



## ADDRESS

Ghana Airways Avenue  
Airport Residential Area  
(behind Alliance Francaise)

Private Mail Bag  
Ministries Post Office  
Accra – Ghana

## POST CODE

GA-037-3212

## CONTACT

PHONE:  
0302-813-756/7

FAX:  
0302813764

## WEBSITE:

[www.energycom.gov.gh](http://www.energycom.gov.gh)

## EMAIL:

[info@energycom.gov.gh](mailto:info@energycom.gov.gh)

## FOLLOW US:

 [EnergyCommissionGhana](https://www.facebook.com/EnergyCommissionGhana)  
 [EnergyCommissionGhana](https://www.youtube.com/EnergyCommissionGhana)  
 [EnergyCommissionGhana](https://www.linkedin.com/EnergyCommissionGhana)

# 2021 ENERGY OUTLOOK FOR GHANA

---

## *Demand and Supply Outlook*

---

---

**APRIL 2021**

---

## **EXECUTIVE SUMMARY**

The Energy Commission in fulfilment of its mandate under the Energy Commission Act (Act 541, 1997) presents supply and demand forecasts for electricity, petroleum and woodfuel for the year 2021. Factors that could influence the demand and supply are also discussed.

### **Electricity Sub-sector**

#### ***Electricity Demand***

For the past five years, Ghana's system peak demand has been increasing at an annual growth rate of 10.3%. The system peak demand in 2020 was 3,090 MW, which was about 10.2% more than 2019 system peak demand. Peak load excluding export (domestic load) was 2,682 MW; a marginal increase of 0.7% over 2019 domestic peak. The total energy consumed including losses was 19,717 GWh as against the projected of 19,685 GWh. A total of 17,887 GWh was consumed during the same period in 2019.

Analysis conducted to determine the impact of COVID-19 on electricity demand in 2020 showed that, there was a dip in demand during the partial lockdown attributed to reduced activities in the industrial and service sectors. However, following the easing of restrictions and the announcement of electricity relief by the government on April 11, 2020, system demand returned to normal such that electricity demand in 2020 grew by 10.2% over that of 2019.

For 2021, system peak demand is projected to be 3,304 MW. This represents an increase of 6.9% over the 2020 peak demand. The projected energy consumption including transmission system losses for 2021 is projected to be 21,266 GWh, an increase of 7.8% over 2020 consumption. The estimated transmission losses and own use represents 5.1% of total projected electricity supply.

#### ***Electricity Supply***

Installed generation capacity excluding embedded capacity as at the end of 2020 was 5,134 MW, an increase of 2.9% over 2019. The dependable capacity was 4,710 MW which is 3.1% more than in 2019. The installed capacity increases to 5,288.1 MW (with a dependable capacity of 4,842 MW) if embedded capacity at the sub-transmission (distribution grid) level are added.

Total electricity generation in the country including embedded generation was 20,229 GWh, an increase of 11.2% over 2019 generation. Without the embedded generation, the country's total generation in 2020 was 19,717 GWh, an increase of 10.2% over 2019.

Power generation capacity of 5,328.1 MW with a dependable capacity of 4,879 MW will be available in 2021. The bulk (68.5%) of the dependable capacity will come from thermal sources. However, considering planned units' maintenance and fuel supply situation, it is anticipated that up to 4,054 MW of capacity will be made available to meet the expected system peak demand of 3,304 MW.

Hydropower and thermal plants are projected to generate 7,001 GWh (32.9%) and 14,112 GWh (66.4%) of total electricity supply in 2021. The remaining supply of 152 GWh, representing 0.7%, is expected to be met by other renewables, including solar PV and biogas.

### ***Fuel for Power Generation***

Total gas supplied in 2020 for electricity production was 95,632 MMscf, 5.4% short of projected. About 361,110 barrels of LCO was used as against 495,732 barrels projected. No plant was expected to run on diesel in 2020, however, 200,327 barrels of diesel was used for electricity generation. About 90.1% of the diesel was used for the operation of KTPP whilst 8.5% was used by Cenpower plants. The remaining, about 1.3%, went to Early Power. HFO used for the operation of AKSA plant, was above the projected 212,859 barrels reaching 564,601 barrels in 2020.

Fuel for thermal power plants in 2021 will be mainly natural gas to be sourced from indigenous and import sources. The total natural gas consumption for 2021 is projected to be about 123.9 TBtu. The expected gas flow from import sources (N-gas and Tema LNG) would be 175 MMscf/day throughout the year, whilst an average of 305 MMscf/day is expected from domestic gas fields during the year. An estimated 121,849 barrels of HFO will be required by AKSA plant for the period January to June 2021. The AKSA plant is expected to switch to natural gas starting July 2021.

For 2021, delivery price of WAGP and domestic gas would be a weighted average price of \$6.08/mmBTU. The total cost of fuel is estimated to be \$758.8 million in 2021. About \$753.3 million will be used to procure natural gas and the remainder for the procurement of HFO to fuel the AKSA plant.

## **Transmission**

The transmission network has 7,200.5 circuit km as at the end 2020. It transmits electricity at four main voltage levels; 69 kV, 161 kV, 225 kV and 330 kV. The network total transformer capacity as at the end of 2020 was 8,901.8 MVA with sixty-five (65) Bulk Supply Points across the nation.

The following transmission projects are expected to be completed to improve power system performance in 2021:

- 161 kV Volta – Achimota – Mallam line corridor upgrade
- 330 kV Anwomaso – Kintampo line and
- 330/34.5 kV Pokuase Substation
- 161/34.5 kV Kasoa Substation

## **Petroleum Sub-sector**

### **Crude Oil**

Crude oil production in 2020 was 66.93 million barrels coming from the three main commercial fields - Jubilee, TEN and Sankofa-Gye Nyame, down from 72.11 million barrels produced in 2019. Average daily production of crude oil for the year was 182,918 barrels, a decline of 7.3% from 2019 average daily production.

Jubilee field's crude production in 2020 decreased to 30.42 million barrels from 32.58 million barrels in 2019. Corresponding average daily production equally dropped from an average of 89,091 barrels in 2019 to 83,162 barrels in 2020. TEN field's crude production dropped from 22.3 million barrels in 2019 to 17.8 million barrels in 2020. The corresponding average daily production equally dropped from 61,128 barrels in 2019 to 48,655 barrels. Finally, Sankofa-Gye Nyame field<sup>1</sup> crude production in 2020 stood at 18.7 million barrels, about 70% increase from 10 million barrels in 2019. Corresponding average daily production equally rose to 51,102 barrels from 47,086 barrels in 2019.

---

<sup>1</sup> Also called OCTP (Offshore Cape Three Point) field

Crude oil production performance in 2020 has been good, despite the global health pandemic. The modest performance is partly attributable to increased gas offtake nominations as well as a temporary increase in gas flaring. The coming on stream of the Ntomme-09 well in the TEN field and OP-9 and OP-10 producer wells in the Sankofa field also added to the gross oil production.

For 2021, crude oil production from the three fields - Jubilee, TEN and Sankofa is expected to be 157,734 barrels per day. Jubilee field is expected to produce about 76,878 barrels/day, while TEN is expected to produce 38,448 barrels/day in 2021. The third field, Sankofa, would produce 42,408 barrels/day.

The average Brent crude oil price in 2020 was US\$ 42 per barrel, a decline of 36.0% lower from 2019 average price. The price of US West Texas Intermediate (WTI) crude averaged US\$39 per barrel in 2020 which is about 32.0% lower than 2019 average price. Jubilee field's crude oil was sold at \$40 per barrel compared with \$64 per barrel in 2019. That of the TEN and the Sankofa-Gye Nyame fields in 2020 were sold at an average price of \$41 and \$44 per barrel compared with \$66 and \$70 per barrel in 2019 respectively.

Crude oil price is expected to bounce back in 2021 after the collapse in 2020. The International Monetary Fund (IMF) put crude oil prices to average US\$50 per barrel in 2021. It is expected that the market price of crude oil from Ghana's fields – Jubilee, TEN and Sankofa will hover around the US\$50 per barrel benchmark price in 2021.

### **Natural Gas**

Total raw gas produced in 2020 was 237,963 MMscf coming from the three main commercial fields – Jubilee, TEN and Sankofa, compared to 169,609 MMscf in 2019, representing an increase of 40.3%. Average daily production of raw gas from the three fields combined was 651 MMscf/day, up from 464 MMscf/day in 2019.

Raw gas produced from the Jubilee field increase by 25.7% in 2020 (64,462 MMscf), from 51,280 MMscf in 2019. Daily production of raw gas from the Jubilee field in 2020 was 176 MMscf/day, up from 140 MMscf/day in 2019. TEN field also witnessed a 21.3% increase in production, from 48,387 MMscf in 2019 to 58,674 MMscf in 2020. Average daily production from the TEN field also increased from 132 MMscf/day in 2019 to 160 MMscf/day in 2020.

Gross raw gas production from associated and non-associated sources at the Sankofa field was 114,826 MMscf in 2020, up from 60,942 MMscf produced in 2019. The corresponding daily average production from Sankofa field increased to 315 MMscf/day in 2020 from 192 MMscf/day in 2019.

Wet gas exported from the Jubilee and TEN in 2020 to Atuabo gas processing plant (AGPP) was 31,960. Jubilee field exported 26,415 MMscf, up from 20,689 MMscf exported in 2019, while TEN exported 5,545 MMscf, up from 701 MMscf exported in 2019. The Sankofa field exported 56,621 MMscf, representing 80.4% of the non-associated gas produced to the Onshore Receiving Facility (ORF) in 2020. The gas exported from the field represent a 73.3% increase over the volume exported in 2019 (32,670 MMscf).

Lean gas processed for power and non-power use in 2020 was 107,138 MMScf, representing an increase of 43.9% over 2019. The total processed gas is made up of 28,423 MMscf from AGPP and 56,571 MMscf of non-associated gas received at the ENI ORF. The remaining 22,144 MMscf was imported from Nigeria via WAGPCo.

Given the availability of domestic gas, priority will be given to usage of gas from the Ghana fields. Thus, in 2021, Sankofa is expected to maintain its capacity to supply up to 180 MMscf per day to the ORF, while Jubilee and TEN together are expected to supply 125 MMscf per day to the AGPP. The expected import from Nigeria is pegged at 50 MMscf per day. LNG import is forecast to be about 125 MMscf/day. In 2021, lean gas from AGPP (Jubilee/TEN), ORF (Sankofa), N-Gas and Tema LNG for power generation is expected to assume the WACOG of \$US6.08/MMBtu as determined by Public Utility Regulatory Commission (PURC).

Gas will continue to remain the most sustainable and relatively cost-competitive fuel supply to produce affordable power in the country. The key challenges hampering reliability of gas supply are inadequate supply, particularly from Nigeria through the WAGP and financing (domestic and international payment deficits).

### **Petroleum Products**

Total petroleum products produced in the country was 580 kilotonnes, down from 669 kilotonnes in 2019. The reduction may be due to challenges of securing the necessary financing to procure crude oil for the state-owned Tema Oil Refinery (TOR). Out of this, gasoil

produced was 150 kilotonnes, a decrease of 24.5% from production in 2019. Also, gasoline production witnessed a drastic decline to 66 kilotonnes in 2020, representing 46.8% decrease from 2019 production. About 85 kilotonnes (1.4% produced by TOR and 98.6% produced by AGPP) of LPG was produced in 2020 as against 49 kilotonnes produced in 2019. ATK witnessed a reduction in production, from 80 kilotonnes in 2019 to 28 kilotonnes in 2020. Kerosene production was 35 kilotonnes in 2020 compared to 12 kilotonnes in 2019, while RFO produced was 216 kilotonnes in 2020, up from 205 kilotonnes produced in 2019. *Add reason*

On the other hand, total petroleum products imported into the country increased from 3,839 kilotonnes in 2019 to 3,970 kilotonnes in 2020, representing an annual increase of 3.7%. Gasoil recorded the highest import of 1,947 kilotonnes in 2020, which is 11.8% increase over its import in 2019. Gasoline is next with an import of 1,682 kilotonnes in 2020, a 33.0% increase over its 2019 import. LPG import was 262 kilotonnes in 2020, a reduction of 4.9% of import in 2019. ATK witnessed a reduction in import, from 181 kilotonnes in 2019 to 80 kilotonnes in 2020. HFO, mainly used for power generation, witnessed an import of 63 kilotonnes in 2020, down from 366 kilotonnes imported in 2019.

Gross petroleum products consumed in 2020, increase by about 6.5%, from 3,882.2 kilotonnes in 2019 to 4,133.4 kilotonnes. Gasoil consumption was highest, constituting 1,964.1 kilotonnes in 2020, an increase of 4.8% over 2019 consumption of 1,872.8 kilotonnes. This was followed by gasoline consumption of 1,526.9 kilotonnes, up from 1,345.6 kilotonnes in 2019. At the same time, LPG, kerosene, premix, RFO and MGO consumptions were 332.4 kilotonnes, 5.0 kilotonnes, 76.8 kilotonnes, 48.3 kilotonnes and 51.3 kilotonnes representing 10.9%, 31.1%, 41.2%, 16.7% and 56.0% increases over 2019 consumption of 299.6 kilotonnes, 3.8 kilotonnes, 54.4 kilotonnes, 41.4 kilotonnes and 32.9 kilotonnes respectively. However, ATK consumption witnessed a reduction by 44.5%, from 231.7 kilotonnes in the 2019 to 128.7 kilotonnes in 2020. This was attributed to the halt in international travels in greater part of 2020 due to COVID-19.

For 2021, total petroleum products required is projected to be 4,464 kilotonnes (equivalent to about 85,611 barrels per stream day refinery capacity), an increase of 8.0% over 2020 consumption. Out of this, gasoil consumption is forecast to be about 1,991 kilotonnes,

increasing by 1.4% over the 2020 consumption, while gasoline will be 1,718 kilotonnes in 2021, up by 12.5% from the 2020 consumption. LPG consumption is expected to grow by 5.0% from 332 kilotonnes in 2020 to about 349 kilotonnes in 2021. ATK and kerosene consumption for 2021 are expected to be 207 kilotonnes and seven (7) kilotonnes, respectively. Other petroleum products such as Premix, RFO and MGO will have a combined consumption of 192 kilotonnes in 2021. Supply to meet projected petroleum products consumption in 2021 will be largely import, since TOR is not likely to operate at full capacity largely due to financial challenges.

### **Woodfuel Sub-sector**

In 2020, wood extracted for use directly as fuel (firewood) was estimated to be 1,438 ktoe. The wood extracted for the production of charcoal on the other hand was estimated to be 2,807 ktoe in 2020. The production of other biomass (mainly crop residue) was also estimated to be 30 ktoe in 2020.

The estimated wood to be extracted for use as firewood in 2021 would be 1,432 ktoe, a decrease of 0.4% from the estimated extraction in 2020. Also, wood to be extracted for charcoal production would be 2,926 ktoe, increasing by 4.2% over estimated extraction in 2020. The production of other biomass (mainly crop residue) would remain about 30 ktoe in 2021.

Biomass consumption in 2020 is estimated to be 2,977 ktoe. The residential sector has been the largest consumer of biomass in the country. In 2020, households consumed an estimated 2,567 ktoe of total biomass consumed, while the industrial and services sectors consumed 279 ktoe and 131 ktoe respectively. Over the last decade, biomass consumption has been estimated to be increasing. This trend could be reversed if government intensify measures that will increase LPG penetration especially in rural areas.

In 2021, household consumption of biomass is expected to rise to an estimated value of 2,605 ktoe, while the services and industrial sectors are each expected to consume 135 ktoe and 287 ktoe respectively.

The national mean price for maxi bag of charcoal in 2020 was GH¢47.81, while mean price for mini bag of charcoal was GH¢36.00. The high-price zone was along the Coastal areas

(Greater Accra, Central and Volta Regions) averaging GH¢52.5 for maxi bag and GH¢42.09 for mini bag. The low-price areas are the Forest, Transition and Savannah zones, where charcoal is usually produced. Charcoal consumption is expected to increase in 2021 due to relatively high price of LPG. As a result, charcoal price is also expected to increase in 2021, but marginally. At worst it would grow at the same rate as the national inflation rate for the year.

## **PREFACE**

ENERGY COMMISSION is mandated to prepare, review and update periodically indicative national plans to ensure that reasonable demands for energy are met in a sustainable manner. The Commission is also mandated to secure and maintain a comprehensive data base 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 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 2021 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 this year.

The Energy Outlook for Ghana outlines projections for energy demand and supply for the year 2021. It 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 preceding year (2020) comparing actuals to projections and providing highlights on the impact of the novel coronavirus disease (COVID-19) on the energy sector. It continues to forecast 2021 energy demand and supply.

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**

## TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY</b> .....	<b>II</b>
<b>PREFACE</b> .....	<b>X</b>
<b>TABLE OF CONTENTS</b> .....	<b>XI</b>
<b>LIST OF TABLES</b> .....	<b>XIII</b>
<b>LIST OF FIGURES</b> .....	<b>XIV</b>
<b>ABBREVIATION</b> .....	<b>XV</b>
<b>CHAPTER ONE: INTRODUCTION</b> .....	<b>1</b>
1.1 BACKGROUND .....	1
1.2 METHODOLOGY .....	3
1.3 OUTLINE OF THE REPORT .....	3
<b>CHAPTER TWO: 2020 ELECTRICITY SYSTEM PERFORMANCE REVIEW</b> .....	<b>4</b>
2.0 INTRODUCTION .....	4
2.1 ELECTRICITY DEMAND IN 2020 .....	4
2.1.1 Peak Demand in 2020 .....	4
2.1.2 Energy Consumption .....	6
2.1.3 Impact of COVID-19 Peak and Energy Demand .....	8
2.2 ELECTRICITY SUPPLY IN 2020 .....	9
2.2.1 Electricity Generation Capacity .....	9
2.2.2 Energy Generation .....	12
2.2.3 Performance of Generation Sources in 2020 .....	15
2.3 FUEL SUPPLY IN 2020 .....	20
2.3.1 Fuel Consumption .....	20
2.3.3 Fuel Cost in 2020 .....	21
<b>CHAPTER THREE: 2021 ELECTRICITY OUTLOOK</b> .....	<b>23</b>
3.0 INTRODUCTION .....	23
3.1 ELECTRICITY DEMAND OUTLOOK .....	23
3.1.1 Projected Peak Demand for 2021 .....	23
3.1.2 Projected Energy Consumption for 2021 .....	25
3.2 ELECTRICITY SUPPLY OUTLOOK .....	26
3.2.1 Generation Sources for 2021 .....	26
3.2.2 Generation Capacity and Projected Peak Demand .....	28
3.2.3 Generation Sources Availability in 2021 .....	29
3.2.4 Demand-Supply Balance for 2021 .....	32
3.3 FUEL SUPPLY OUTLOOK .....	35
3.3.1 Fuel Requirements .....	35
3.3.2 Fuel Price and Cost .....	37
3.4 TRANSMISSION OUTLOOK .....	38
3.4.1 Overview of Transmission System .....	38
3.4.2 Transmission Line Feeder and Substation Availability in 2021 .....	38
3.5 ELECTRICITY SUPPLY CHALLENGES IN 2021 .....	39
3.5.1 Fuel Supply Challenges .....	39
3.5.2 Transmission Challenges .....	40
<b>CHAPTER FOUR: 2020 PETROLEUM SUB-SECTOR PERFORMANCE REVIEW</b> .....	<b>42</b>

4.0 INTRODUCTION .....	42
4.1 CRUDE OIL .....	42
4.1.1 Crude Oil Production .....	42
4.1.2 Crude Oil Import .....	45
4.1.3 Crude Oil Price.....	46
4.2 NATURAL GAS.....	48
4.2.1 Natural Gas Production.....	48
4.2.2 Gas Export from Producing Fields.....	51
4.2.3 Lean Gas Produced and Supplied in 2020 .....	52
4.3 PETROLEUM PRODUCT .....	53
4.3.1 Petroleum Products Production .....	53
4.3.2 Petroleum Product Import .....	54
4.3.3 Petroleum Product Consumption .....	55
4.3.4 Petroleum Product Prices.....	58
<b>CHAPTER FIVE: 2021 PETROLEUM OUTLOOK .....</b>	<b>59</b>
5.0 INTRODUCTION .....	59
5.1 OUTLOOK FOR CRUDE OIL .....	59
5.1.1 Crude Oil Production .....	59
5.1.2 Crude Oil Price.....	60
5.2 OUTLOOK FOR NATURAL GAS.....	61
5.2.1 Natural Gas Export from Production Fields .....	61
5.2.2 Natural Gas Import.....	61
5.3 OUTLOOK FOR PETROLEUM PRODUCTS.....	61
5.3.1 Petroleum Products Demand.....	61
<b>CHAPTER SIX: WOODFUEL SUB-SECTOR.....</b>	<b>63</b>
6.0 INTRODUCTION .....	63
6.1 WOODFUEL PRODUCTION AND CONSUMPTION.....	63
6.1.1 Woodfuel Production.....	63
6.1.2 Biomass Consumption .....	64
6.2 WOODFUEL PRICES .....	65
6.2.1 Weight and Retail Price of Bag of Charcoal.....	65
<b>CHAPTER SEVEN: CONCLUSION AND RECOMMENDATIONS.....</b>	<b>69</b>
7.1 CONCLUSIONS .....	69
7.1.1 Electricity.....	69
7.1.2 Petroleum .....	70
7.1.3 Woodfuel.....	71
7.2 RECOMMENDATIONS .....	71
7.2.1 Electricity.....	71
7.2.2 Petroleum .....	72
7.2.3 Woodfuel.....	73
<b>APPENDICES.....</b>	<b>74</b>

