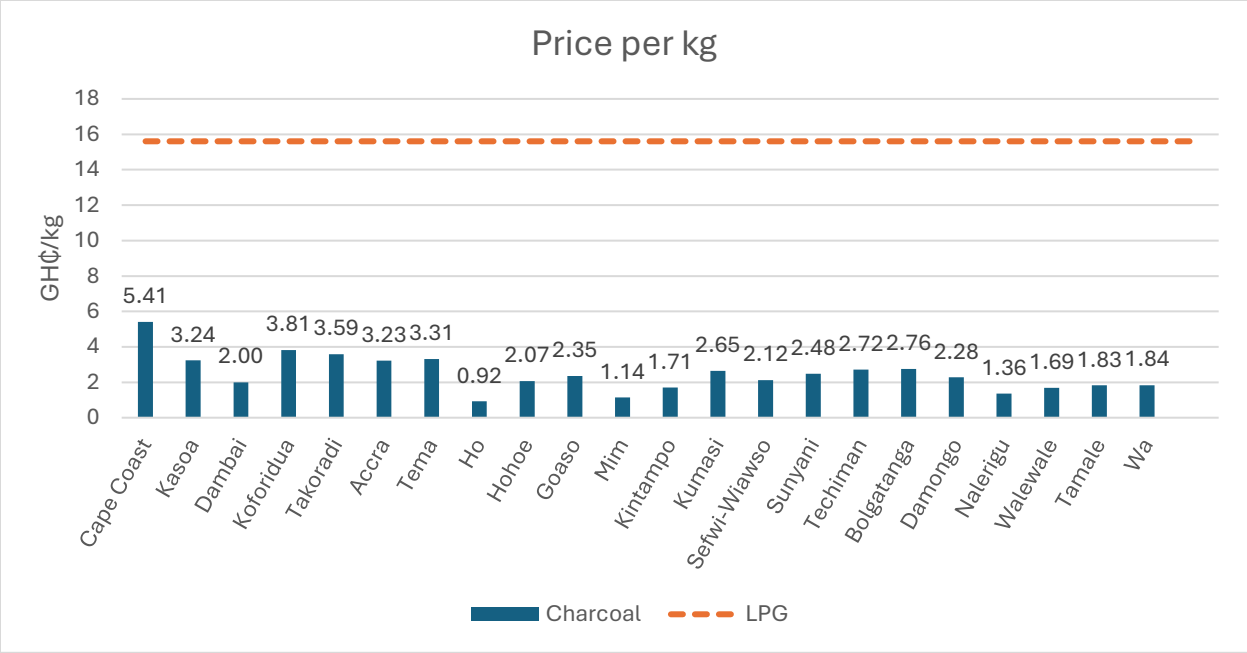


Figure 40: Average price per kilogram of charcoal across major market centres in Ghana from January to June 2024

For energy use purposes, fuel is utilised because of its energy content. Figure 41, therefore, presents the price of energy (measured in MMBtu) of LPG versus charcoal.