## LIST OF TABLES

Table 1: Installed and dependable capacity as at the end of December 2020 .....	11
Table 2: Fuels used by the thermal plants in 2020 .....	20
Table 3: Costs due to projected and actual price of the fuels in 2020 .....	21
Table 4: Existing and committed power plants for 2021 .....	27
Table 5: 2021 Projected electricity demand/supply balance, GWh.....	33
Table 6: Natural gas and liquid fuel allocation to thermal power plants at full capacity .....	36
Table 7: Expected average delivery fuel prices for the thermal plants for 2021 .....	38
Table 8: Monthly crude oil production in 2020, million barrels .....	43
Table 9: Projected and actual average daily production of crude oil.....	44
Table 10: Monthly average daily volumes of crude oil production in 2020, barrels.....	44
Table 11: Monthly international average crude oil prices in 2020, US\$ per barrel.....	47
Table 12: Achieved market price of Ghana Group crude oil lifting in 2020 .....	47
Table 13: Monthly raw gas production in 2020, MMscf.....	49
Table 14: Projected and actual average daily gas production from the three fields in 2020 ..	50
Table 15: Monthly average daily volumes of natural gas produced in 2020, MMscf/day .....	50
Table 16: Monthly raw gas exported from Jubilee, TEN and Sankofa in 2020, MMscf.....	51
Table 17: Monthly lean gas made available for AGPP, ENI ORF and WAGPCo, MMscf.....	53
Table 19: Petroleum products produced in the country in 2020, Kilotonnes.....	54
Table 20: Monthly quantity of petroleum products imported into the country in 2020, Kilotonnes .....	55
Table 21: Projected and actual consumption of major petroleum products in 2020, kilotonnes .....	56
Table 22: Outlook for Ghana's crude oil production profile for 2021, barrels/day.....	59
Table 23: Monthly outlook for petroleum product consumption, kilotonnes.....	62

## LIST OF FIGURES

Figure 1: Trend in peak demand from 2016-2020.....	4
Figure 2: System peak demand for 2020 .....	5
Figure 3: Monthly actual and projected system peak demand for 2020.....	6
Figure 4: Trend in energy consumption from 2016-2020 .....	7
Figure 5: Energy consumption by customer classes for 2020.....	7
Figure 6: Effect of Lockdown on daily domestic peak demand .....	8
Figure 7: Monthly projected and actual domestic energy consumption in 2020.....	9
Figure 8: Installed and dependable capacity in the recent past .....	10
Figure 9: Shares of hydro, thermal and renewable capacity at the end of December 2020...	12
Figure 10: Electricity generation (2016 – 2020).....	13
Figure 11: Monthly breakdown of electricity generation for 2020.....	13
Figure 12: Monthly breakdown of energy transmitted and losses.....	14
Figure 13: Trend in transmission losses in the recent past.....	15
Figure 14: Akosombo Reservoir Elevation .....	16
Figure 15: Bui Reservoir Elevation.....	17
Figure 16: 2020 projected and actual hydro generation .....	18
Figure 17: 2020 Projected and actual generation from thermal sources.....	19
Figure 18: Commodity price and service charges of gas in Ghana.....	22
Figure 19: Monthly projected peak demand for 2021 .....	24
Figure 20: Share of projected peak demand by customer class .....	24
Figure 21: Projected monthly energy consumption for 2021 .....	25
Figure 22: Share of projected energy consumption by the various customer classes .....	26
Figure 23: Capacities and System Peak demand for 2021 .....	28
Figure 24: Projected monthly capacity verses system peak for 2021 .....	29
Figure 25: Akosombo reservoir trajectory for 2021 .....	30
Figure 26: Bui reservoir trajectory .....	31
Figure 27: Share of electricity supply by generation type for 2021 .....	34
Figure 28: Natural gas flowrates for thermal power plants in 2021 .....	35
Figure 29: Thermal plants fuel requirements for 2021 .....	36
Figure 30: Monthly projected fuel requirements.....	37
Figure 31: Crude oil production from 2010 to 2020 .....	42
Figure 32: Monthly crude oil imported into the country in 2020.....	45
Figure 33: Average crude oil prices for US WTI and Europe Brent 2000-2020.....	46
Figure 34: Volumes of raw gas production from 2014 to 2020.....	49
Figure 35: Trend in petroleum products consumption from 2010-2020.....	56
Figure 36: Monthly consumption of petroleum products in 2020.....	57
Figure 37: Trend in bi-weekly petroleum products prices.....	58
Figure 38: Monthly crude oil price forecast for 2021, US\$ per barrel.....	60
Figure 39: Woodfuel production .....	64
Figure 40: Biomass consumption by sectors .....	65
Figure 41: Average weight of maxi and mini bags of charcoal.....	66
Figure 42: Average price per bag of charcoal in the ecological zones of Ghana in 2020.....	67
Figure 43: Comparison of unit price of charcoal and LPG from 2015-2020.....	68

## ABBREVIATION

AfDB	African Development Bank
AGPP	Atuabo Gas Processing Plant
ATK	Aviation Turbo Kerosene
BPA	Bui Power Authority
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
FPSO	Floating Production Storage and Offloading
GDP	Gross Domestic Product
GNGC	Ghana National Gas Company
GRIDCo	Ghana Grid Company
GWh	Gigawatt hour
HFO	Heavy Fuel Oil
IPPs	Independent Power Producers
KTPP	Kpone Thermal Power Plant
LCO	Light Crude Oil
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MGO	Marine Gas Oil
MMBtu	Million British Thermal unit
MMscf	Million Standard Cubic Feet
MW	Megawatt
NEDCo	Northern Electricity Distribution Company
NG	Natural Gas
N-Gas	Nigeria Gas
NITS	National Interconnected Transmission System
NMS	Network Manager System
OPEC	Organisation of Petroleum Exporting Countries
ORF	On-shore Receiving Facility
PURC	Public Utilities Regulatory Commission
RFO	Residual Fuel Oil
SAPP	Sunon-Asogli Power Plant
TAPCO	Takoradi Power Company
TEN	Tweneboa Enyenra Ntomme
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
VALCO	Volta Aluminium Company
VRA	Volta River Authority
WAGP	West Africa Gas Pipeline
WAGPCo	West Africa Gas Pipeline Company
US WTI	US West Texas Intermediate

## Chapter One: Introduction

### 1.1 Background

---

Ghana's energy sector has evolved over the last two decades. This is due to continuous reforms and stability that allowed for increased investment by private players especially in the electricity sub-sector. In addition, the discovery of oil and gas in commercial quantities in 2007 and subsequent production in 2010, further put the country's energy sector in the path of growth. The country started oil production in 2010 with only one field, but now can boast of a total of three oil producing fields namely; Jubilee, Tweneboa Enyenra Ntomme (TEN) and OCTP Sankofa Gye Nyame. Despite the tremendous progress made in the energy sector, the year 2020 happens to be a challenging one.

In 2020, the global energy sector was dramatically affected by the outbreak of the health pandemic, novel coronavirus disease (COVID-19). Governments' lockdown measures and travel restrictions world-wide aimed at halting the spread of COVID-19 had a considerable impact on energy demand and supply. Global demand for oil and other forms of energy (especially electricity demand in productive sectors) significantly reduced. The fall in oil demand, coupled with the price war between Saudi Arabia and Russia<sup>2</sup>, saw a sharp fall in oil price. After opening the year at \$64 per barrel, oil prices plunged to a low of \$18 per barrel in April 2020 as COVID-19 spread around the world. In a bid to stabilize oil prices, members of the Organization of Petroleum Exporting Countries (OPEC), along with other oil-producing nations cut total global output by 9.7 million barrels per day<sup>3</sup>. While this effort, coupled with economic recoveries resulting from the pandemic, has helped oil prices recover to around \$51 per barrel as of December 31, 2020<sup>4</sup>, the significant negative impact on oil producing countries and oil companies cannot be underestimated. In 2021, it is envisaged that oil prices will continue to rebound till they reach their pre-pandemic levels.

---

<sup>2</sup>Saudi Arabia's Unwinnable Oil Price War Against Russia

<https://www.iaee.org/en/publications/newsletterdl.aspx?id=894>

<sup>3</sup>Energy: OPEC to cut oil by 9.7 mln. barrels per day from May 1 <https://www.aa.com.tr/en/energy/international-organization/opec-to-cut-oil-by-97-mln-barrels-per-day-from-may-1/28961>

<sup>4</sup> US Energy Information Administration: [https://www.eia.gov/dnav/pet/pet\\_pri\\_spt\\_s1\\_d.htm](https://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm)

Ghana's GDP (including oil) at the end of the first quarter of 2020 stood at GH¢92.5 billion against GH¢84.9 billion in the first quarter of 2019. However, the second quarter of 2020 witnessed a reduction to GH¢88.3 billion, when the impact of COVID-19 was severe, but higher than the same period in 2019 (GH¢84.3 billion). It then increased to GH¢92.2 billion (compared to GH¢85.5 in the third quarter of 2019) in the third quarter 2020<sup>5</sup> as measures to halt the spread of COVID-19 were being eased and the productive sector began bouncing back.

The contribution by oil and gas to GDP at the end of the third quarter of 2020 was GH¢8.2 billion, a drop of 20.9% from GH¢10.3 billion recorded at the end of the third quarter of 2019<sup>6</sup>. This partly affected real GDP growth. Real GDP (with oil) growth in the first quarter of 2020 was 4.9% (4.9% non-oil), a decline from 6.7% (6.0% non-oil) in the first quarter of 2019, which further worsened in the second quarter of 2020 where growth was -3.2% (-3.4% non-oil) compared to 5.7% (4.3% non-oil) in the second quarter of 2019, reflecting the negative impact of COVID-19 on the Ghanaian economy.

Despite the negative effect of COVID-19, modest progress in Ghana's energy sector was made in 2020. The Government of Ghana (GoG) took certain measures related to energy in a bid to mitigate the effect. Notable is the absorption of bills (whole for lifeline customers and 50% for non-lifeline customers) for electricity. The whole range of consequences of the COVID-19 for the energy sector is still evolving considering that the disease is still waging. Notwithstanding, an attempt is made to provide an outlook of the energy sector of Ghana for 2021.

The 2021 Energy Outlook for Ghana outlines projections for energy demand and supply for the year 2021. The report provided an overview of the actual performance of the energy sector, specifically the electricity and petroleum industry as well as the woodfuel subsector of the preceding year (2020), comparing actuals to projected values. It continues to forecast the year's energy demand and supply, which is largely driven by economic variables.

---

<sup>5</sup> Ghana Statistical Service: Rebased GDP quarterly bulletin December 2020 edition  
[https://www.statsghana.gov.gh/nationalaccount\\_macros.php?Stats=MjkwMzA1NjI0LjE0MTU=/webstats/oq43q9p651](https://www.statsghana.gov.gh/nationalaccount_macros.php?Stats=MjkwMzA1NjI0LjE0MTU=/webstats/oq43q9p651)

<sup>6</sup> Ghana Statistical Service: Rebased GDP quarterly bulletin December 2020 edition  
[https://www.statsghana.gov.gh/nationalaccount\\_macros.php?Stats=MjkwMzA1NjI0LjE0MTU=/webstats/oq43q9p651](https://www.statsghana.gov.gh/nationalaccount_macros.php?Stats=MjkwMzA1NjI0LjE0MTU=/webstats/oq43q9p651)

## **I.2 Methodology**

---

The report started by reviewing the performance of the energy sector in 2020 using actual data collected and comparing same with projections. Other reports were also reviewed to support the performance review of 2020. For the Electricity Outlook, the report relied on projections in the 2021 Electricity Supply Plan for Ghana which was produced by the Power Planning Technical Committee (PPTC). For the Petroleum Outlook, planned crude oil production and natural gas uptake were obtained from Ghana National Petroleum Corporation (GNPC). Time series analysis using petroleum products consumption data from 1999 to 2020 was used to forecast petroleum product consumption for 2021<sup>7</sup>. For Woodfuel Outlook, production and consumption were extrapolated from field survey data. Also, woodfuel (specifically charcoal) price was also presented from field survey.

## **I.3 Outline of the Report**

---

The report is structured into seven chapters. Chapter 1 is the introductory chapter that gives some background information, methodology and the report outline. Chapter 2 is dedicated to a review of the electricity's system performance, while Chapter 3 presents the outlook for electricity in 2021. Chapter 4 presents a review of the petroleum industry performance in 2020, focusing on crude oil, natural gas and petroleum products, while Chapter 5 presents the outlook for petroleum in 2021. Chapter 6 provides some updates on the woodfuel subsector. Conclusion and recommendations are presented in Chapter 7.

---

<sup>7</sup> National Petroleum Authority: National Consumption from 1999-2020 <http://www.npa.gov.gh/downloads/general>

# Chapter Two: 2020 Electricity System Performance Review

## 2.0 Introduction

This chapter presents the performance review of the Ghana Electricity System in the year 2020. It comprises a comparison of the projected and actual electricity demand, electricity supply and fuel supply in 2020. It also highlights major events which occurred during the year and their impact on the power system.

## 2.1 Electricity Demand in 2020

### 2.1.1 Peak Demand in 2020

System peak consists of domestic, Volta Aluminium Company (VALCO) and export load at peak. Domestic load at peak on the other hand, consists of the demand of the Electricity Company of Ghana (ECG), Northern Electricity Distribution Company (NEDCo), Mines and direct customers. System peak load has witnessed an increasing trend (10.3% annual growth rate) over the last five years as depicted in Figure I.

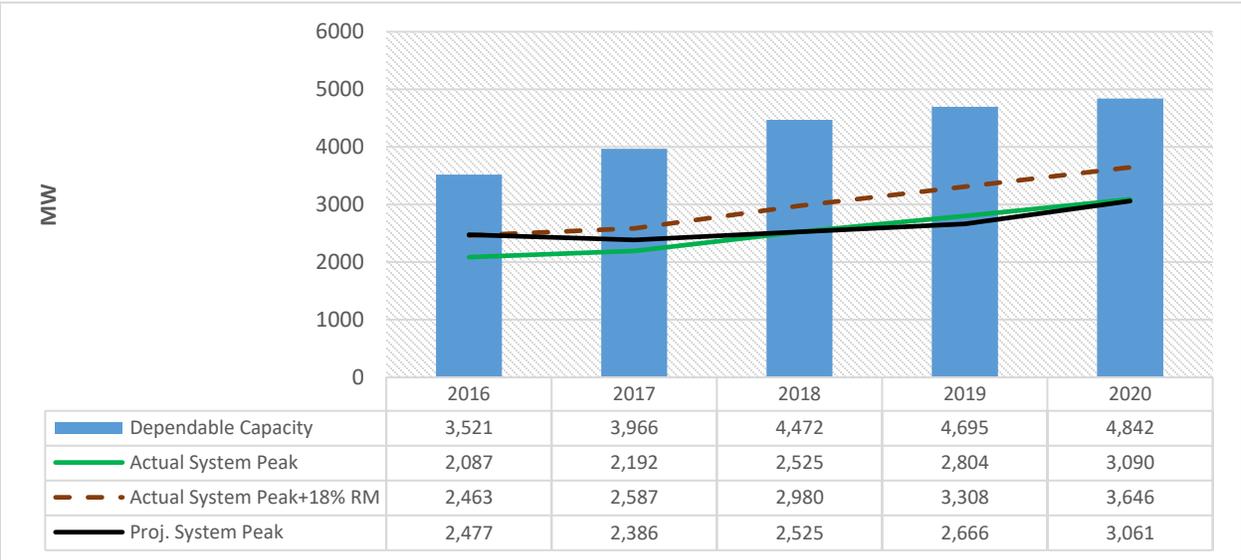


Figure I: Trend in peak demand from 2016-2020

In 2020, the system peak (coincident) recorded was 3,090 MW, up from 2,804 MW in 2019. This represents an increase of 10.2% over 2019 system peak demand, and a slightly higher than (by 0.9%) the system peak of 3,061 MW<sup>8</sup> projected for 2020 (Figure 1).

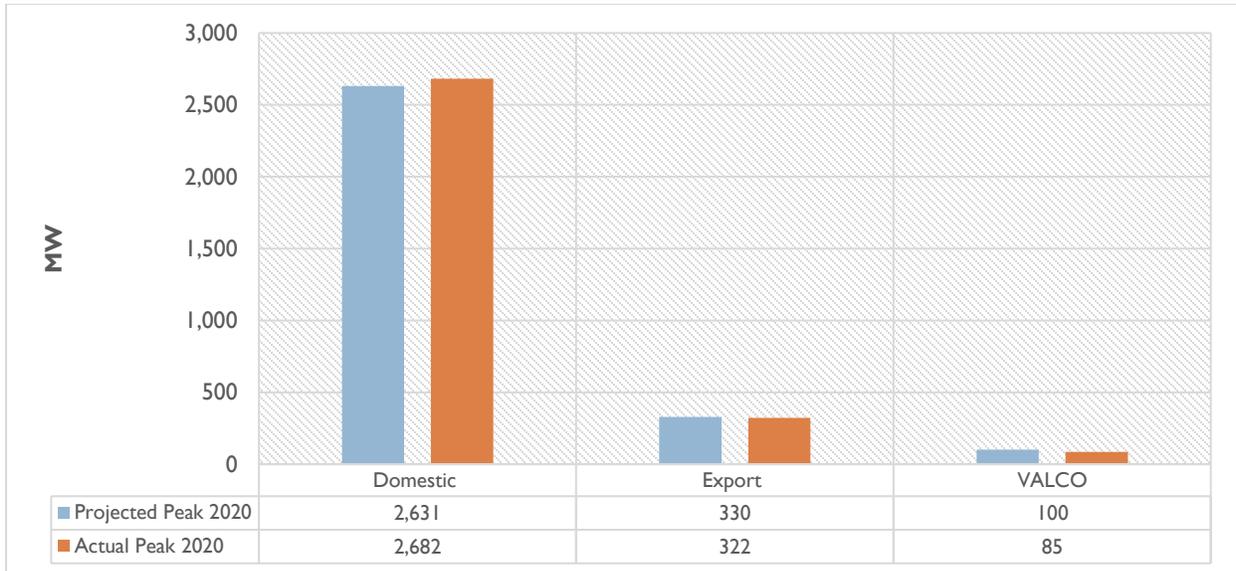


Figure 2: System peak demand for 2020

Domestic load at peak was 2,682 MW, representing a 0.7% increase over 2019 (2,613 MW) and up by 1.9% of the 2020 projected (2,631 MW). The export market and VALCO recorded 322 MW (up by 2.4% of projected 330 MW) and 85 MW (15% decrease of the projected 330 MW) respectively (Figure 2). Figure 3 compares monthly actual and projected system peak load for 2020.

<sup>8</sup> 2020 Electricity Supply Plan for Ghana Power System: A mid-year review: <http://energycom.gov.gh/files/2020%20Supply%20Plan%20Mid%20Year%20Review.pdf>

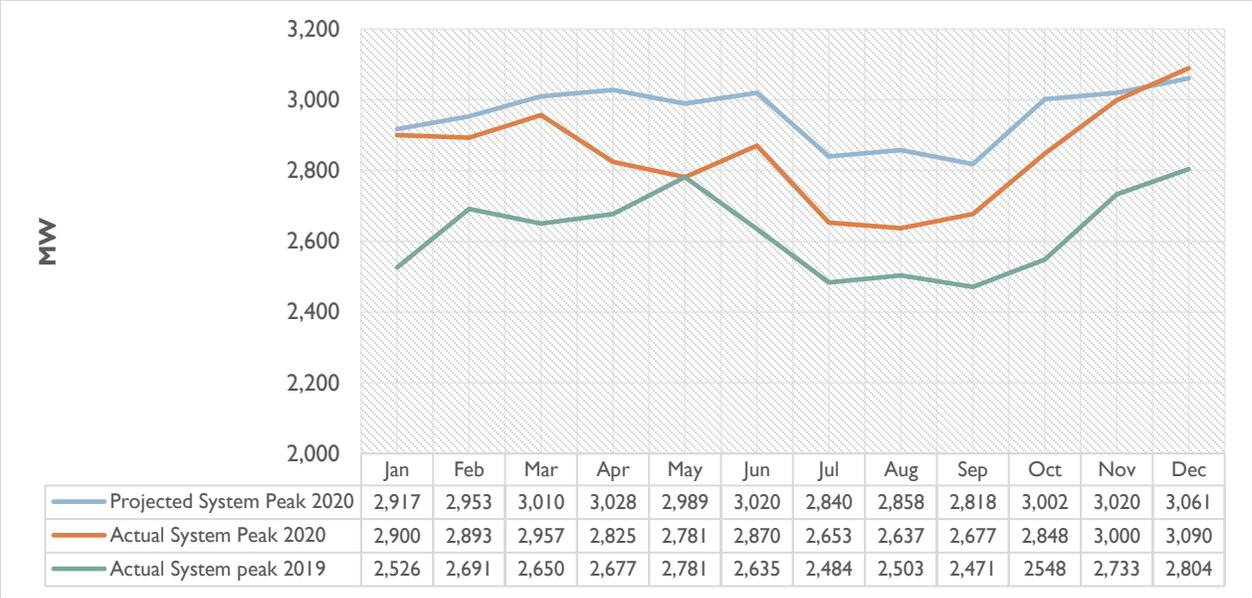


Figure 3: Monthly actual and projected system peak demand for 2020

The power system started with a system peak demand of 2,900 MW in January, which rose to 2,957 MW in March. Between July and September, the system peak was flat similar to the projection, then saw a modest rise, attaining a maximum system peak of 3,090 MW on December 4, 2020. Due to the overcapacity being witnessed in the sector (Figure 1), the rising system peak in the short-medium term may not require addition of new capacity.

**2.1.2 Energy Consumption**

Energy consumption has witnessed a continuous growth as depicted in Figure 4. Total energy consumed increased from 13,700 GWh in 2016 to 19,717 GWh in 2020, representing an average annual growth of 9.5% (Figure 4).