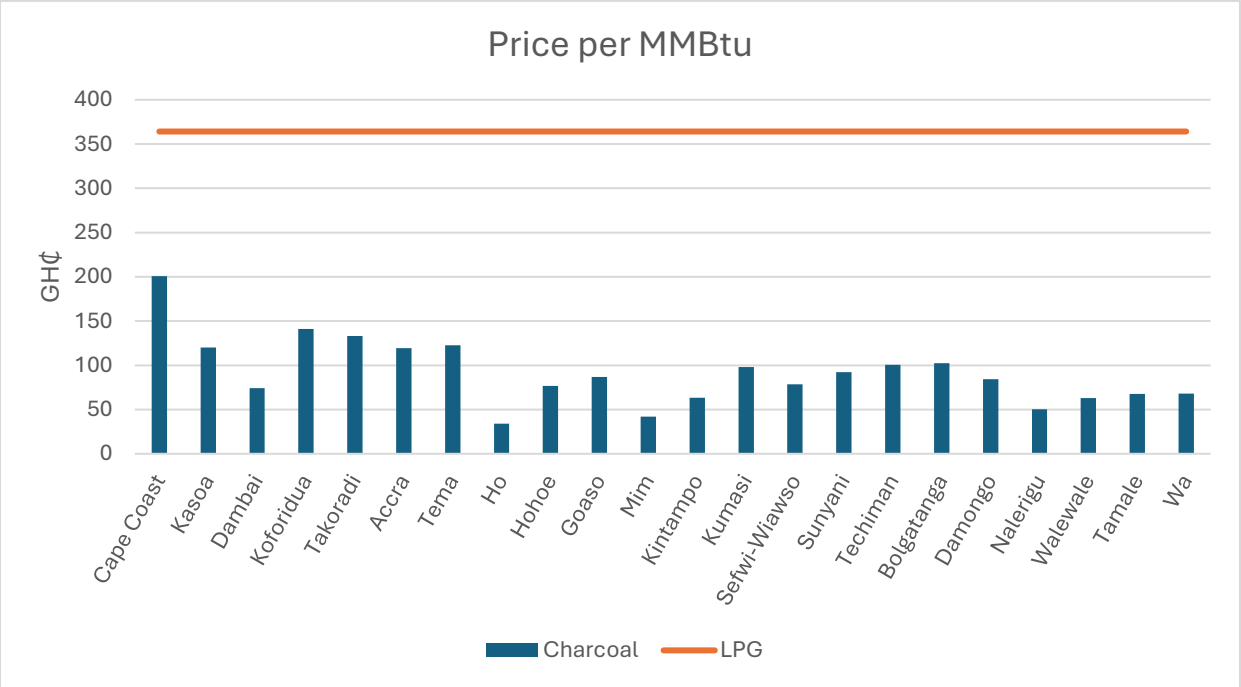


Figure 41: Price per MMBtu of LPG and Charcoal

As evident in Figure 41, the price of charcoal per MMBtu is lower than that of LPG in all locations. Different technologies are used in burning these fuels. Whilst LPG uses the LPG stove, charcoal is used mainly in traditional stoves or improved cookstoves. One of the popular improved cookstoves is the Gyapa. These appliances have different thermal efficiencies. Therefore, the useful energy from LPG and charcoal when used in these end-use appliances is varied. Using a thermal efficiency of 60.7%[8], 33.3% and 23.4%[9] for LPG stoves, improved cookstoves (Gyapa) and traditional charcoal stoves respectively, the effective cost of MMBtu of useful energy is shown in Figure **Error! Reference source not found.**42.

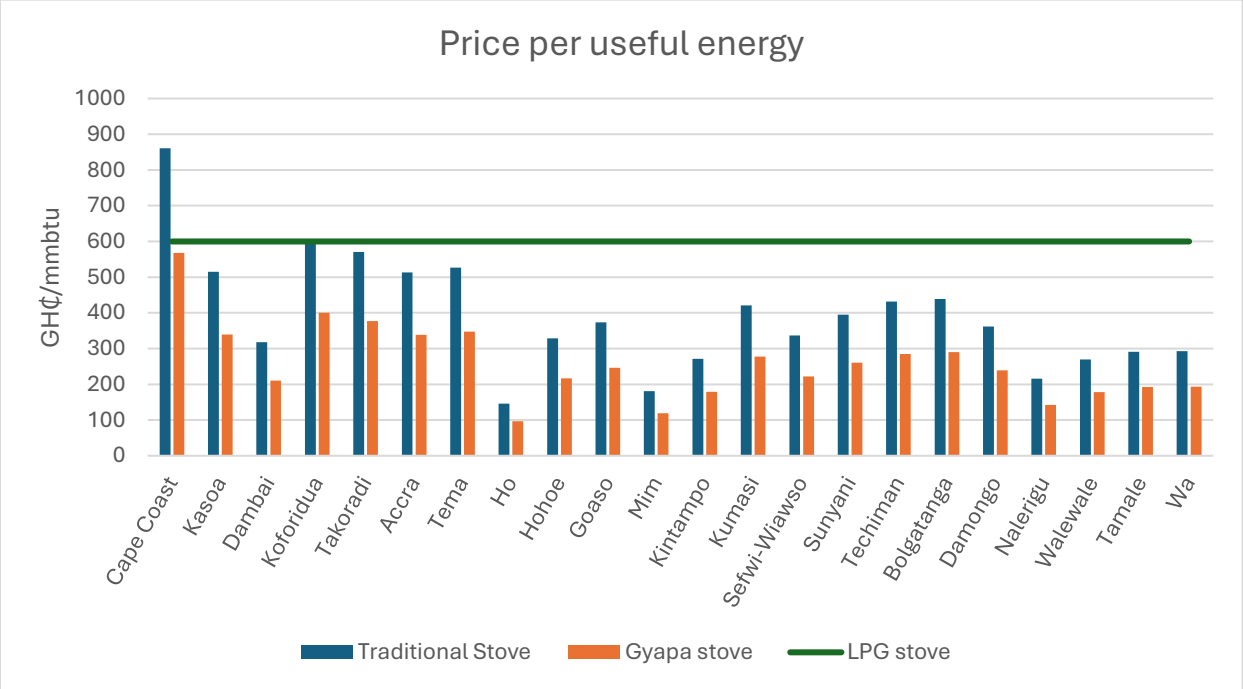


Figure 42: Price per MMBtu of useful energy of LPG and Charcoal Stove.