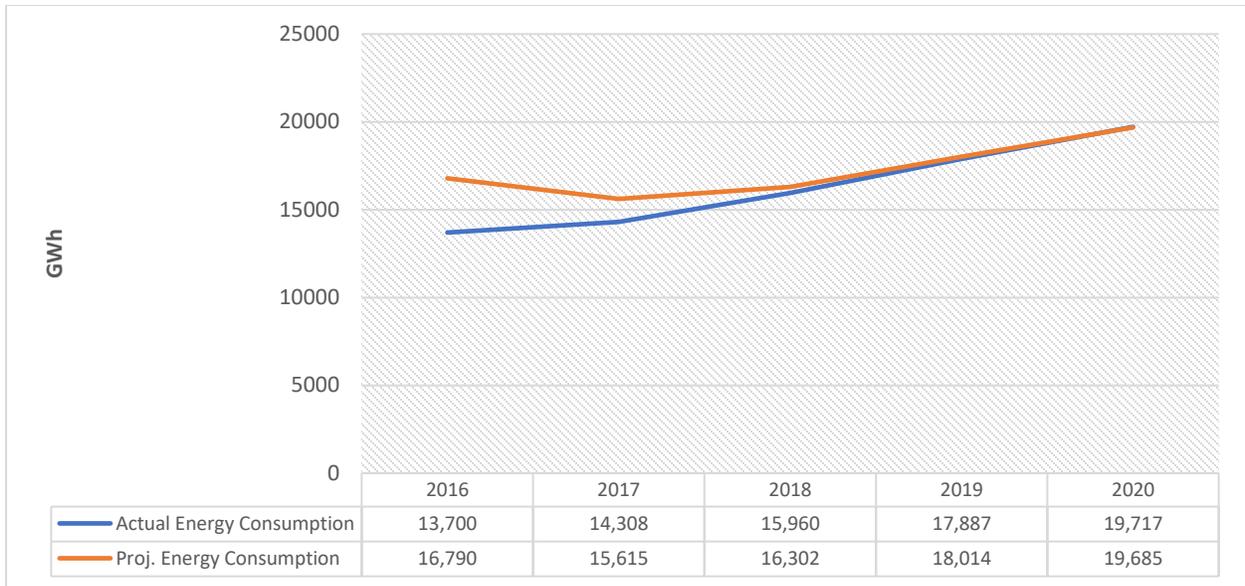


Figure 4: Trend in energy consumption from 2016-2020

Total energy consumed in 2020, including losses, was 19,717 GWh, an increase of 10.2% over that of 2019 (17,887 GWh). The actual energy consumed for 2020 was higher (0.2%) than the projected (19,685 GWh<sup>9</sup>). Figure 5 presents the consumptions by the various customers classes.

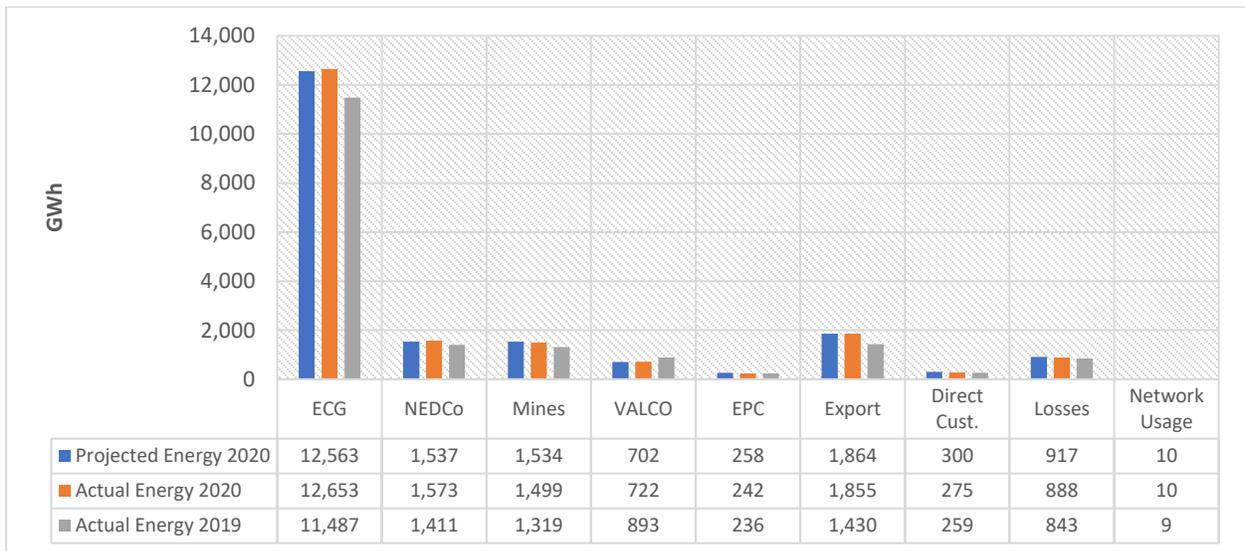


Figure 5: Energy consumption by customer classes for 2020

<sup>9</sup> 2020 Electricity Supply Plan for the Ghana Power System: A mid-year review: <http://energycom.gov.gh/files/2020%20Supply%20Plan%20Mid%20Year%20Review.pdf>

Energy consumption by ECG in 2020 witnessed an increase of 10.2% over 2019 level and a slight increase (0.7%) over the projected consumption for 2020. NEDCo also saw an annual increase of 11.5% in 2020. Mining load has also grown by 16.3%, from 1,319 GWh in 2019. However, VALCO consumption reduced from 893 GWh in 2019 to 702 GWh in 2020, representing a 19.2% reduction. The reduction is due to VALCO’s inability to operate on two pot lines as planned. Consumption by Direct customers also witnessed an increase of about 5.9% in 2020. Export consumption witnessed a significant growth of 29.7% in 2020, which is primarily due to increased supply to Burkina Faso as well as growth in supply to CIE in the last quarter of 2020.

**2.1.3 Impact of COVID-19 Peak and Energy Demand**

The year 2020 was turbulent for many industries including the energy sector of Ghana. This was largely due to the outbreak of COVID-19 in 2020, and the associated shocks on the economy and work programmes of major industry players. Nevertheless, the energy sector performed well.

In 2020, there was an overall growth of 10.2% in peak load over that of 2019. Peak Load in 2019 increased by 11.0% over that of 2018. This suggests that COVID-19 did not affect load much as there has not been any significant change in the load trend in 2020. Figure 6 illustrates domestic peak load trends in 2020, 2019 and 2018.

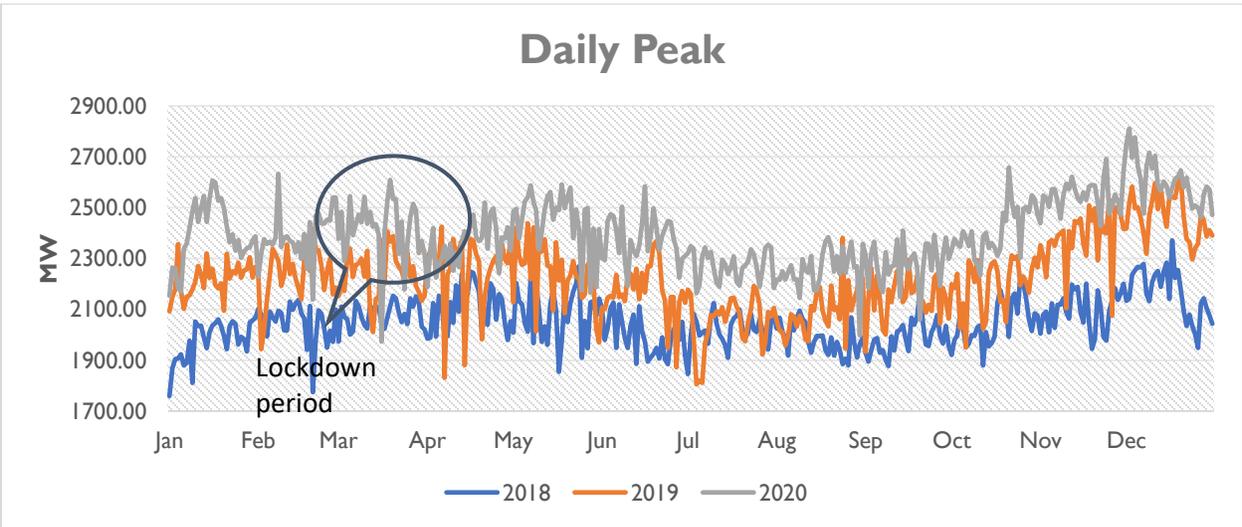


Figure 6: Effect of Lockdown on daily domestic peak demand

Analysis for the shorter period (i.e., March 30 to April 20) of lockdown in 2020 witnessed 2% increase in peak demand over the same period in 2019 (8% increase in the peak load over that of 2018). This indicates a comparatively stunted growth in load which is attributed to reduced activities in the industrial and service sectors due to the COVID-19 pandemic.

Total energy generated in the lockdown period was 1,061.9 GWh, which represents a marginal 4.9% growth over the 2019 generation compared to 7.4% growth in 2018. The monthly projected versus actual energy consumed in 2020, as illustrated in Figure 7 shows that actual consumption tipped more within the period of the lockdown.

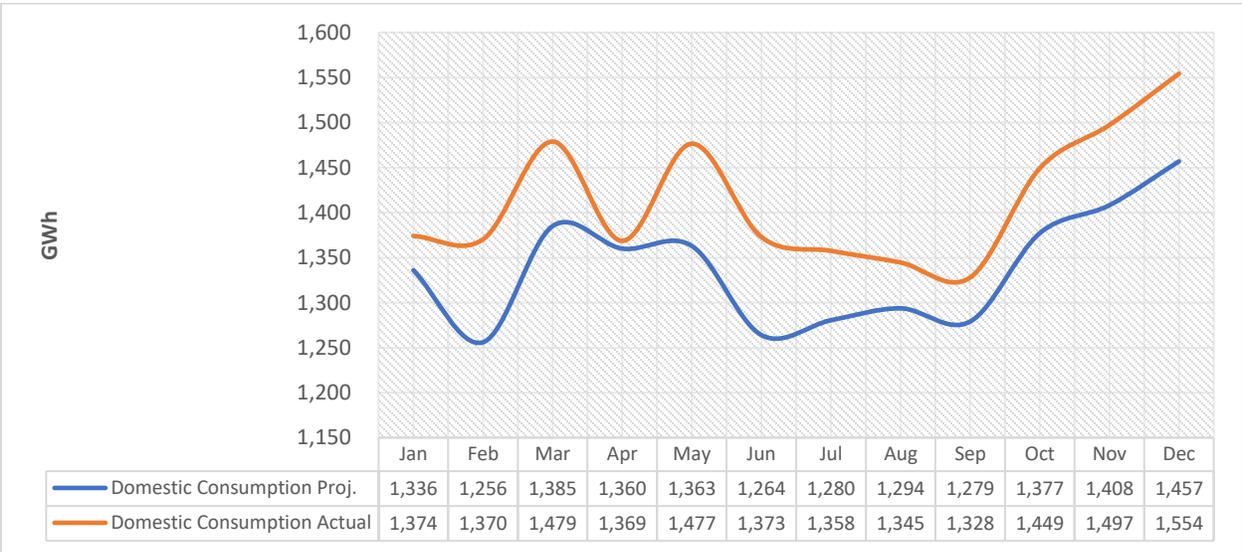


Figure 7: Monthly projected and actual domestic energy consumption in 2020

The reduction in electricity generation from the commencement of the lockdown recovered fast soon after the lifting of the lockdown. This could partly be attributed to the electricity relief announced by government on April 11, 2020, as businesses tried to take advantage of the relief.

**2.2 Electricity Supply in 2020**

**2.2.1 Electricity Generation Capacity**

Ghana’s electricity generation sources are hydro, thermal (crude oil, natural gas, heavy fuel oil and diesel) and renewables (solar and biogas). Electricity generation capacity has been increasing

over the last few years as depicted in Figure 8. This is as a result of the coming onstream of new capacities from thermal and renewable sources year-on-year.

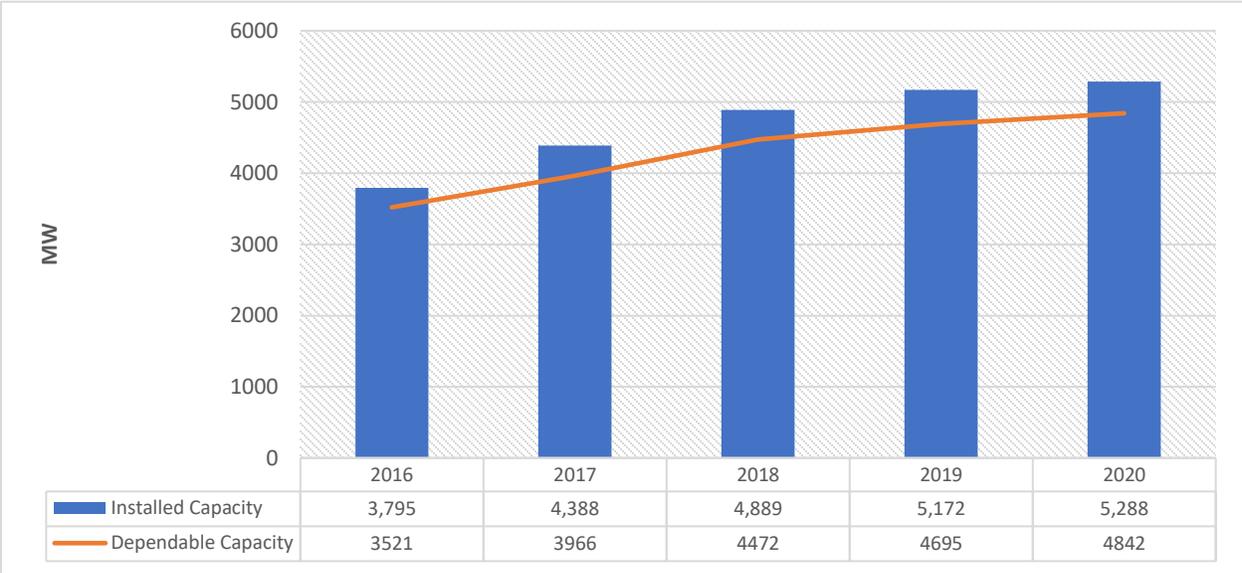


Figure 8: Installed and dependable capacity in the recent past

Installed electricity generation capacity increased from 3,795 MW in 2016 to 5,288 MW in 2020, representing an increase of 39.3%, with dependable capacity increasing from 3,521 MW in 2016 to 4,842 MW in 2020. The full complement of power plants in Ghana as at the end of December 2020 is shown in Table I.

Table I: Installed and dependable capacity as at the end of December 2020

Power Plant	Fuel Type	Installed Capacity (Nameplate)	Dependable Capacity
<b>Hydro Power Plants</b>			
Akosombo	Hydro	1,020	900
Bui	Hydro	400	360
Kpong	Hydro	160	140
<b>Sub-total</b>		<b>1,580</b>	<b>1,400</b>
<b>Thermal Power Plants</b>			
TAPCO	Oil/NG	330	300
TICO	Oil/NG	340	320
SAPP	NG	560	520
TT1PP	Oil/NG	110	100
TT2PP	Oil/NG	87	70
CENIT	Oil/NG	110	100
KTPP	Oil	220	200
AMERI	NG	250	230
Karpower	NG/HFO	470	450
AKSA	HFO	370	350
Cenpower	Oil/DFO	360	340
Amandi*	Oil/NG	203	190
Early Power*	NG/LPG	144	140
<b>Sub-total</b>		<b>3,554</b>	<b>3,320</b>
Genser	NG/LPG	95	85
<b>Sub – total (incl. embedded generation)</b>		<b>3,649</b>	<b>3,395</b>
<b>Renewables (excluding large hydro)</b>			
VRA Solar (Navrongo)	Solar	2.5	2.0
Meinergy Solar	Solar	20	16
BXC Solar	Solar	20	16
VRA Solar (Lawra)	Solar	6.5	4.5
Tsatsadu Hydro	Hydro	0.045	0.045
Bui Solar*	Solar	10	8
Safisana Biogas	Biogas	0.1	0.1
<b>Sub – total</b>		<b>59.145</b>	<b>46.645</b>
<b>Total (incl embedded gen.)</b>		<b>5,288.1</b>	<b>4,841.6</b>
<b>Total (excl embedded gen.)</b>		<b>5,134.0</b>	<b>4,710.0</b>

NB: \*Undergoing test run

Installed generation capacity excluding embedded capacity as at the end of 2020 was 5,134 MW. This represents about 2.9% expansion over 2019. The dependable capacity, in this case, is 4,710 MW which is 3.1% more than in 2019. Figure 9 shows the shares of the generating sources.

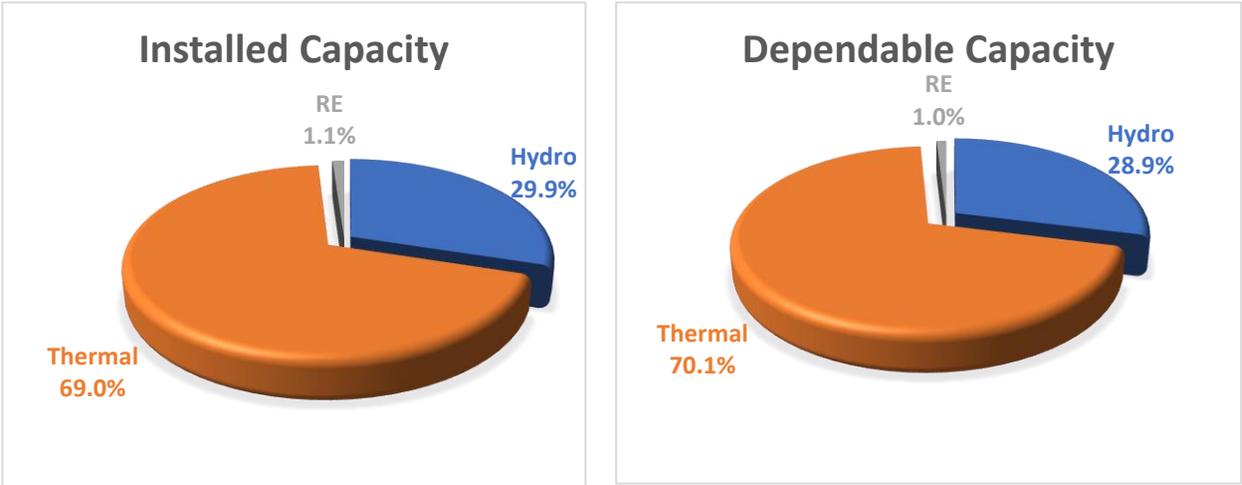


Figure 9: Shares of hydro, thermal and renewable capacity at the end of December 2020

In 2020, the energy mix remained relatively stable with hydro contribution 29.9% of total installed capacity. Conventional thermal plants contributed 69.0% of the total installed capacity in 2020, while renewable sources accounted for 1.1%. Thermal has surpassed hydro as the most dominant source of electricity generation in Ghana since 2015.

### 2.2.2 Energy Generation

Grid electricity generation continue to increase due to increasing electricity consumption. Figure 10 presents the grid electricity generation over the last five years.

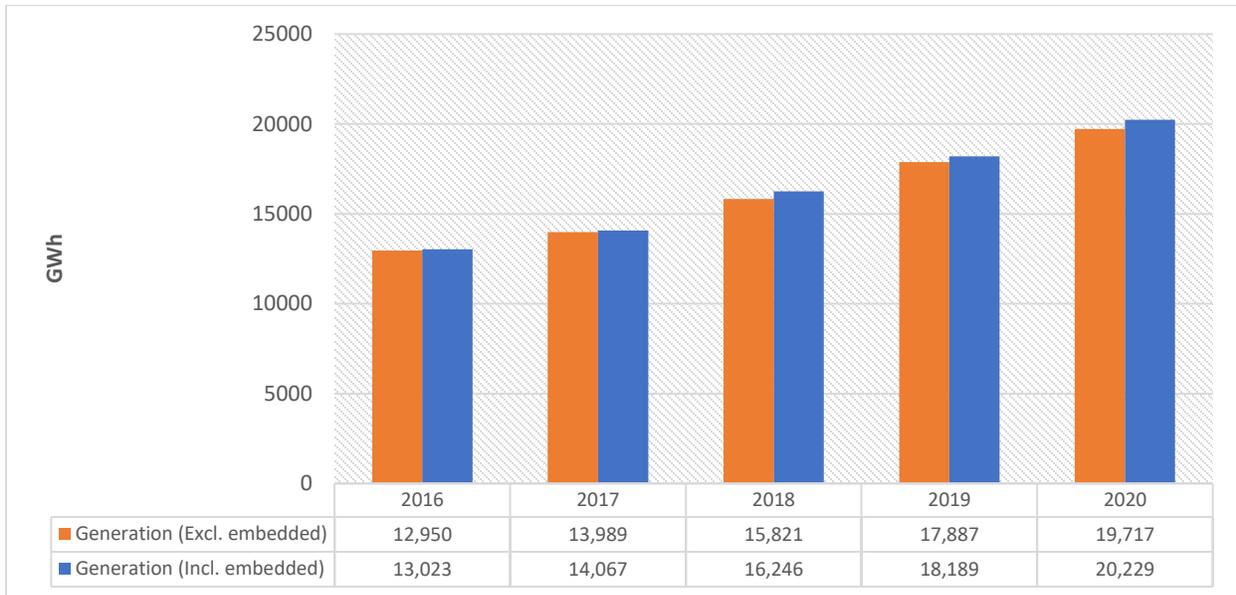


Figure 10: Electricity generation (2016 – 2020)

Total electricity generation in the country including the embedded generation<sup>10</sup> and import in 2020 was 20,229 GWh<sup>11</sup>, representing 11.2% increase over what was generated in 2019. Total generation at the transmission level (excluding embedded generation and import) was 19,659 GWh, an increase of 10.6% over 2019 generation. Figure 11 presents monthly electricity generation at the transmission level in 2020.

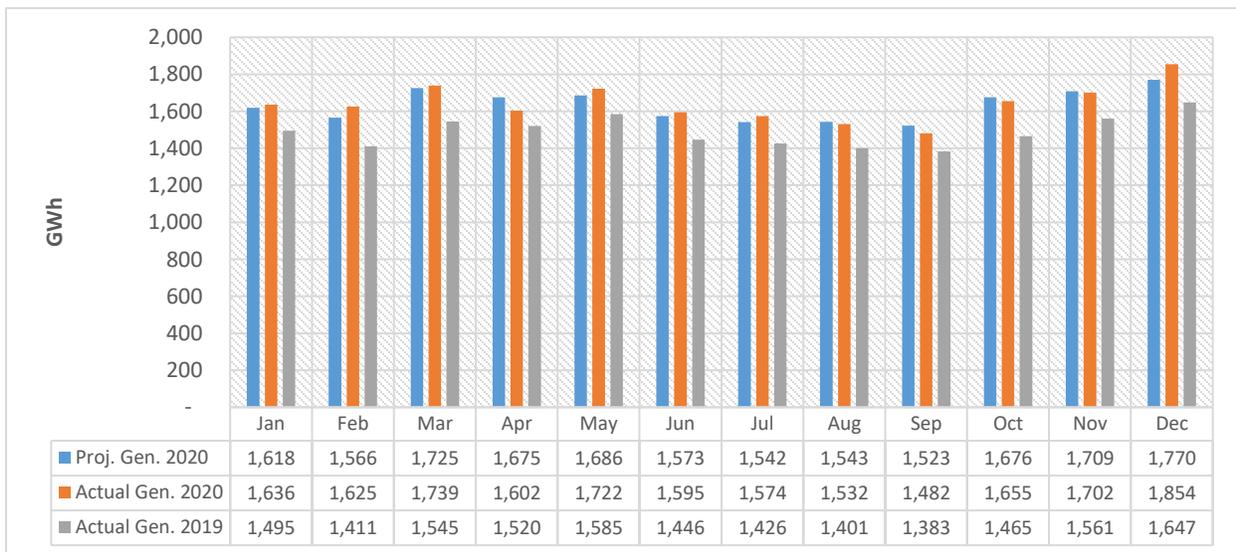


Figure 11: Monthly breakdown of electricity generation for 2020

<sup>10</sup> i.e. Genser thermal plant and the grid-tied solar plants delivering power at the sub-transmission level

<sup>11</sup> Excluding import is 20170 GWh

Electricity made available for transmission through the National Interconnected Transmission System (NITS), during the year was 19,717 GWh consisting of 7,293 GWh (37.0%) from hydro generation, 12,365 GWh (62.7%) from thermal generation and 58 GWh (0.3%) of import. This represents 10.2% increase over 2019 (Figure 12).

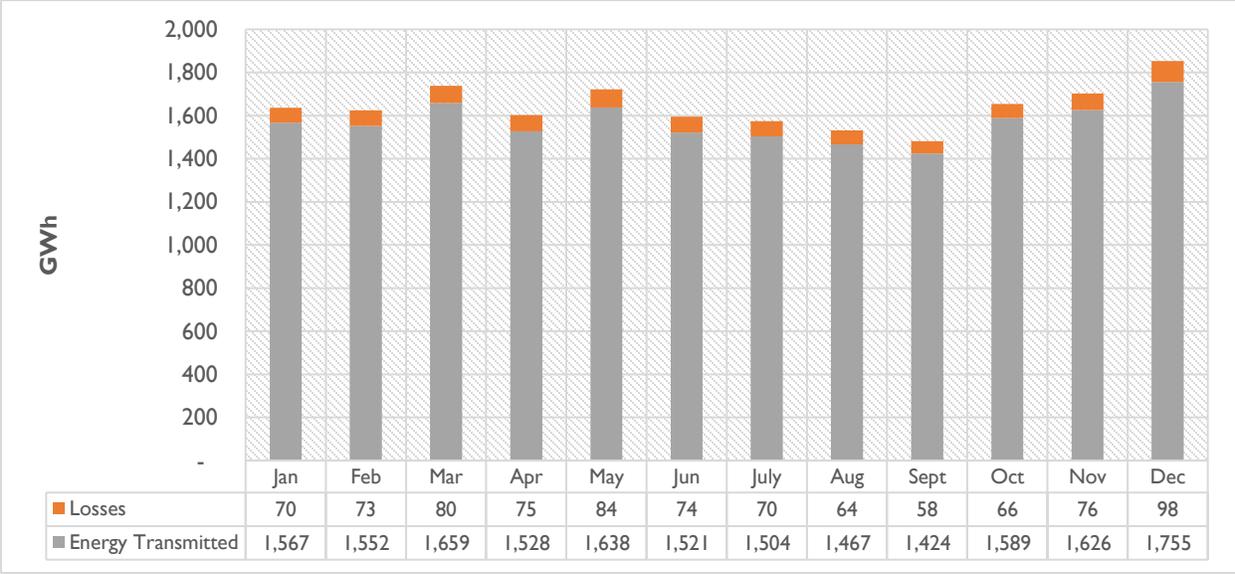


Figure 12: Monthly breakdown of energy transmitted and losses

Total electricity delivered for both domestic and export consumption<sup>12</sup> was 18,829 GWh, representing 8.9% increase over 2019 and 4.3% less than the projected requirement of 19,685 GWh for the year. The electricity supplied<sup>13</sup> to the country for domestic consumption was 16,974 GWh, an increase of 8.7% over what was supplied in 2019.

Transmission losses have witnessed a continuous growth in the last three years as depicted in Figure 13. With the exception of 2017, losses have surpassed the PURC benchmark of 4.1%.

<sup>12</sup> Total generation + the net imports – transmission losses.

<sup>13</sup> Gross grid electricity plus imports, less wheeled, less exports, less transmission losses.

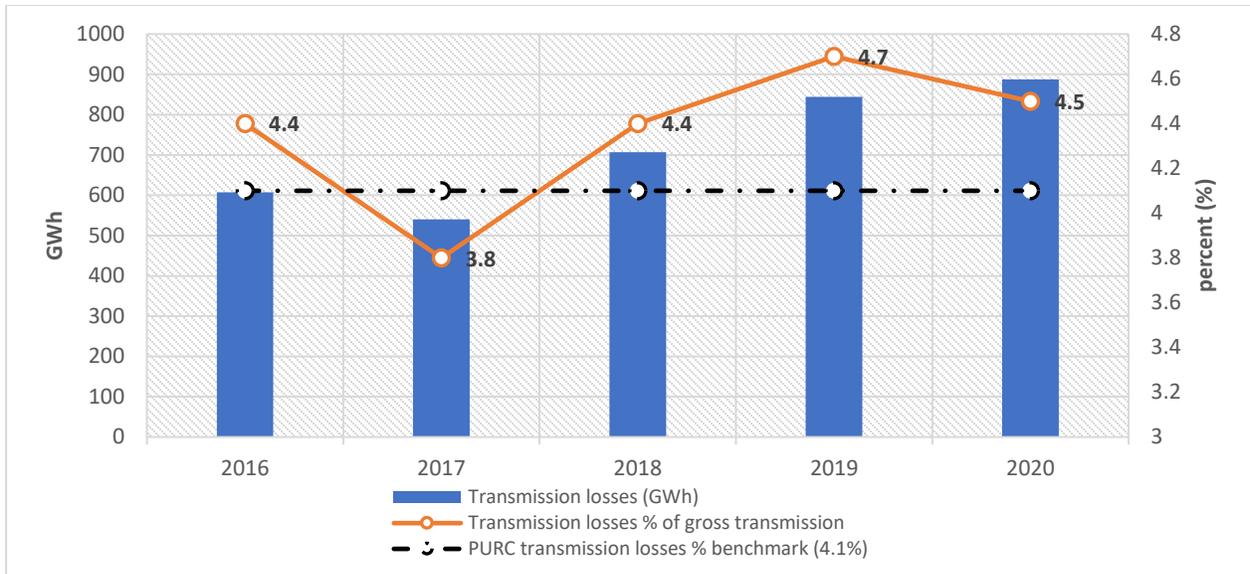


Figure 13: Trend in transmission losses in the recent past

Total transmission losses recorded in 2020 was 888 GWh, representing 4.5% (above PURC benchmark of 4.1%) of the total energy transmitted. This represents a 1.0% drop below the projected transmission losses of 897.03 GWh, but 5.2% increase over 2019 losses.

Averting the increasing trend in losses, require investment in new transmission lines, upgrade of existing outmoded ones and localized siting of new generation capacity that will also improve grid stability and reliability in times of contingency<sup>14</sup>.

## 2.2.3 Performance of Generation Sources in 2020

### 2.2.3.1 Hydro Generation Sources

The Volta Lake started the year 2020 at an elevation of 263 ft (80.7 m), about 29.8ft (9.1 m) above the extreme minimum operating level of 235.0ft (71.6 m). Based on this reservoir elevation, and the intent to store water in the reservoir, it was recommended to operate up to four (4) units during the off-peak period and up to five (5) units during the peak period in the year 2020. The foregoing mode of operation, which was adhered to, saw the reservoir elevation dropped to a minimum of 257.4 ft (78.5 m) during the dry season in May 2020 and started to rise in June

<sup>14</sup> Integrated Power System Master Plan, 2019:  
<http://energycom.gov.gh/files/Integrated%20Power%20System%20Master%20Plan%20Vol.%202.pdf>

2020. The elevation was 2.4 ft (0.7 m) more than the projected 255 ft for the year. Figure 14 shows the Akosombo reservoir trajectory for 2020 plotted against the trajectory for 2019.

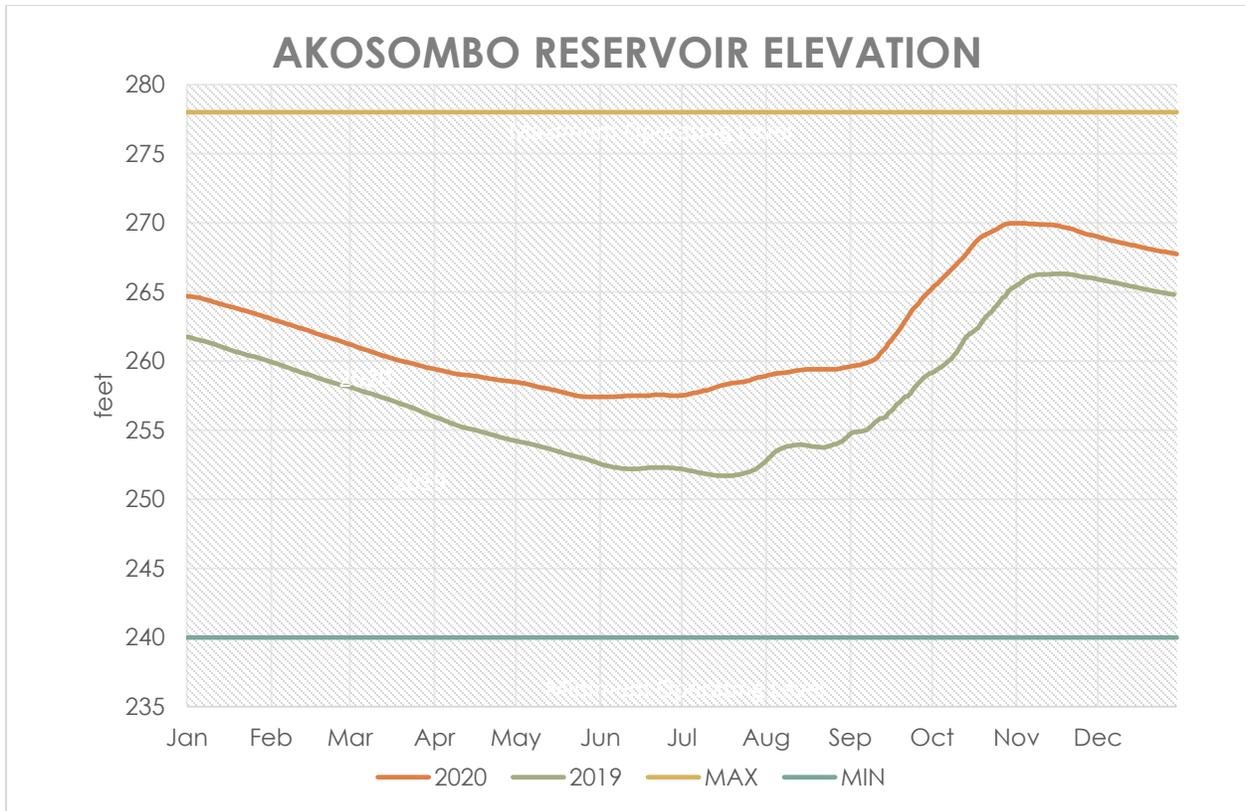


Figure 14: Akosombo Reservoir Elevation

The reservoir elevation at the end of 2020 was 267.7 ft (81.6 m). This figure represents an increase of 3.8 ft (1.2 m) above the projected elevation of 261.0 ft (79.6 m). The recorded maximum lake elevation at the end of year 2020 inflow season was 270.0 ft (82.3 m), a rise of 30 ft (9.1 m) above the minimum operating level of 240 ft. The total net inflow recorded in 2020 was 31.86 MAF, which was above the long-term average of 25.21 MAF.

The Kpong hydro plant, operated three (3) out of the four (4) generating units in major part of 2020. The fourth unit which was unavailable for major retrofit was restored to service on September 19, 2020.

In 2020, Bui hydropower plant was projected to operate an average of two turbine (2) units throughout the year. This mode of operation of the Bui hydro was expected to lead to a projected

annual production of 1,387 GWh and was expected to ensure that its reservoir level would be about 5 m above its target minimum level of 170 m-high compared to its 168 m-minimum operating level to guarantee continuous and sustainable operation of the dam for 2020. Figure 15 shows the Bui reservoir trajectory in 2019 and 2020.

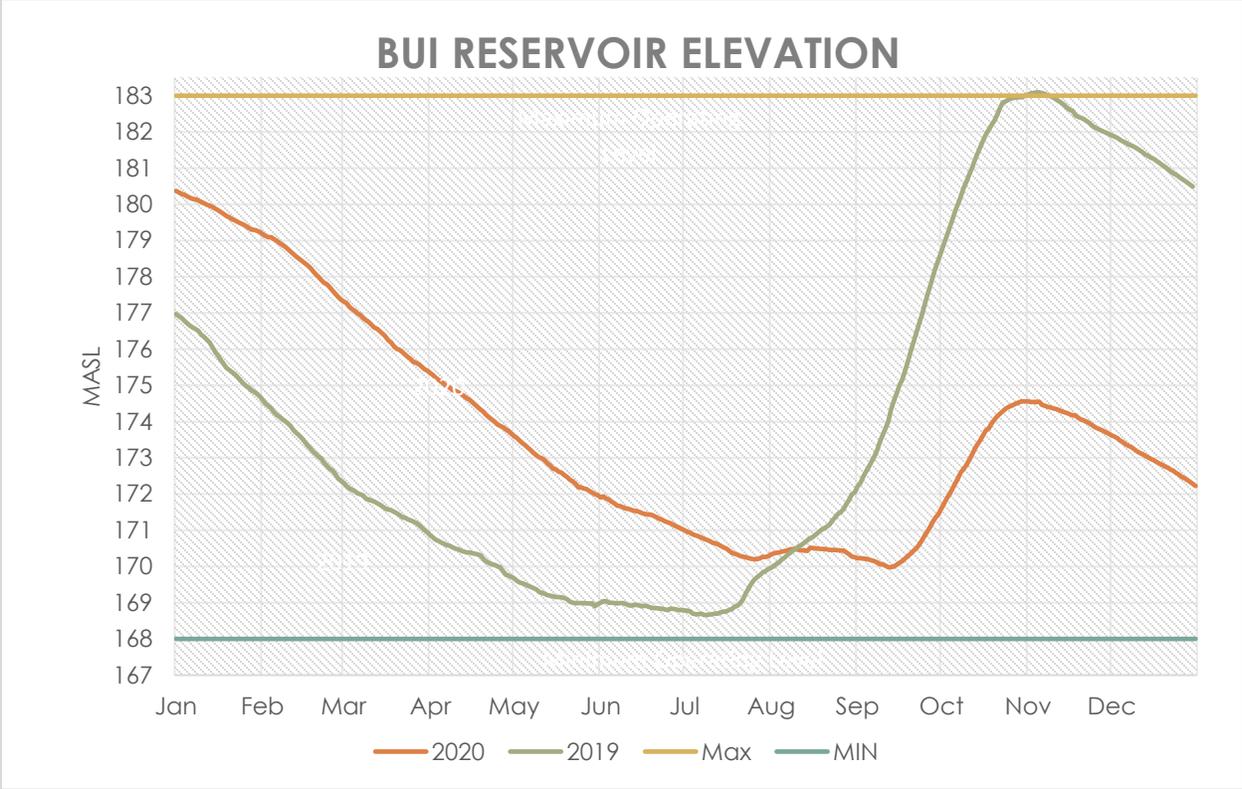


Figure 15: Bui Reservoir Elevation

Bui reservoir started the year at an elevation of 180.4 masl and dropped to 170.0 masl at the end of the dry season, thus reaching the projected minimum of 170.0 masl for the year. At the end of the inflow season, the reservoir level rose to a maximum of 174.6 masl, the lowest ever recorded since the dam was constructed. The year-end elevation was 172.2 masl.

Based on the planned mode of operations and elevations achieved, over all, hydro generation in 2020 was 7,293 GWh as against the projected generation of 7,388 GWh. This represents 0.6% decrease from hydro generation in 2019. Figure 16 presents electricity generation from the three hydropower plants (Akosombo, Kpong and Bui) in 2020.

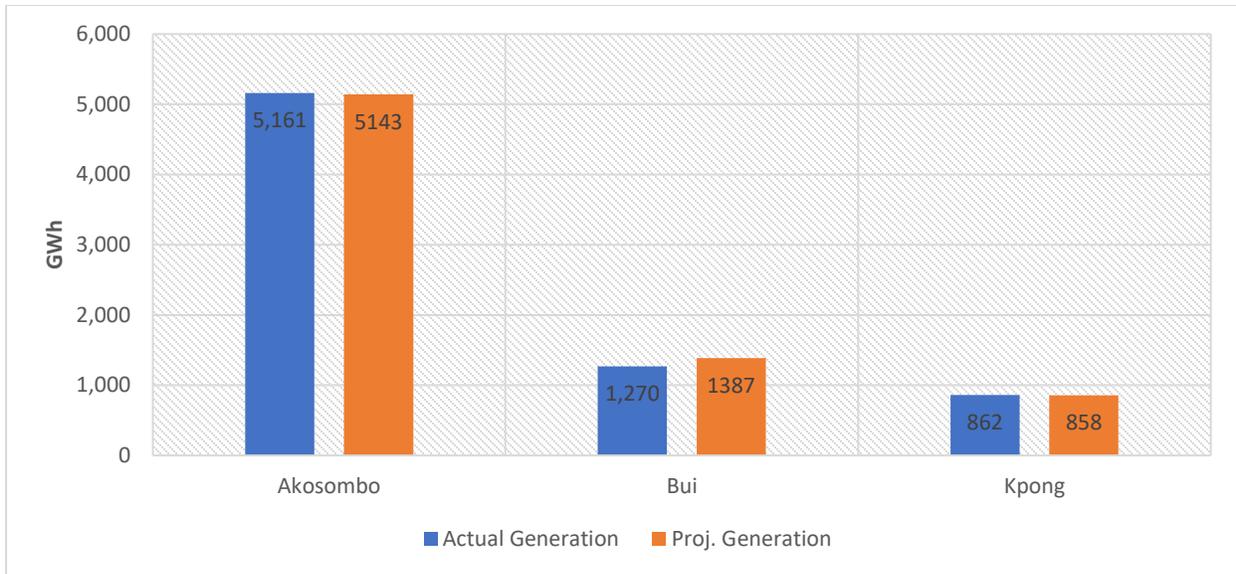


Figure 16: 2020 projected and actual hydro generation

Akosombo hydropower plant produced 5,161 GWh in 2020 as against projected supply of 5,143 GWh, representing 0.3% more than the projected. Kpong, generated 862 GWh as against a projected generation of 858 GWh. Bui hydro plant also generated 1,270 GWh compared to the projected 1,387 GWh<sup>15</sup>.

### 2.2.3.2 Thermal Sources

Total grid electricity generated from the thermal plants excluding the embedded generation was 12,365 GWh which was 1.1% more than what was projected for 2020. The generation from thermal sources was 17.7% higher than the generation in 2019. Projected and actual generation from thermal plants in 2020 are presented in Figure 17.

<sup>15</sup> 2020 Electricity Supply Plan for the Ghana Power System: A mid-year review:  
<http://energycom.gov.gh/files/2020%20Supply%20Plan%20Mid%20Year%20Review.pdf>

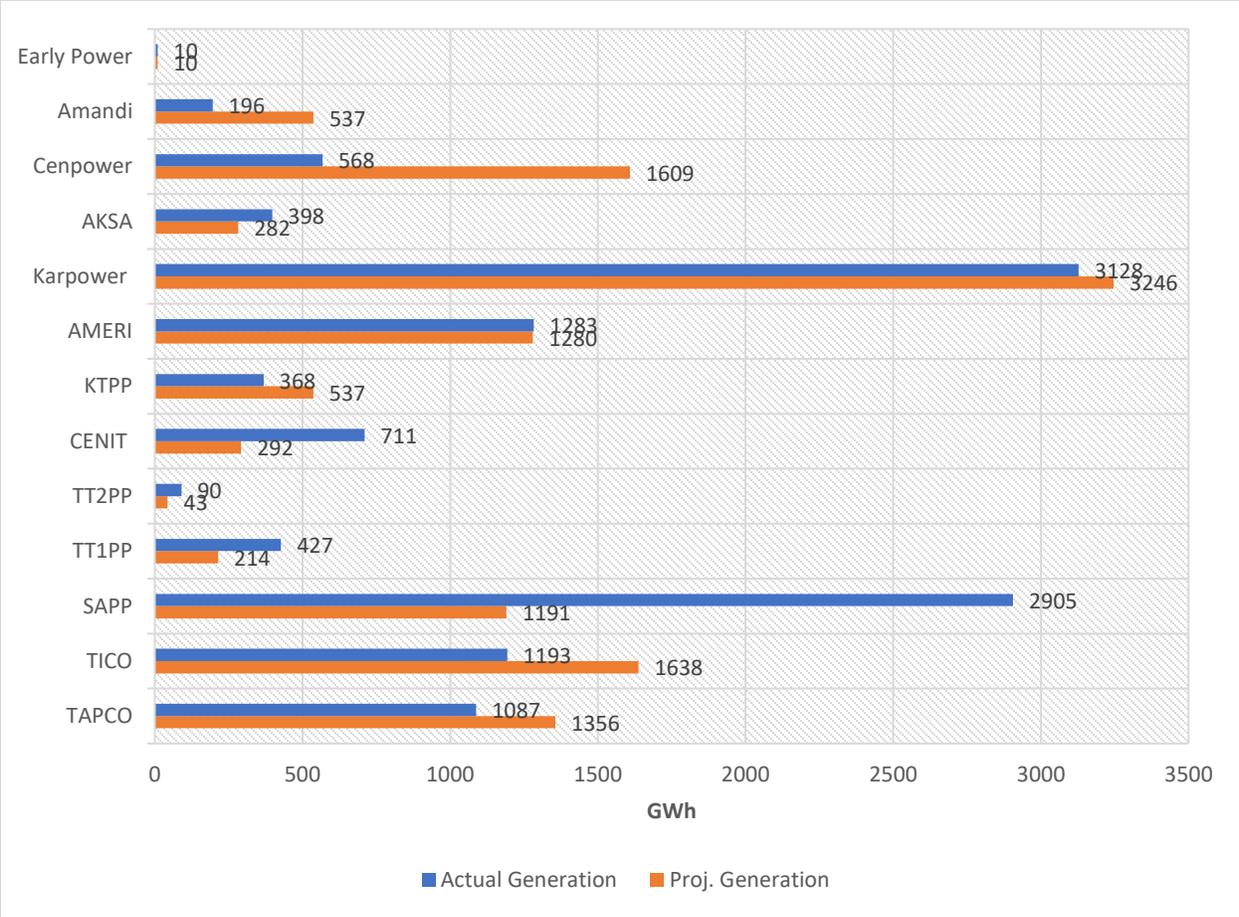


Figure 17: 2020 Projected and actual generation from thermal sources

**2.2.3.3 Embedded Generation**

Grid-tied embedded generation at the distribution level accounted for 3.5% (186.3 MW) of installed capacity and 2.4% of generation (511.95 GWh) in 2020. Renewable Energy installations increased from about 78.6 MW in 2019 to about 91.3 MW in 2020. Total grid tied Solar PV at the distribution level is 59 MWp.