Source: Survey data

Generally, it costs households less to use traditional charcoal stove or Gyapa stove than to use LPG stove as shown in the figure above. The cost of useful energy from LPG stove is GH₵600

[8] Lather, R. S. (2019, November). Performance Analysis of an LPG Cooking Stove for Improvements and Future Usability Perspective. In National Conference on IC Engines and Combustion (pp. 633-643). Springer, Singapore.
[9] Boafo-Mensah, G., Amponsah-Benefo, K., Animpong, M. A. B., Oduro, W. O., Kotey, E. N., Akufo-Kumi, K., & Laryea, G. N. (2013). Thermal efficiency of charcoal fired cookstoves in Ghana.

per MMBtu. However, on average, it will cost a household about GH₵ 394 per MMBtu of useful energy if the household uses the traditional cookstove, giving a cost reduction of about 34%. This cost saving will further increase to about 57% if an improved cookstove is used.

The price of LPG is driven by developments in the global crude oil market and the depreciation of the Ghanaian Cedi. Anticipated for the rest of 2024 is a modest increase in charcoal prices, with the potential for growth aligning closely with the national inflation rate for the year at worst.

Chapter Seven: Conclusions and Recommendations

7.1 Conclusions

7.1.1 Electricity

The initial projected system peak demand which is expected to occur in the second half of 2024 has been revised to 3,732 MW due to a significant curtailment of load to the export market in the first half of 2024. The new peak demand projection represents a growth of 3.1% over the 2023 peak load. The corresponding energy consumption for the second half of 2024 has accordingly been reviewed downwards to 12,132 GWh, reflecting a 4.4% increase compared to consumption in 2023. Thus, the initial projected 2024 total electricity consumption has been adjusted downwards to 24,601 GWh, representing a 4.5% increase over 2023.

To meet the expected demand in the second half of 2024, hydro generation has been revised upwards (due to the rising level of the hydro dams particularly the Akosombo dam) to 4,879 GWh (64.4%), while thermal generation has been reviewed downwards to 7,153 GWh (34.9%). The remaining 100 GWh, constituting 0.7%, is expected to be supplied by embedded generation, mostly solar sources.

In the second half of 2024, the grid connected power generation installed capacity will be 5,260 MW, with a total dependable capacity of 4,855.8 MW. The primary fuel for thermal power plants is expected to be natural gas, sourced both locally and through imports. The projected total natural gas consumption for the period is 63.5 TBtu. The AKSA plant is estimated to require 246,047 barrels of HFO in the second half of 2024. The overall fuel expenditure is estimated to be US$519.35 million, with US$510.32 million allocated for the procurement of natural gas and the remaining amount designated for HFO to fuel the AKSA plant.

7.1.2 Petroleum

Crude oil production is expected to be higher in 2024 due to new wells in the Jubilee and TEN fields. The total projected production for the second half of 2024 is reviewed upwards to 32.47

million barrels. The average daily production is expected to increase, driven by the Jubilee field, which will contribute a significant portion of the total production.

Natural gas production for the second half of 2024 is projected to reach 158,601 mmscf, with significant contributions from both associated and non-associated gas from Jubilee, TEN, and Sankofa fields. The lean gas supply is projected to remain stable with a slight increase due to higher production from OCTP and continued imports from Nigeria.

The gas demand-supply balance analysis indicates that while the supply meets demand in July, the planned maintenance activities in August, September, and October will lead to significant shortfalls. These disruptions, combined with the steady demand increase from September to the end of the year, result in consistent supply deficits. Proactive measures, such as increasing gas supply from available domestic sources, import from Nigeria, or utilizing liquid fuels in the dual-fueled power plants, will be essential to mitigate these supply deficits.

Petroleum products consumption for 2024 has been revised upwards to 4,926.4 kilotonnes, a 2.7% increase from the initial projection of 4,797.32 kilotonnes. This revision is primarily attributed to higher consumption levels in the first half of 2024 due to economic growth.