**2.2.3.4 Electricity Exchange**

Electricity export to neighbouring countries witnessed an increase, rising from 1,430 GWh in 2019 to 1,855 GWh in 2020. This increase is attributed to increased exports to Burkina Faso. Out of the total electricity exported in 2020, 715 GWh was exported to Togo/Benin (CEB) as against 778 GWh exported in 2019. There was an increase in export to Burkina Faso, from 577

GWh in 2019 to 990 GWh in 2020, representing 71.6% increase. A total of 208 GWh was exchanged between Ghana and Cote d'Ivoire, made up of 58 GWh of import and 149 GWh of export.

## 2.3 Fuel Supply in 2020

### 2.3.1 Fuel Consumption

Thermal plants constitute 69.0% of total installed generation capacity in the country. The main fuels sources for the thermal plants are Natural gas, Light Crude Oil (LCO) and Heavy Fuel Oil (HFO). Up to 89% of installed thermal plants depend on natural gas as the primary fuel source due to its comparative advantage over oil in terms of indigeneity, cost and environmental friendliness. The various fuels and their quantities consumed by the thermal plants for the year 2020 are shown in Table 2.

Table 2: Fuels used by the thermal plants in 2020

Power Plant	GAS		LCO		DFO		HFO	
	MMscf		Barrels					
	Proj.	Actual	Proj.	Actual	Proj.	Actual	Proj.	Actual
TAPCO	9,955	7,811	-	-	-	-	-	-
TICO	14,410	11,663	-	41,937	-	184	-	-
AMERI	13,058	11,666	-	-	-	-	-	-
SAPP	9,030	21,030	-	-	-	-	-	-
TT1PP	1,824	4,801	-	1	-	-	-	-
CENIT	3,572	7,346	-	-	-	-	-	-
TT2PP	65	677	-	-	-	-	-	-
KARPOWER	26,405	23,646	-	-	-	-	-	534
TROJAN	-	-	-	-	-	-	-	-
KTPP	6,592	3,039	-	-	-	180,423	-	-
AKSA	-	-	-	-	-	-	212,859	564,067
CENPOWER	10,508	2,544	495,732	319,173	-	16,931	-	-
AMANDI	5,709	1,408	-	-	-	-	-	-
EARLY POWER	-	-	-	-	-	2,789	-	-
GENSER	-	-	-	-	-	-	-	-
<b>Total</b>	<b>101,126</b>	<b>95,632</b>	<b>495,732</b>	<b>361,110</b>	<b>-</b>	<b>200,327</b>	<b>212,859</b>	<b>564,601</b>

Source: GRIDCo Daily Report

Total gas supplied in 2020 for electricity production was 95,632 MMscf, 5.4% short of projected.

About 361,110 barrels of LCO was used as against 495,732 barrels projected. In addition, 200,327 barrels of diesel was used for electricity generation. About 90.1% was used for the operation of KTPP whilst 8.5% was used by Cenpower plants. The remaining, about 1.3%, went to Early Power. HFO used for the operation of AKSA plant, was above the projected 212,859 barrels reaching 564,601 barrels in 2020.

### 2.3.3 Fuel Cost in 2020

In 2020, all the prices of liquid fuels purchased for power generation were below the projected. This was due to the outbreak of the global pandemic (COVID-19), which resulted in a drastic fall in oil prices. For natural gas, both domestic and import sources assumed PURC weighted delivered gas price of \$US6.08/MMBtu throughout 2020.

Table 3: Costs due to projected and actual price of the fuels in 2020

	Gas		LCO		HFO	
	Projected	Actual	Projected	Actual	Projected	Actual
<b>Price US\$/unit</b>	6.08	6.08	60	39	84	<b>42</b>
<b>Fuel consumed</b>	654,197		361		565	
<b>Cost US\$1 000</b>	654.20	618.65	29.74	14.08	17.88	8.41
<b>Net gain US\$ million</b>	<b>35.54</b>		<b>15.66</b>		<b>9.41</b>	
<b>Total Savings</b>						<b>60.67</b>

Note - US\$/unit: **MMBtu** for gas, and **barrels** for LCO and HFO

A total amount of \$642 million was used to procure fuel for the operation of thermal power plants in the country. The total amount was 2.2% more than what was projected for the year. The total amount used for liquid fuels was 62.3% less than projected for 2020.

#### 2.3.3.1 Natural Gas Price

The price of lean gas from both domestic and import sources for power generation is a weighted average delivered cost determined by the Public Utilities Regulatory Commission (PURC). The Weighted Average Cost of Gas (WACOG) for power generation in 2020 was US\$6.08/MMBtu.

For non-power use, the price is determined on bilateral terms between GNGC and the consumer. Figure 18 shows the commodity price and service charges of gas used to determine the WACOG from four sources - Jubilee, TEN, Sankofa and N-gas for power plants that utilise natural gas.

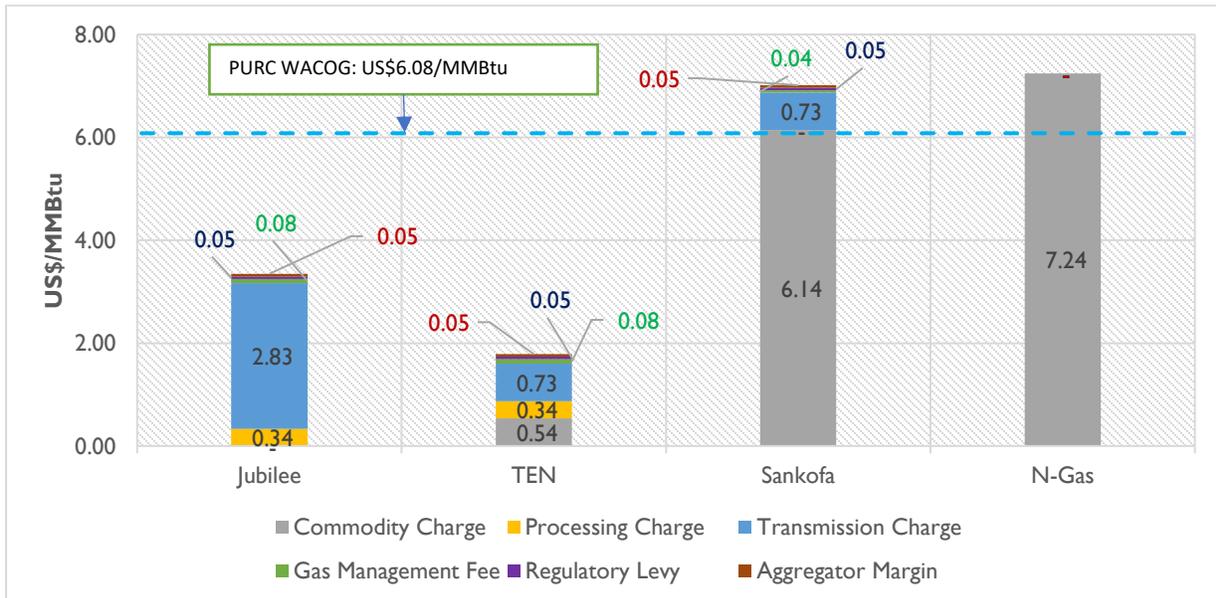


Figure 18: Commodity price and service charges of gas in Ghana

Jubilee gas has the lowest commodity charge among the sources. This is because the initial 200,000 MMscf is delivered free to the government of Ghana as part of the conditions of the petroleum agreement. Thus, PURC WACOG, based on 60,000 MMBtu (Jubilee), 15,000 MMBtu (TEN), 170,000 MMBtu (Sankofa) and 60,000 MMBtu (N-Gas) was US\$6.08/MMBtu effective 1<sup>st</sup> July 2019.

## Chapter Three: 2021 Electricity Outlook

### 3.0 Introduction

---

This chapter presents 2021 electricity demand and supply outlook for Ghana. Section 3.1 presents electricity demand outlook (both peak and energy demand), Electricity supply outlook and fuel supply outlook are presented in Sections 3.2 and 3.3 respectively. The transmission outlook is presented in Section 3.4. A discussion on the anticipated challenges to electricity supply for the year is presented in section 3.5.

### 3.1 Electricity Demand Outlook

---

The real GDP growth rate as at quarter three of 2020 was 0.2% (0.4% *non-oil*), a drastic contraction from the 6.5% (5.2% *non-oil*) recorded for the same period in 2019. The contraction was due to the outbreak of Covid-19 pandemic<sup>16</sup>. For 2021, Ghana's overall real GDP growth is projected to expand by 5.0% (6.7% *non-oil*)<sup>17</sup>. Based on the projected real GDP growth rate, electricity demand outlook for the country is as follows:

#### 3.1.1 Projected Peak Demand for 2021

Ghana's system peak in 2021 is forecast to be about 3,304 MW. This represents an increase of 6.9% over 2020 actual peak demand of 3,090 MW and is expected to occur in December 2021. Figure 19 presents the monthly projected peak demand for 2021. The contribution of the various customer classes to the projected system peak demand is also presented in Figure 20.

---

<sup>16</sup> Ghana Statistical Service: Rebased Quarterly Gross Domestic Product 2013Q1-2020Q3

<sup>17</sup> The Budget Statement and Economic Policy of the Government of Ghana for the 2021 Financial Year  
[https://mofep.gov.gh/sites/default/files/budget-statements/2021-Budget-Statement\\_v1.pdf](https://mofep.gov.gh/sites/default/files/budget-statements/2021-Budget-Statement_v1.pdf)

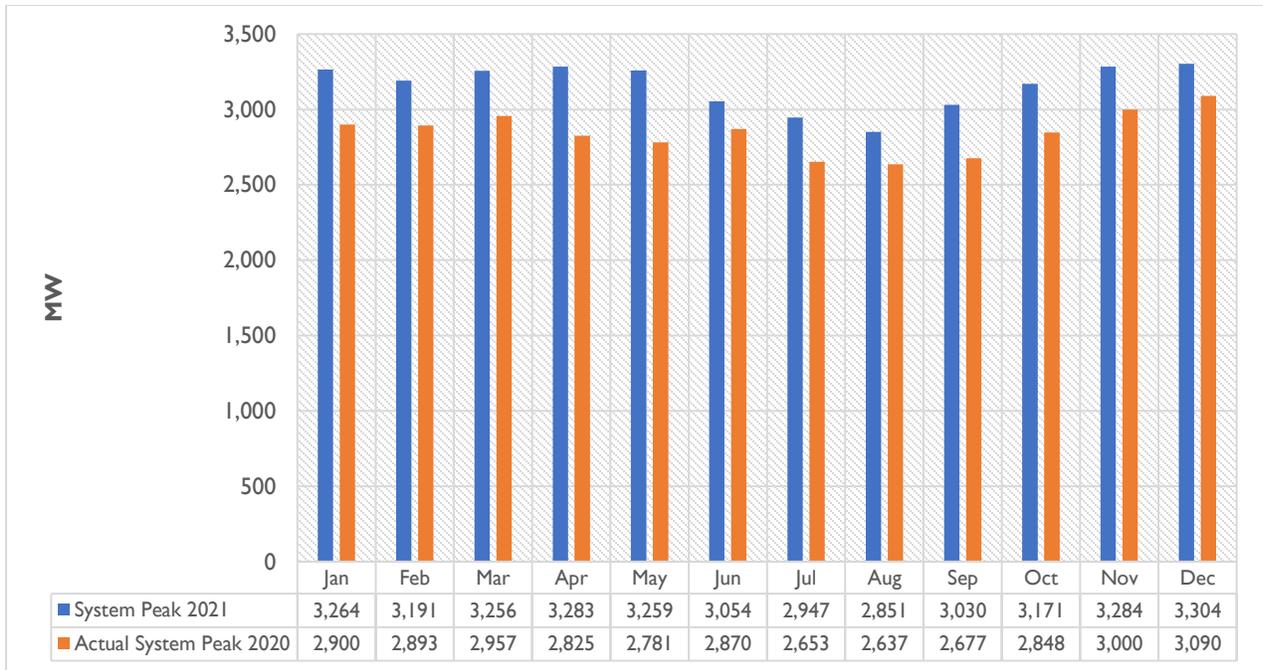


Figure 19: Monthly projected peak demand for 2021

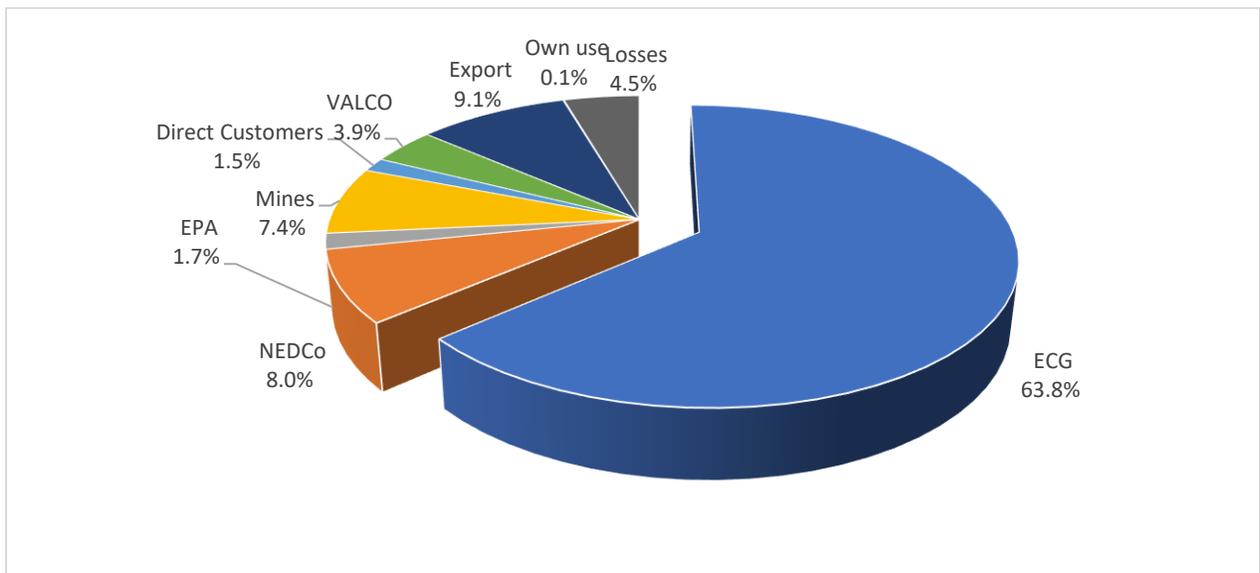


Figure 20: Share of projected peak demand by customer class

ECG is expected to contribute 63.8% to the system peak in 2021 followed by export (to Togo/Benin, Côte d'Ivoire and SONABEL) contributing 9.1%. NEDCo and the Mines are expected to contribute 8.0% and 7.4% respectively to system peak in 2021. VALCO operating on two pot-lines is expected to contribute 3.9% of the system peak demand whilst other direct

customers and transmission losses will contribute 1.5% and 4.5% of system peak in 2021 respectively.

### 3.1.2 Projected Energy Consumption for 2021

In 2021, 21,266 GWh (including transmission network losses and usage of 1,091 GWh), is projected to be consumed. The estimated transmission losses and network use, represents 5.1% of total projected energy consumption. The projected 2021 energy consumption represents an increase of 7.8%, over the 2020 consumption of 19,717 GWh. The expected monthly energy consumption for 2021 is presented in Figure 21.

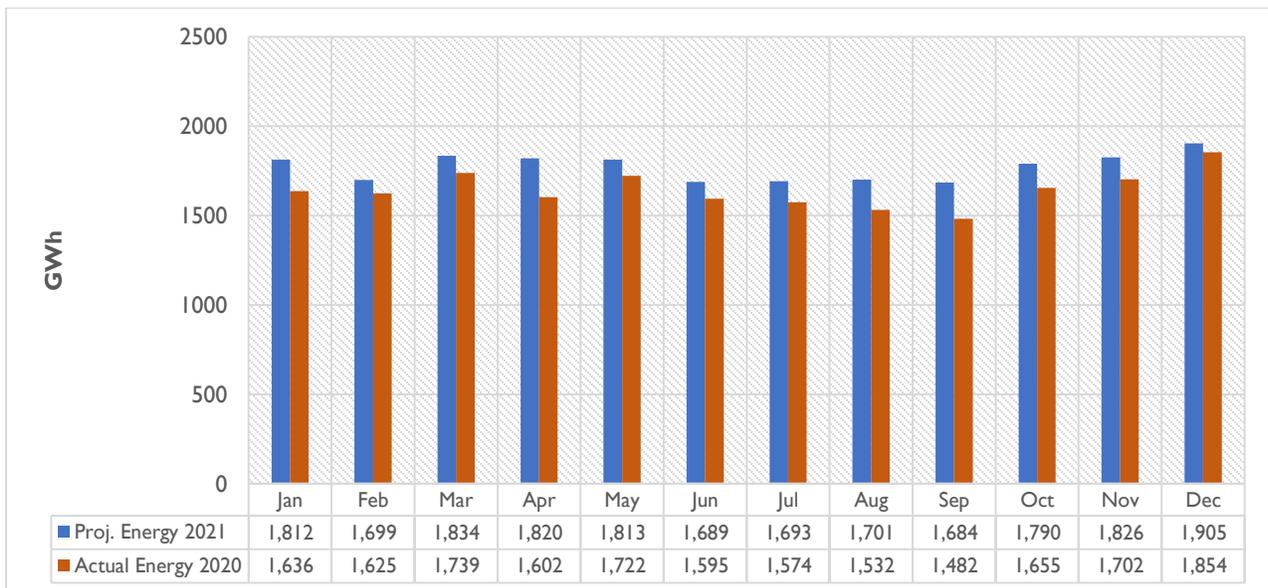


Figure 21: Projected monthly energy consumption for 2021

ECG is projected to consume 13,583 GWh of electricity, representing 63.9% of total projected energy consumption for 2021. Mines and NEDCo are projected to consume 1,846 GWh and 1,612 GWh of electricity respectively, representing 8.7% and 7.6% of total consumption respectively. Export (to Togo/Benin, Côte d'Ivoire and SONABEL) will constitute 7.2%, of total consumption, whilst VALCO operating on two pot-lines will use 5.0% of projected total electricity consumption in 2021. Energy losses are expected to constitute 5.1%, of total projected electricity supply, which is more than the PURC benchmark of 4.1%. The share of projected consumption by the various customer classes is presented in Figure 22.

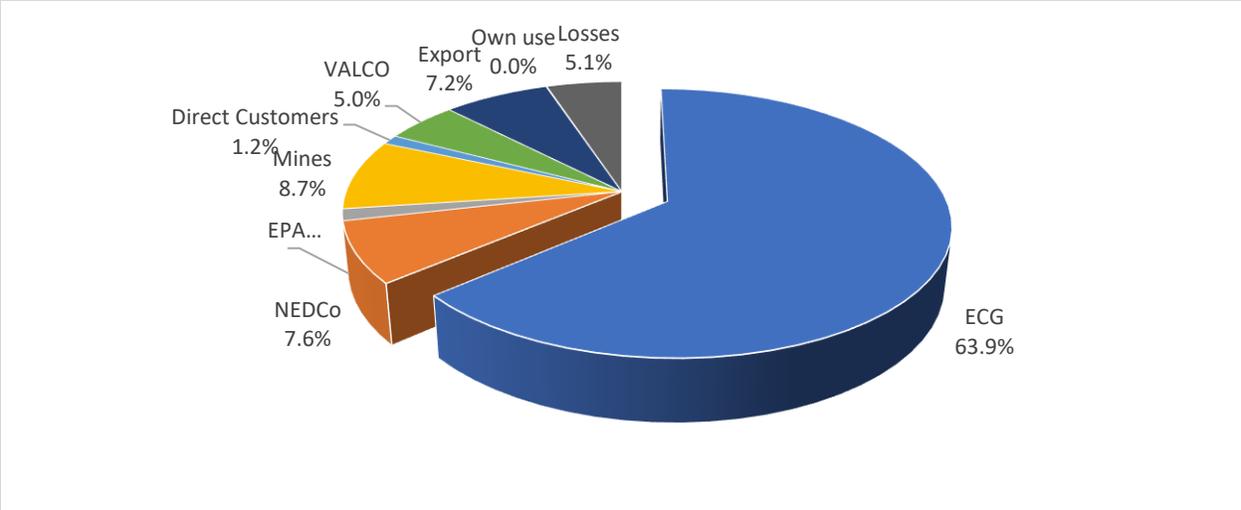


Figure 22: Share of projected energy consumption by the various customer classes

### 3.2 Electricity Supply Outlook

#### 3.2.1 Generation Sources for 2021

Existing and committed power plants (plants expected to come on line during the year) considered for the electricity supply outlook for 2021 are presented in Table 4. Generation from thermal sources will constitute 68.5% of total electricity to be generated in 2021.

The 203 MW Amandi Thermal Power Plant located in Takoradi which was completed and undergoing test-runs since 2019 is expected to fully come online in January 2021. In addition, a 144 MW Early Power plant is expected to be commissioned by end of first quarter 2021.

Table 4: Existing and committed power plants for 2021

Power Plant	Fuel Type	Installed Capacity (Nameplate)	% Share	Dependable Capacity	
<b>Hydro Power Plants</b>					
Akosombo	Hydro	1,020		900	
Bui	Hydro	400		360	
Kpong	Hydro	160		140	
<b>Sub-total</b>		<b>1,580</b>	<b>30.8</b>	<b>1,400</b>	
<b>Thermal Power Plants</b>					
Takoradi Power Company (TAPCO)	Oil/NG	330		300	
Takoradi International Company (TICO)	Oil/NG	340		320	
Sunon–Asogli Power (SAPP)	NG	560		520	
Tema Thermal Plant I (TT1P)	Oil/NG	110		100	
Tema Thermal Plant 2 (TT2P)	Oil/NG	87		70	
CENIT Energy Ltd (CEL)	Oil/NG	110		100	
KTPP	Oil	220		200	
AMERI	NG	250		230	
Karpower (power rental)	HFO	470		450	
AKSA	HFO	370		350	
Cenpower	Oil/DFO	360		340	
Amandi*	Oil/NG	203		190	
Early Power*	Gas/LPG	144		140	
<b>Sub-total</b>		<b>3,554</b>		<b>69.2</b>	<b>3,310</b>
Genser	NG/LPG	95			85
<b>Sub – total (incl. embedded gen.)</b>		<b>3,649</b>	<b>68.5</b>	<b>3,395</b>	
<b>Renewables (excl. large hydro)</b>					
VRA Solar (Navrongo)	Solar	2.5		2	
Meinergy Solar	Solar	20		16	
BXC Solar	Solar	20		16	
VRA Solar (Lawra)	Solar	6.5		4.5	
Tsatsadu Hydro	Hydro	0.045		0.045	
Bui Solar	Solar	50		45	
Safisana Biogas	Biogas	0.1		0.1	
<b>Sub – total</b>		<b>99.145</b>		<b>1.9</b>	<b>83.645</b>
<b>Total (incl embedded gen.)</b>		<b>5,328.1</b>		<b>4,878.6</b>	
<b>Total (excl embedded gen.)</b>		<b>5,134.0</b>		<b>4,710.0</b>	

\*Completed and undergoing test-run for commissioning sometime in 2021

### 3.2.2 Generation Capacity and Projected Peak Demand

There is significant excess capacity in the country’s power system. This excess capacity is expected to continue into the mid-2020s as the power plants currently under construction are being commissioned<sup>18</sup>. The expected dependable capacity for 2021 is 4,879 MW. With a projected peak demand of 3,304 MW and considering 18% (595 MW) reserve margin, the excess capacity in the system will be 1,030 MW, representing 20.9% of projected dependable capacity. Figure 23 juxtaposes the available capacity to projected peak demand for 2021.

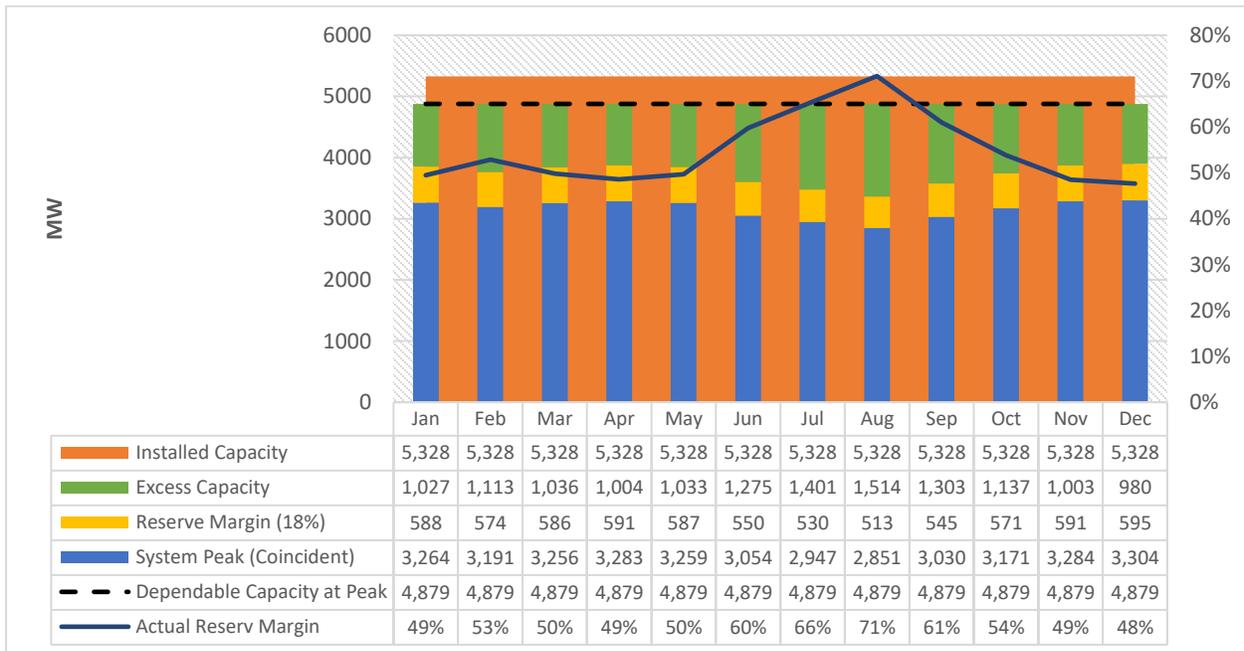


Figure 23: Capacities and System Peak demand for 2021

Projected monthly dependable capacities, taking planned units’ maintenance and fuel supply situation into consideration are shown in Figure 24.

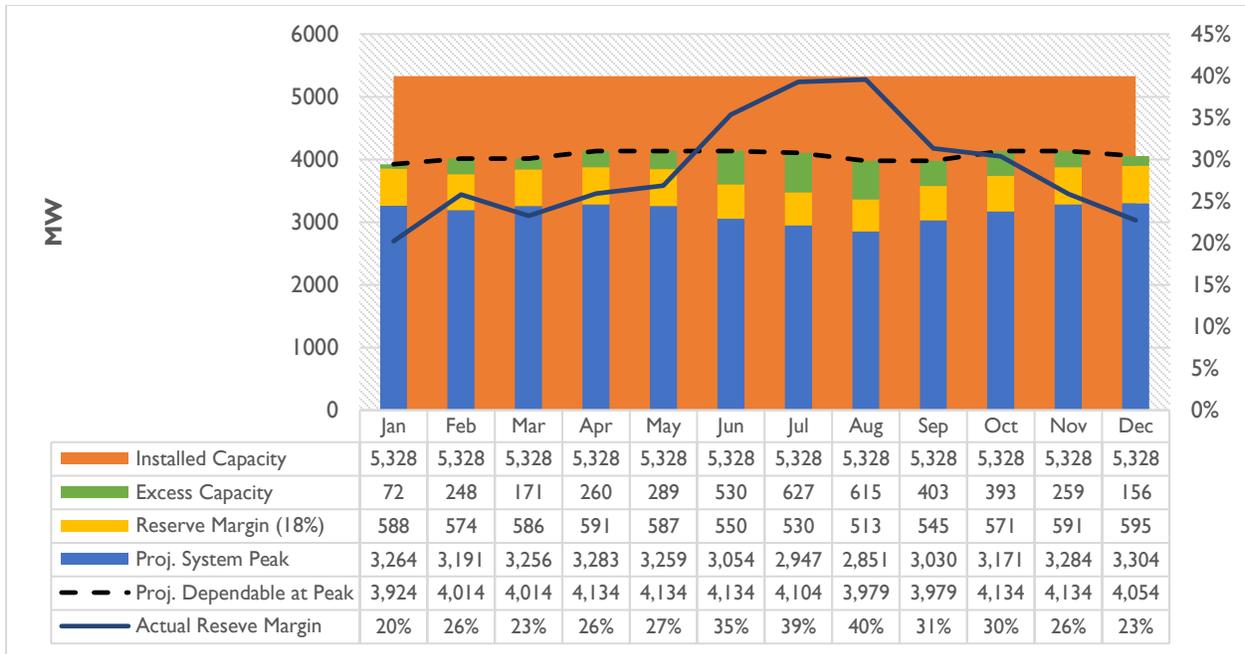


Figure 24: Projected monthly capacity versus system peak for 2021

With about 40% of actual reserve margin, capacity challenges are therefore not anticipated. Some power plants may not be dispatched whilst others may be forced to operate below their available capacities.

### 3.2.3 Generation Sources Availability in 2021

#### 3.2.3.1 Hydro Generation Sources

Akosombo hydropower plant is expected to have a maintenance schedule that will make available maximum of five units throughout 2021. This will result in operating capacity of up to 750 MW.

Figure 25 presents projected Akosombo reservoir trajectory for 2021.

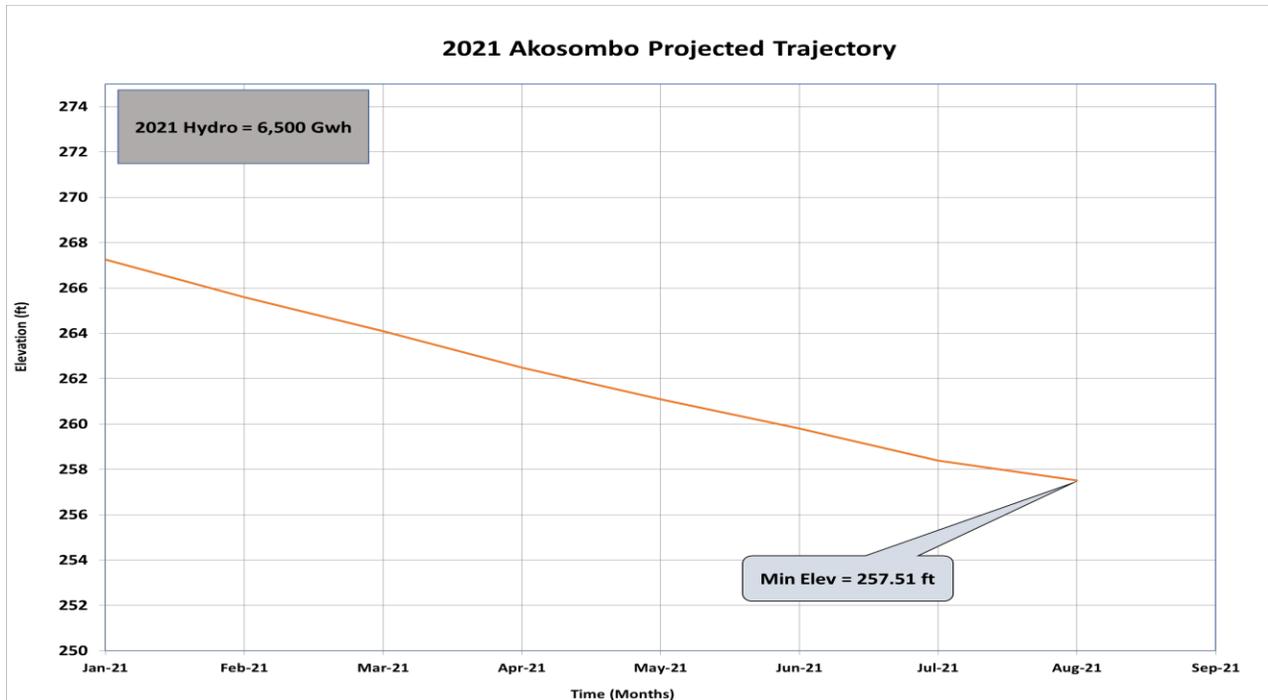


Figure 25: Akosombo reservoir trajectory for 2021

The elevation at Akosombo at the beginning of the year was 267.7 ft (81.6 m). With the foregoing mode of operation, elevation is expected to drop by about 10.2 ft (3.1m). This will result in a projected minimum elevation of 257.5 ft (78.5 m) at the end of August 2021. The Kpong hydro power plant will have all four units available in 2021, with a total capacity of 140 MW.

In 2021, Bui hydropower plant is projected to operate an average of two units throughout the year. The plant is expected to supply an average generation capacity of 220 MW to support demand. Bui reservoir trajectory for 2021 is presented in Figure 26.

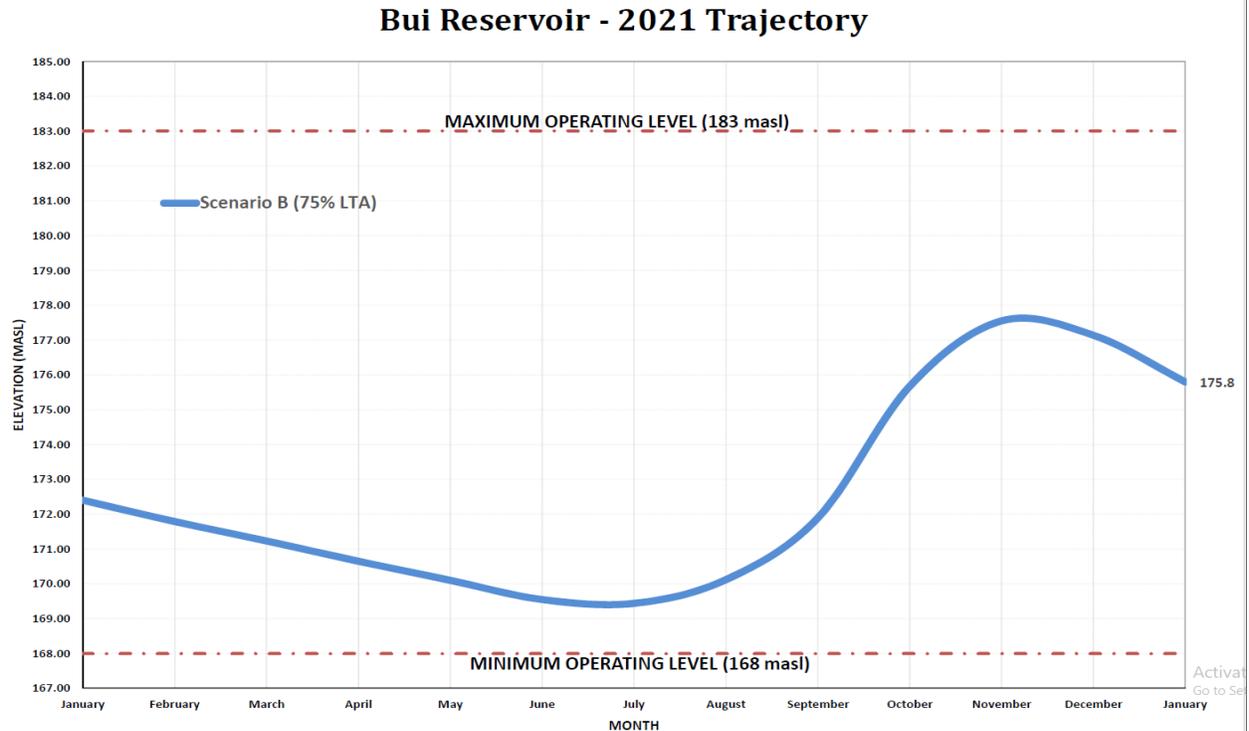


Figure 26: Bui reservoir trajectory

As a result of low inflows into the Bui reservoir in 2020, the reservoir level is very low, with 2021 year-start elevation of 172.4 masl. With this year-start elevation, the year-end elevation is projected at 178.0 masl. It is estimated that, for continuous and sustainable operation of the Bui hydro plant for 2021, the reservoir level at the end of the dry season in 2021 should not drop below elevation 170.0 masl. Assuming 75% (4,625 Mm<sup>3</sup>) inflow (long term average inflow is 6,167 Mm<sup>3</sup>), Bui is expected to generate up to 501 GWh in 2021.

### 3.2.3.2 Thermal Generation Sources

Total dependable capacity for existing thermal plants is 3,105 MW. In addition, a total of 347 MW (203 MW Amandi Power Plant and 144 MW Bridge Power) thermal capacity is expected to be commissioned by the end of March 2021. These plants are currently undergoing test-runs. The Amandi plant is designed to operate on LCO and natural gas and is sited within the Western enclave of the power system. The Early Power plant, on the other hand, is designed to operate on LPG and natural gas and sited within the Eastern enclave.

### **3.2.3.3 Renewable Generation Sources**

VRA is expected to increase the installed capacity of the Kaleo/Lawra solar power plant from 6.5 MWp to 17 MWp from April 2021. Also, BPA is projected to dispatch 10 MWp from the Bui Solar PV farm beginning January 1, 2021. The capacity is expected to increase to 50 MWp by the end of March 2021. Generation is also expected from the 20 MW BXC solar plant and the 20 MW Meinergy solar power, 2.5 MW Navrongo solar plant and the 0.1 MW Safisana Biomass plant.

### **3.2.3.4 Electricity Exchange**

Power import in 2021 is not anticipated. However, inadvertent energy exchanges on tie-lines could result from transient flows. Emergency imports may be necessitated as a result of short-term capacity shortages caused by faults or fuel supply contingencies. On the other hand, electricity export to neighbouring countries would be 1,527 GWh in 2021.

## **3.2.4 Demand-Supply Balance for 2021**

The criteria to be used to determine which power plants would be dispatched on a monthly basis during the year are as follows:

- i. Merit order dispatch
- ii. Availability of fuel per plant
- iii. Must-run plants/take-or-pay plants
- iv. Variable or intermittent systems like the grid-tied solar plants
- v. System stability requirements
- vi. PURC and EMOP energy allocation for the year
- vii. Bilateral Agreements between customers who are outside ECG Market such as VALCO, Enclave Power Company Ltd., Mines, NEDCo, Industrial Loads, etc.

It should be noted that in instances where there is supply surplus, some plants would not be dispatched. The electricity demand-supply balance for 2021 is presented in Table 5.

Table 5: 2021 Projected electricity demand/supply balance, GWh

<b>Customer Class</b>	<b>Demand/Supply</b>
Domestic	18,683.1
VALCO	1,055.1
Export (CEB+CIE+SONABEL)	1,527.3
<b>Total Energy Requirement</b>	<b>21,265.5</b>
<b>Projected Generation</b>	
Akosombo	5,650.0
Kpong	850.0
Bui	501.2
<b>Sub-total</b>	<b>7,001.2</b>
TAPCO	1,972.7
TICO	2,085.1
TTIPP	353.3
KTPP	369.2
TT2PP	111.7
AMERI Power Plant	795.0
SAPP	2,166.6
CENIT	525.8
Karpower Barge	3,107.6
AKSA	121.2
CEN Power	1,259.6
Amandi	1,119.0
Early Power	125.2
<b>Sub-total</b>	<b>14,112.0</b>
<b>Renewable</b>	
VRA Solar (Navrongo)	3.0
VRA Solar (Kaleo/Lawra)	26.6
Bui Solar	68.0
BxC Solar	27.0
Safisana	0.7
Meinergy Solar	27.0
<b>Sub-total</b>	<b>152.3</b>
<b>Grand Total</b>	<b>21,265.5</b>

Hydro generation for 2021 is expected to be 7,001 GWh, down from 7,293 GWh in 2020. The reduced generation is as a result of anticipated reduction in generation from Bui hydro plant. A greater portion of electricity generation would therefore come from thermal sources. Total generation from thermal is projected to be 14,112 GWh, an increase of 14.1% over 2020 generation. With the coming on stream of VRA Kaleo/Lawra solar and Bui solar, generation from renewable sources is expected to be 152.3 GWh, in 2021 up from 55 GWh in 2020. Figure 27 shows the share of generation from the various sources.

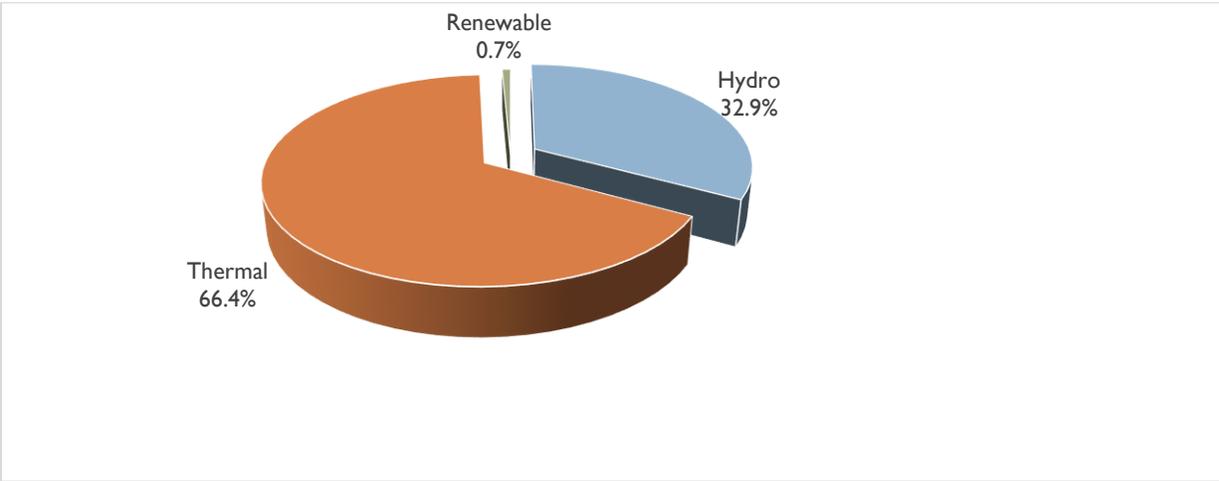


Figure 27: Share of electricity supply by generation type for 2021

Thermal generation would constitute 66.4% of total generation in 2021, whilst hydro generation would contribute 32.9%. Generation from renewable sources (solar PV and Biogas) would constitute 0.7% of total electricity generation in 2021. The bulk of the 2021 electricity generation coming from thermal sources may have serious implication for the power sub-sector for the following reasons:

- i. It will adversely impact the finances of power utilities, since local tariffs are cedi denominated and if the cedi becomes relatively unstable during the year.
- ii. Any prolong disruptions in gas supply would have dire consequences on the power supply situation in the country in terms of reliability of supply and on generation costs since gas price is on the average cheaper than liquid fuels.