7.1.3 Woodfuel

The production of firewood in 2023 was 1,537 ktoe but is projected to decrease to 1,498.9 ktoe for 2024, down from an initial projection of 1,740 ktoe. Conversely, charcoal production in 2023 remained steady at 2,378 ktoe, with initial projections for 2024 set at 2,370 ktoe. However, current estimates for 2024 have been revised upwards to 2,460 ktoe, indicating a potential rise in charcoal production. This increase is driven by economic trends that promote charcoal use in industrial and urban areas.

The residential sector will maintain its position as the largest consumer of biomass. In the residential sector, the initial projection of 2,618 Ktoe has been adjusted downward to 2,440 Ktoe, indicating a decrease in wood fuel demand due to changes in heating and cooking practices. Similarly, the service sector's wood fuel use has been slightly reduced from an initial projection

of 112 Ktoe to 104 Ktoe, reflecting operational efficiencies. Notably, the industrial sector's wood fuel demand has seen a substantial reduction from an initial 351 Ktoe to 279 Ktoe, suggesting a significant shift away from wood fuel, potentially driven by the adoption of alternative energy sources.

The average national price per kilogram of charcoal during the first half of 2024 was GH₵ 2.42. With the cost of useful energy from an LPG stove being GH₵600 per MMBtu, households and businesses can achieve a significant cost reduction of approximately 34% by opting for traditional cookstoves, which cost about GH₵394 per MMBtu of useful energy. This cost saving is even more pronounced, reaching about 57%, when households use improved cookstoves. This clearly indicates that households/businesses benefit financially by using traditional charcoal stoves or the Gyapa stove instead of LPG stoves. The cost dynamics of LPG are influenced by fluctuations in the global crude oil market and the depreciation of the Ghanaian Cedi. For the remainder of 2024, while there is an expectation of a modest increase in charcoal prices, it is likely to align closely with the national inflation rate.

7.2 Recommendations

The following recommendations are made.

7.2.1 Electricity

1. Projected hydro generation levels are to be adhered to keep fuel costs at projected levels and mitigate any short-term gas supply challenges.

2. Security and adequacy of fuel supply to thermal plants remain the single most important risk to power supply reliability in the country. In this regard, it is strongly recommended that all stakeholders work together to ensure that the fuel supply is always adequate and secure.

3. Consequently, the Commission recommends that when domestic supply is insufficient to meet demand, increasing imports from Nigeria should be pursued. Purchase of liquid fuel,

such as LCO and DFO, should be the last fuel supply option due to higher costs and environmental impact.

4. Quantities of liquid fuels (LCO, HFO and Diesel) therefore need to be procured and stored for use at the respective dual-fired thermal power plants in case of instances of gas supply interruption.

5. Due to the growing electricity demand, there is a need to make medium to long-term arrangements to increase gas supply volumes to enable more thermal generation to avoid excessive drawdown on Akosombo and Bui hydro facilities.

6. Government should make necessary investments towards improved gas supply reliability owing to the increasing dependency on natural gas for power generation. Therefore, the government should expedite action on the proposed construction of gas pipeline connecting Tema and Tarkoradi power enclaves.

7.2.2 Petroleum

1. The government should intensify the rollout of the cylinder recirculation model nationwide to help increase access as government targets 50% LPG penetration in households by 2030.
2. Enhancing the dependability of domestically produced petroleum products is crucial. Beyond various economic benefits, this initiative will bolster the security of our fuel supply. The government should actively address and eliminate any impediments to ensure the efficient operation of TOR.
3. Optimize production techniques across all fields to maximize output.
4. Adopt advanced technologies to enhance production efficiency and manage field operations effectively
5. Continue with a robust gas infrastructure maintenance regime to handle higher volumes

and ensure reliability.

6. Encourage the transition to cleaner fuels in power generation and industrial use by building gas distribution networks in the industrial enclave and provide incentives and support for industries making the switch to reduce environmental impact.

7.2.3 Woodfuel

1. Biomass consumption has been estimated to be increasing over the last decade. It is recommended that government intensify measures that will increase LPG penetration, especially in rural areas, to reverse the increasing demand for woody biomass.
2. A comparison of charcoal and LPG prices per MMBtu revealed that it costs more to get a unit of useful energy from LPG than from charcoal, regardless of stove efficiency. To encourage and increase LPG use (which is more efficient and environmentally friendly), the Ministry of Energy, through relevant stakeholders such as NPA, take necessary steps to reduce the price of LPG. The price intervention will also help realise the government's policy of achieving 50% of households using LPG by 2030.