### 3.3 Fuel Supply Outlook

#### 3.3.1 Fuel Requirements

Natural gas would be the dominant fuel for thermal plants in 2021. It is expected to come from two sources; import through WAGP and Tema LNG, and indigenous gas from Jubilee, TEN and ENI Sankofa fields. Figure 28 shows the expected natural gas flowrates from the various sources for power generation.

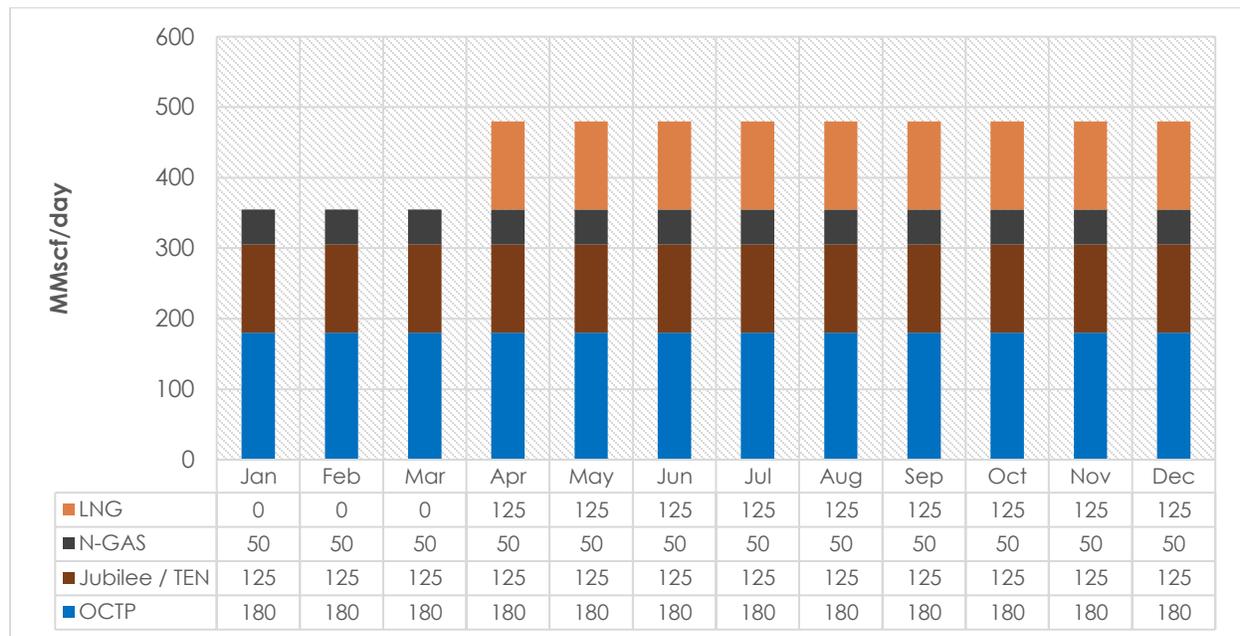


Figure 28: Natural gas flowrates for thermal power plants in 2021

Gas supply from Sankofa field is expected to be 180 MMscf/day, whilst Jubilee and TEN combined is expected to supply 125 MMscf/day. Import from Nigeria through the WAGP is expected to be about 50 MMscf/day. Natural gas supply is expected to be bolstered by additional 125 MMscf/day from the Tema LNG Project. This project is expected to be operational from April 2021. A maximum total of 480 MMscf/day quantity of gas is expected in 2021. Fuel allocation to the various power plants operating at full capacity is presented in Table 6<sup>19</sup>.

<sup>19</sup> It is worth noting that, depending on the output of the power plant and ambient conditions the fuel usage could be less.

Table 6: Natural gas and liquid fuel allocation to thermal power plants at full capacity

Plant	Natural Gas (MMScf/day)
TAPCO	60
TICO	60
TTIPP	30
KTPP	18
TT2PP	55
AMERI	90
Karpower	50
SAPP	30
CENIT	35
AMANDI	60
CENPOWER	-
AKSA	488
<b>Total</b>	

Based on the assumed gas supply from domestic and import sources, the total natural gas consumption for 2021 is projected to be about 123.9 TBtu. Total fuel requirement for each thermal plant is shown in Figure 29.

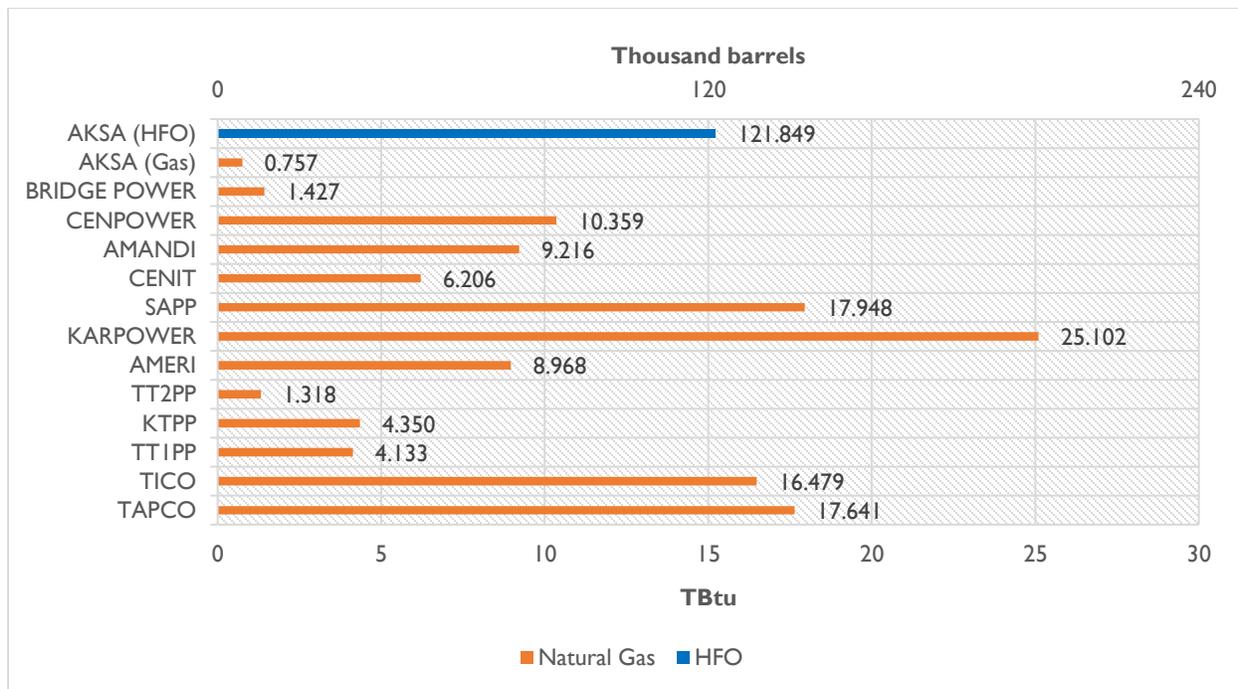


Figure 29: Thermal plants fuel requirements for 2021

AKSA will run on heavy fuel oil (HFO) till June 2021, when it is expected to switch to natural gas. An estimated 121,849 barrels of HFO will be required by AKSA for the period January to June 2021 (Figure 30). The AKSA plant is expected to switch to natural gas starting July 2021. Light crude oil (LCO) and diesel would be used as backup fuels for some plants. The stock of LCO and diesel for power generation at the beginning of January 2021 were 350,833 barrels, and 86,202 barrels respectively. Monthly fuel requirements are presented in Figure 30.

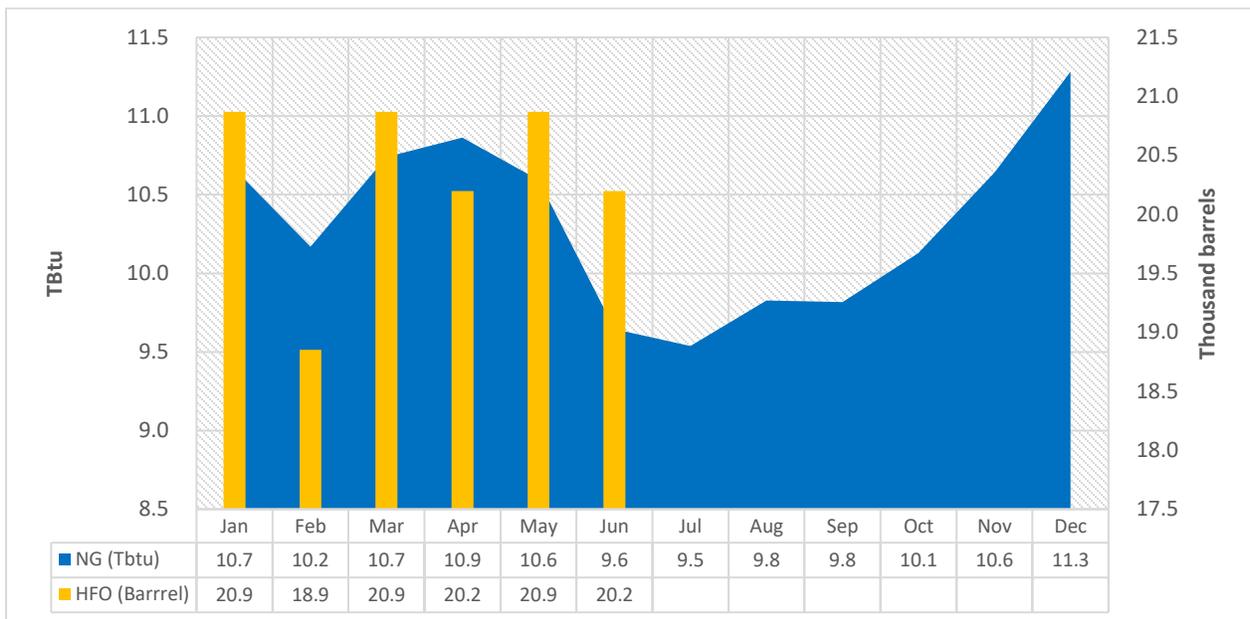


Figure 30: Monthly projected fuel requirements

### 3.3.2 Fuel Price and Cost

Assuming the weighted average price of lean gas for both domestic and import (N-gas and LNG) sources remains at \$6.08/MMBtu<sup>20</sup>, about \$750.33 million would be needed for gas procurement in 2021 (Table 7). With an estimated delivery price of \$45/barrels, an amount of \$5.46 million will be required to procure HFO to run the AKSA power plant from January-June 2021. Overall, about \$755.79 million would be needed to procure fuel to run thermal plants in 2021.

<sup>20</sup> Published by the Public Utility Regulatory Authority (PURC)

Table 7: Expected average delivery fuel prices for the thermal plants for 2021

Fuel Type	Average Delivery Price		Total Coast
	US\$/MMBtu	US\$/barrel	(US\$) million
Natural Gas	6.08	-	750.33
HFO	-	45	5.46
<b>Total</b>			<b>755.79</b>

### 3.4 Transmission Outlook

#### 3.4.1 Overview of Transmission System

The National Interconnected Transmission System (NITS) increased from approximately 6,472.2 circuit kilometers (km) at the end of 2019 to 7,200.5 circuit km as at the end of 2020. It connects all the major generation plants to sixty-five (65) Bulk Supply Points across the nation. electricity transmission is done at three main voltage levels; 69 kV, 161 kV and 330 kV. There is also a 74 km of 225 kV voltage level transmission that facilitates interconnection with Ghana's western neighbour Cote d'Ivoire and northern neighbour Burkina Faso. There is also an interconnection with Togo through two 161 kV lines and a 330 kV line. The network total transformer capacity was 8,901.8 MVA as at end of 2020.

#### 3.4.2 Transmission Line Feeder and Substation Availability in 2021

The criteria used for ensuring high transmission Line, Feeder and Substation availability are as follow:

- All existing transmission lines are expected to be in service in 2021 to ensure transmission of electricity from the generation stations to the Bulk Supply Points across the nation and to enable the execution of power exchanges with neighbouring countries.
- Maintenance work on transmission lines and substations is to be organised in order not to significantly affect power supply to customers except for single transformer substations and consumers served on radial lines.

The following are some transmission lines and substations that are expected to be commissioned into services in the second half of 2021 to help boost power evacuation.

- 330 kV, Anwomaso – Kintampo Transmission line Project.
- 161 kV, Volta – Accra East – Achimota line reconstruction
- 161kV Achimota – Mallam line reconstruction
- 330/161/34.5 kV Pokuase Substation project.

Maintenance work on transmission lines and substations are not expected to significantly affect power supply to customers except for single transformer substations and consumers served on single radial lines. Most transformers in operation on the NITS are designed with a capability of 100% continuous loading and Transformer Utilization Factor (TUF). Indications from GRIDCo therefore, suggests that there is adequate transformer capacity on the NITS for the supply of power under normal operating conditions.

### **3.5 Electricity Supply Challenges in 2021**

---

#### **3.5.1 Fuel Supply Challenges**

##### Hydro Fuel Risk

Even though there are high prospects for rainfall this year, it would still be prudent to continue the conservative dispatch of the hydro plants to ensure that the reservoirs are not drawn down below their minimum operating levels to guarantee sustainable operations in the coming years. The availability and reliability of the thermal units are also very key to maintain the planned hydro draft rate.

##### Thermal Fuel Risk

Gas supply reliability from domestic and import sources remains a major risk to the country's electricity supply reliability. Although there is high installed generating capacity, gas supply sustainability remains one of the major risks to reliable electricity supply in Ghana. Any disruptions in fuel supply, mostly gas, would render some thermal plants inoperable, which will negatively impact supply reliability.

The most critical outage scheduled in 2021 is a planned shutdown of the Takoradi Distribution Station (TDS) and pipeline for maintenance works in mid-April 2021. Also, WAPCo plans to

undertake one (1) pigging exercise of the WAGP to inspect and clean three (3) lateral lines at Cotonou (Benin), Lomé (Togo) and Tema (Ghana). The WAPCo maintenance is scheduled to coincide with the TDS maintenance.

Lastly, maintenance activities on gas importing facilities in Nigeria are expected to be undertaken in the third (3rd) quarter and involve a two (2) day shutdown at Itoki Station and a five (5) day pigging operation on the Itoki to Lagos Beach stretch of the pipeline.

Any disruption can be averted by securing alternative fuels supply for the power plants to make up for any shortfall in gas supply within the period.

### **3.5.2 Transmission Challenges**

Insufficient reactive power compensation in some portion of the transmission network could lead to poor customer supply voltage in areas such as Kumasi, Accra and some parts of the Western region. Due to project financing issues, work on the 330kV Anwomaso – Kintampo transmission line and 161kV Volta – Achimota – Mallam corridor upgrade projects have delayed, but work is expected to resume in 2021.

The 330kV Anwoamso – Kintampo line is the remaining section of the 330kV Central Transmission Backbone infrastructure. This project is to enable the NITS improve system stability whilst exporting at least 100MW power to Burkina. Due to the delays in delivering the project, the 161kV Anwwomaso –Kumasi line is experiencing high loading contributing to system losses. Any contingency on the line will create severe system disturbances which may collapse the power system. GRIDCo must get the necessary support from Government and African Development Bank (AfDB) to complete this section of the line.

The 161kV Volta-Achimota-Mallam Corridor is the most heavily loaded corridor on the Ghana grid, supplying power to the Capital and surrounding towns. It is made up of light capacity conductors which are at least 50 years old. In 2018 GRIDCo secured funds to replace all the towers and transmission lines with high-capacity conductors. The project has stopped due to project management issues and non-disbursement from AfDB. As the demand for power increases in 2020, any line contingency on the corridor will mean severe load curtailment to

Accra. It is of utmost importance all efforts be harnessed to complete the project to avoid any load shedding to the Capital in 2020.

Also, supply reliability to customers served via single circuit radial lines is quite low. This is because an outage on such single circuit radial lines interrupts supply to such customers. Some of the single circuit radial lines on the NITS are the: Tamale–Yendi, Takoradi–Esiama; Dunkwa–Asawinso; Bogoso–Akyempim; Bolga- Zebilla; Zebila–Bawku lines, etc. Supply reliability to customers served on these lines would improve in future when such lines are upgraded through the construction of additional line(s) or by looping them into other adjoining substations.

Similar to single circuit radial lines, consumers supplied by single transformer substations also suffer low level of supply reliability. Maintenance and/or upgrade works at these stations are often a challenge due to difficulties in securing outages to carry out planned maintenance works. Such townships supplied via single transformer stations are Yendi, Sogakope, Esiama, Akosombo Township, VRA Township at Akuse, etc.

# Chapter Four: 2020 Petroleum Sub-sector Performance Review

## 4.0 Introduction

This chapter presents a review of the Petroleum Sub-sector performance in 2020 with particular focus on assessing the impact of COVID-19 on the sub-sector. Section 1.1 presents a review of crude oil production, import, export and prices. This is followed in Section 1.2 with a review of natural gas production, import and export. Lastly, Section 1.3 presents a review of petroleum products refinery, import, export, consumption and prices.

## 4.1 Crude Oil

### 4.1.1 Crude Oil Production

Crude oil production continues to be exploited from three fields – Jubilee, Tweneboa Enyenra Ntomme (TEN) and Sankofa Gye Nyame fields (hereafter refers to as Sankofa field). Jubilee field was the first to come online with first oil in December 2010, while TEN and Sankofa commenced production in August 2016 and May 2017 respectively. As shown in Figure 31, crude oil production continues to increase since 2016 with the coming on stream of TEN and Sankofa fields.

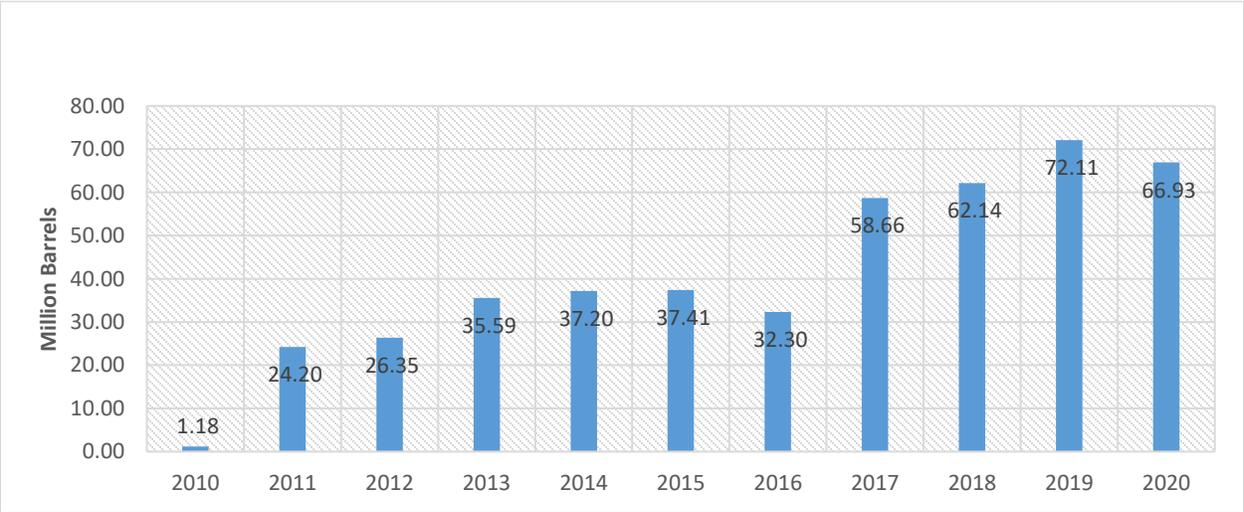


Figure 31: Crude oil production from 2010 to 2020

Source: Petroleum Commission

Oil production suffered a setback as a result of the global oil price crash, mainly caused by the COVID-19 pandemic.

Total volume of crude oil produced from the three commercial fields - Jubilee, TEN and Sankofa in 2020 was 66.93 million barrels, down from 72.11 million barrels in 2019. The decrease in production in 2020 resulted from reduced production on the Jubilee and TEN Fields. Table 8 shows the monthly production of crude oil from the three fields in 2020.

Table 8: Monthly crude oil production in 2020, million barrels

Month	Jubilee	TEN	Sankofa	Total Production
<b>Jan</b>	1.98	1.62	1.71	<b>5.31</b>
<b>Feb</b>	2.49	1.50	1.57	<b>5.56</b>
<b>Mar</b>	2.73	1.59	1.66	<b>5.98</b>
<b>Apr</b>	2.66	1.54	1.57	<b>5.78</b>
<b>May</b>	2.81	1.55	1.56	<b>5.93</b>
<b>Jun</b>	2.72	1.47	1.48	<b>5.67</b>
<b>Jul</b>	2.76	1.48	1.47	<b>5.71</b>
<b>Aug</b>	2.79	1.56	1.59	<b>5.94</b>
<b>Sep</b>	2.52	1.52	1.51	<b>5.55</b>
<b>Oct</b>	2.47	1.43	1.56	<b>5.46</b>
<b>Nov</b>	2.28	1.29	1.48	<b>5.05</b>
<b>Dec</b>	2.20	1.26	1.52	<b>4.98</b>
<b>Total</b>	<b>30.42</b>	<b>17.80</b>	<b>18.70</b>	<b>66.93</b>

Source: Petroleum Commission (PC)

In 2020, 30.42 million barrels of crude oil was produced from the Jubilee field, down from 32.58 million barrels in 2019. The Jubilee field recorded its lowest production in January 2020, which was attributed to a planned shutdown from 24<sup>th</sup>-31<sup>st</sup> January 2020 to execute a Wet Fuel Gas project. The project was to increase gas throughput capacity on the Floating Production Storage and Offloading (FPSO).

TEN field produced 17.80 million barrels of crude oil in 2020, down from 22.32 million barrels in 2019. This reduction was attributed mainly to increase water cut (the rate of water production with oil) and delay in the Ntomme-09 well coming on stream. Production from Ntomme-09 well started early August, adding about 5,000 barrels/day to the TEN production.

The Sankofa field saw an increase of 8.7%, with 18.70 million barrels of crude oil produced in 2020 as against 17.21 million barrels in 2019. The growth was attributed to stable production operations, resulting from the FPSO uptime of almost 100%, and the coming on stream of the OP-9 and OP-10 producer wells.

Accordingly, average daily production from the three fields combined was lower in 2020 compared to 2019. Average daily production per day reduced from 197,305 barrels in 2019 to 182,918 barrels in 2020 representing a decline of about 7.3%. This was also outside the average daily production range projected for 2020<sup>21</sup> (Table 9).

Table 9: Projected and actual average daily production of crude oil

Field	Average Daily Production, barrels	
	2020 Forecasted Production	2020 Actual Production
Jubilee	90,000-95,000	83,162
TEN	65,000-90,000	48,655
Sankofa	48,000-50,000	51,102
<b>Total</b>	<b>203,000-235,000</b>	<b>182,918</b>

Table 10 presents monthly average daily production of crude oil for Jubilee, TEN and Sankofa fields in 2020.

Table 10: Monthly average daily volumes of crude oil production in 2020, barrels

Month	Jubilee	TEN	Sankofa	Total
Jan	63,839	52,300	55,279	171,418
Feb	86,020	51,595	54,161	191,775
Mar	88,080	51,283	53,442	192,805
Apr	88,794	51,488	52,456	192,738
May	90,777	49,977	50,472	191,227
Jun	90,830	48,854	49,449	189,133
Jul	88,950	47,729	47,477	184,156
Aug	90,000	50,429	51,293	191,721
Sep	84,106	50,557	50,411	185,075
Oct	79,626	45,971	50,418	176,016
Nov	75,846	42,941	49,439	168,226
Dec	71,070	40,734	48,921	160,726
<b>Average</b>	<b>83,162</b>	<b>48,655</b>	<b>51,102</b>	<b>182,918</b>

<sup>21</sup> 2020 Energy (Supply and Demand) Outlook for Ghana: <http://energycom.gov.gh/planning/data-center/energy-outlook-for-ghana>

Source: Ghana National Petroleum Corporation (GNPC)

Average daily production from Jubilee field in 2020 was 83,162 barrels compared to 89,091 barrels in 2019, representing a decrease of 6.7%. Similarly, the average daily production from the TEN field reduced from 61,128 barrels in 2019 to 48,655 barrels in 2020. Production from Sankofa field on the other hand, increased from an average of 47,086 barrels per day in 2019 to 51,102 barrels per day in 2020 (Table 10).

Generally, production performance in 2020 has been good, despite the global health pandemic. The high performance is partly attributable to increased gas offtake nominations from the Ghana National Gas Company (GNGC) as well as a temporary increase in flaring, following approval from the Ministry of Energy<sup>22</sup>. The coming on stream of the Ntomme-09 well in the TEN field and OP-9 and OP-10 producer wells in the Sankofa field have also added to the gross oil production.

#### 4.1.2 Crude Oil Import

The country relies on crude oil import for its refineries and for power generation. Figure 32 presents monthly volumes of crude oil imported into the country for the refineries and power plants.

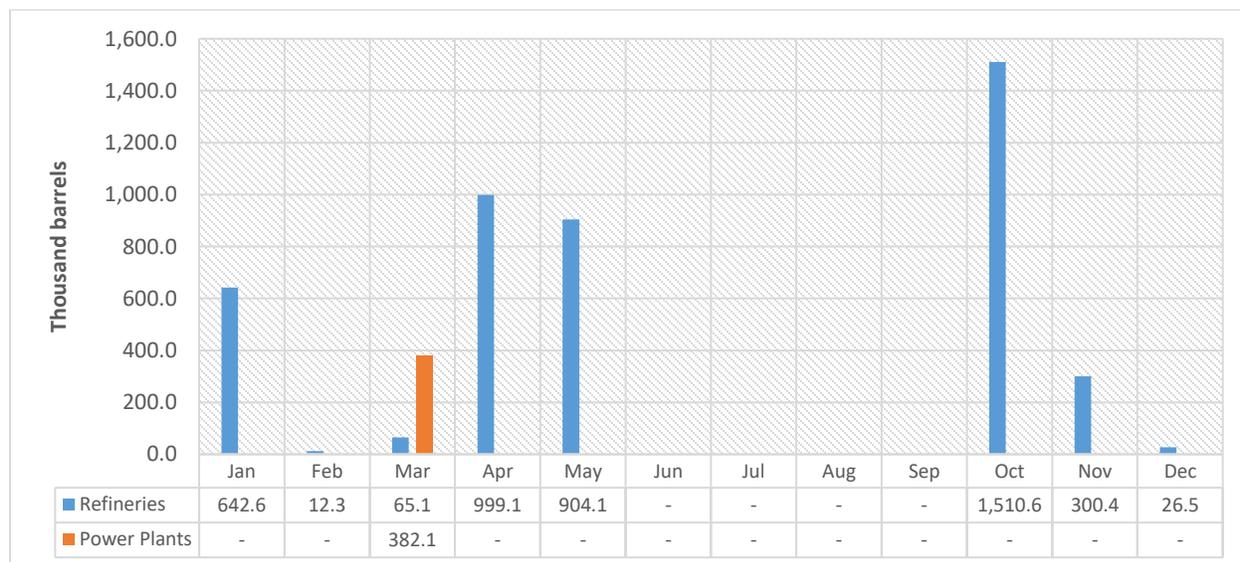


Figure 32: Monthly crude oil imported into the country in 2020

<sup>22</sup> Fitch Solution: <https://www.fitchsolutions.com/corporates/solid-performance-ghanas-upstream-sector-despite-headwinds-28-10-2020>

Total crude oil imported in 2020 was 4,842.8 thousand barrels, an increase of 14.6% of import in 2019. Of the crude oil import, 4,460.8 thousand barrels was for refineries while 382.1 thousand barrels was imported for power plants.

#### 4.1.3 Crude Oil Price

Many types of crude oil are produced in different locations worldwide and traded in a global market. Variations in quality and location result in price differentials, but because oil markets are integrated globally, prices tend to move together. Ghana’s crude oil is light and sweet and is comparable to crude such as the Europe Brent. The country’s crude oil has an API Gravity of 37.6 degrees and sulphur content of 0.25%<sup>23</sup>. Crude oil of this type is attractive for worldwide refineries and can compete with the international price reference oils. Figure 33 depicts average monthly crude oil prices over the last two decades for two international reference crude oil – Europe Brent and US West Texas Intermediate (WTI).

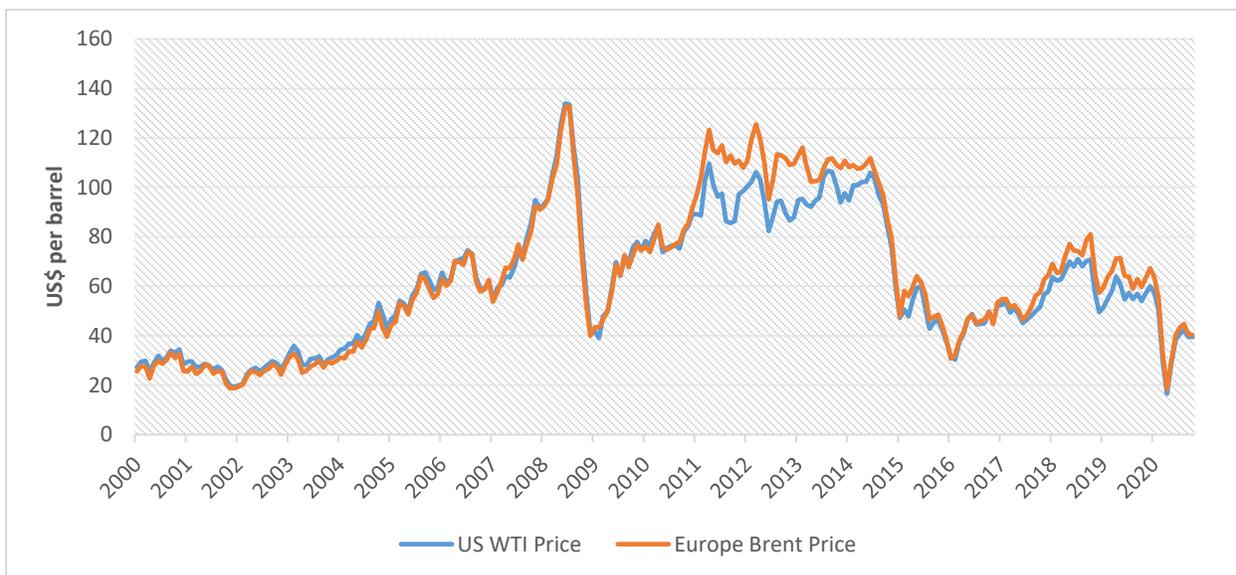


Figure 33: Average crude oil prices for US WTI and Europe Brent 2000-2020

The average Brent crude oil price in 2020 was US\$ 42 per barrel. This represents a 36.0% lower than the average price in 2019. The price of US West Texas Intermediate (WTI) averaged US\$39 per barrel in 2020 which is about 32.0% lower than the average price in 2019. After plunging in

<sup>23</sup> Basic Overview of Ghana’s Emerging Oil Industry: <http://library.fes.de/pdf-files/bueros/ghana/10490.pdf>

March and April for both Europe Brent and US WTI due to COVID-19, crude oil prices saw a robust recovery from May 2020. The recovery in prices was driven by a sharp reduction in production, especially by Organization of Petroleum Exporting Countries (OPEC), as well as a modest recovery in consumption as global lockdown measures were eased and travel and transport began to pick up. Both Brent and WTI prices have been broadly flat since then, averaging US\$41 per barrel and US\$39 per barrel respectively (Table 11).

Table 11: Monthly international average crude oil prices in 2020, US\$ per barrel

Month	US WTI Crude			Europe Brent Crude		
	Forecast	Actual	Difference	Forecast	Actual	Difference
January	55	58	3	60	64	4
February	54	51	-3	59	56	-3
March	54	29	-24	59	32	-27
April	53	17	-36	58	18	-40
May	52	29	-23	57	29	-28
June	53	38	-14	58	40	-18
July	55	41	-14	60	43	-17
August	56	42	-13	61	45	-16
September	57	40	-17	62	41	-21
October	58	39	-18	63	40	-23
November	59	41	-18	64	43	-21
December	60	47	-18	65	50	-22
<b>Average</b>	<b>55</b>	<b>39</b>	<b>-16</b>	<b>61</b>	<b>42</b>	<b>-19</b>

Source: US Energy Information Administration

For economic reasons, Ghana has traditionally preferred to export its crude oil produced from the local indigenous fields. Table 12 presents the achieved prices of Jubilee, TEN and Sankofa fields for the period under review.

Table 12: Achieved market price of Ghana Group crude oil lifting in 2020

Field	Date Lift	Price Per Barrel (US\$/barrel)
Jubilee	04-Feb-2020	56
	04-Apr-2020	12
	23-Jun-2020	42
	28-Aug-2020	42
	07-Oct-2020	40
	14-Dec-2020	50

Field	Date Lift	Price Per Barrel (US\$/barrel)
	<b>Average</b>	<b>40</b>
<b>TEN</b>	26-Feb-2020	51
	21-Jun-2020	36
	27-Sep-2020	39
	<b>Average</b>	<b>42</b>
<b>Sankofa</b>	16-Jan-20	62
	7-Jun-20	32
	27-Sep-20	39
	<b>Average</b>	<b>44</b>

Source: GNPC

The Government of Ghana and GNPC (Ghana Group) lifted six cargoes from Jubilee field in 2020 at an average price of US\$40 per barrel compared with US\$64 per barrel for three cargoes lifted in 2019. The achieved unit price for the Jubilee field was slightly lower than the international Brent average price of US\$42 per barrel in 2020. From TEN, the Ghana Group lifted three cargoes in 2020 at a price of US\$41 per barrel compared with an average of US\$66 per barrel in 2019, significantly lower than the international Brent crude average price of US\$42 per barrel. The Ghana Group lifted three cargoes in the form of royalty on the Sankofa field at US\$44 per barrel in 2020, down from US\$70 per barrel for one cargo lifted in 2019. The achieved unit price for the Jubilee field was higher than the international Brent average price of US\$42 per barrel in 2020.

## 4.2 Natural Gas

---

### 4.2.1 Natural Gas Production

Natural gas produced (both associated and non-associated) from the three fields – Jubilee, TEN and Sankofa in 2020 was 237,963 MMscf (Table 13). This represents a 40.3% increase over the volume of 169,609 MMscf produced in 2019, and is the highest recorded since 2014. This is mainly due to stable operations on the three producing fields and the increased gas offtake nominations for electricity generation.

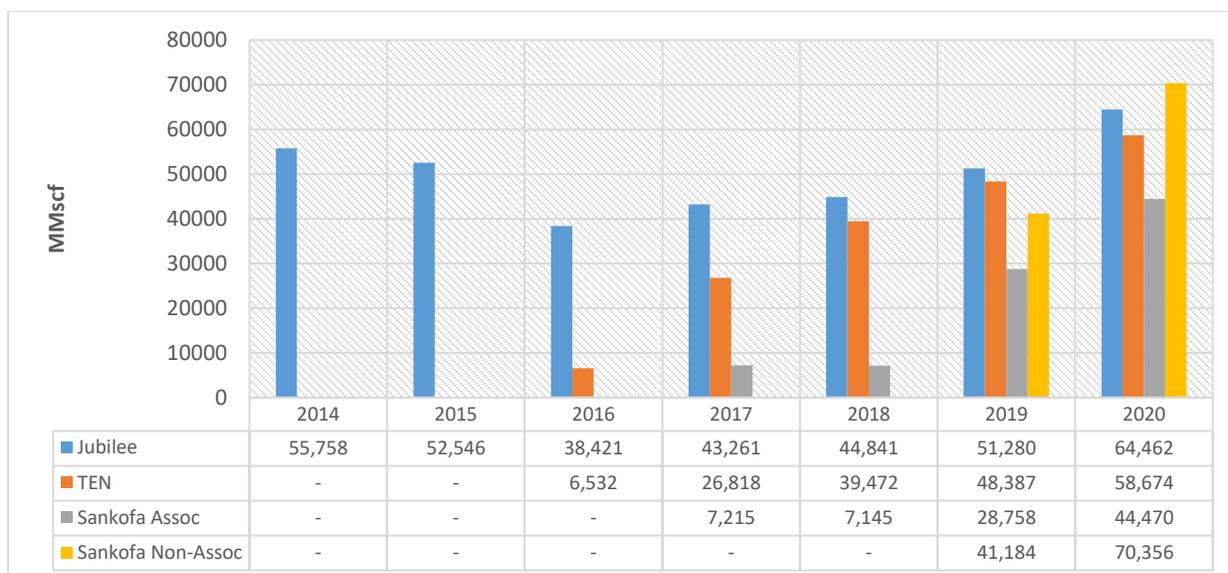


Figure 34: Volumes of raw gas production from 2014 to 2020

Source: GNPC and PC

Raw gas produced from the Jubilee field increase by 25.7% in 2020, from 51,280 MMscf in 2019 (Figure 34). TEN field also witnessed a 21.3% increase in production, from 48,387 MMscf in 2019 to 58,674 MMscf in 2020. Gross raw gas production from associated and non-associated sources at the Sankofa field was 114,826 MMscf in 2020, up from 60,942 MMscf produced in 2019. Table 13 presents monthly production of raw for Jubilee, TEN and Sankofa in 2020.

Table 13: Monthly raw gas production in 2020, MMscf

Month	Associated			Non-Associated	Total
	Jubilee	TEN	Sankofa	Sankofa	
Jan	3,689	4,550	3,083	5,950	17,271
Feb	4,732	4,351	3,243	5,403	17,730
Mar	5,658	4,743	3,418	7,418	21,236
Apr	5,515	4,726	3,473	6,467	20,182
May	5,841	4,758	3,677	5,875	20,151
Jun	5,634	4,724	3,543	5,901	19,803
Jul	5,836	4,747	3,572	5,915	20,071
Aug	5,771	4,912	3,753	4,950	19,386
Sep	5,388	5,448	4,053	4,651	19,540
Oct	5,443	5,323	4,285	5,830	20,881
Nov	5,384	5,132	4,144	5,485	20,145
Dec	5,571	5,261	4,226	6,509	21,568
<b>Total</b>	<b>64,462</b>	<b>58,674</b>	<b>44,470</b>	<b>70,356</b>	<b>237,963</b>

Source: PC

In 2020, average daily production of raw gas from the three fields combined was 651 MMscf/day, an increase of 40.3% over 2019 average daily production. The average daily gas produced was outside the range projected for 2020<sup>24</sup>. Table 14 presents monthly average daily production of raw for Jubilee, TEN and Sankofa in 2020.

Table 14: Projected and actual average daily gas production from the three fields in 2020

Field	Average Daily Production, MMscf/day	
	2020 Forecasted Production	2020 Actual Production
Jubilee Assoc	100-120	176
TEN Assoc		160
Sankofa Assoc	180-200	122
Sankofa Non-Assoc		193
<b>Total</b>	<b>280-320</b>	<b>651</b>

Table 15: Monthly average daily volumes of natural gas produced in 2020, MMscf/day

Month	Associated			Non-Associated	Total
	Jubilee	TEN	Sankofa	Sankofa	
Jan	119	147	99	192	<b>557</b>
Feb	163	150	116	193	<b>622</b>
Mar	183	153	110	239	<b>685</b>
Apr	184	158	116	216	<b>673</b>
May	188	153	119	190	<b>650</b>
Jun	188	157	118	197	<b>660</b>
Jul	188	153	115	191	<b>647</b>
Aug	186	158	121	160	<b>625</b>
Sep	180	182	135	155	<b>651</b>
Oct	176	172	138	188	674
Nov	179	171	138	183	671
Dec	180	170	136	210	696
<b>Average</b>	<b>176</b>	<b>160</b>	<b>122</b>	<b>193</b>	<b>651</b>

Source: GNPC

Daily production of raw gas from the Jubilee field in 2020 was 176 MMscf/day, up from 140 MMscf/day in 2019. Average daily production from the TEN field also increased from 132

<sup>24</sup> 2020 Energy (Supply and Demand) Outlook for Ghana: <http://energycom.gov.gh/planning/data-center/energy-outlook-for-ghana>

MMscf/day on in 2019 to 160 MMscf/day in 2020. Average daily production from both Jubilee and TEN was 336 MMscf/day, which is higher than the average daily production (100-120 MMscf/day) forecasted in 2020. Daily average production from Sankofa field increased to 315 MMscf/day in 2020 from 192 MMscf/day in 2019 (Table 15). The major factor that could have accounted for the increase production of raw gas in 2020, especially for the Sankofa field is the increase in gas demand for power generation.

#### 4.2.2 Gas Export from Producing Fields

Total raw gas exported from Jubilee and TEN (associated gas) to Atuabo Gas Processing Plant (AGPP) and from Sankofa to the ENI Offshore Receiving Facility (ENI ORF) (non-associated gas) witnessed a significant increase in 2020. A total of 88,531 MMscf of associated and non-associated gas was exported in 2020, an increase of 63.8% over the 2019 volume of 54,060 MMscf. Table 16 presents monthly raw gas export from the three fields in 2020.

Table 16: Monthly raw gas exported from Jubilee, TEN and Sankofa in 2020, MMscf

Month	Jubilee	TEN	Sankofa	Total
Jan	1,274	232	4,639	6,145
Feb	147	324	4,115	4,587
Mar	169	470	6,037	6,677
Apr	2,450	230	5,215	7,895
May	2,574	574	4,724	7,872
Jun	2,648	697	4,793	8,138
Jul	2,715	573	4,638	7,927
Aug	2,925	445	3,786	7,156
Sep	2,017	854	3,702	6,573
Oct	3,007	360	4,827	8,194
Nov	3,042	306	4,576	7,924
Dec	3,445	479	5,520	9,443
<b>Total</b>	<b>26,415</b>	<b>5,545</b>	<b>56,571</b>	<b>88,531</b>

Source: PC

AGPP continue to receive a steady supply of raw gas from the Jubilee field. The field exported 26,415 MMscf of raw gas to AGPP in 2020, representing 41.0% of gas produced, with the remainder re-injected, used as fuel or flared. The raw gas exported was 27.7% higher than that of 2019 (20,689 MMscf). The high in export was attributed to a substantial increase in gas offtake

in 2020. The dip in February and March was attributed to a blockage in the gas export pipeline. The pipeline blockage was resolved and export restored on March 23, 2020.

There was also a significant increase in raw gas supplied from the TEN field to the AGPP in 2020. The field exported 5,545 MMscf to the AGPP in 2020, up from 701 MMscf exported in 2019. A greater portion of raw gas produced from the TEN field (91.5%) was either re-injected, used as fuel on the FPSO or flared. The low volume of gas exported was attributed to a pipeline blockage and planned maintenance of the facility.

The Sankofa field exported 56,621 MMscf, representing 80.4% of the non-associated gas produced to the ORF in 2020. The gas exported from the field represent a 73.3% increase over the volumes exported in 2019 (32,670 MMscf). The remaining volume of gas was re-injected, flared or used for electricity generation on the FPSO. Gas export during the period was generally stable. Operations were affected slightly by compressor trips, emergency shutdowns resulting from process upsets, and downstream gas export demand.

#### **4.2.3 Lean Gas Produced and Supplied in 2020**

Total lean gas supplied for power and non-power use in 2020 was 107,138 MMscf, representing an increase of 43.9% over the total supplied in 2019. The total supplied in 2020 is made up of 28,423 MMscf supplied by AGPP from processing raw gas exported from Jubilee and TEN fields and 56,571 MMscf of non-associated gas received at the ENI ORF. The remaining 22,198 MMscf was imported from Nigeria via WAGPCo. The increase in supply of lean gas in 2020 was as a result of increase demand for electricity. Monthly supplies of lean gas from the three sources AGPP, ENI ORF and WAGPCo are presented in Table 17.

Table 17: Monthly lean gas made available for AGPP, ENI ORF and WAGPCo, MMscf

Month	ENI ORF	Atuabo Gas	N-Gas	Total
Jan	4,639	1,361	1,952	<b>7,952</b>
Feb	4,115	446	1,527	<b>6,089</b>
Mar	6,037	580	1,505	<b>8,121</b>
Apr	5,215	2,408	1,898	<b>9,521</b>
May	4,724	2,895	2,217	<b>9,835</b>
Jun	4,793	2,993	2,047	<b>9,832</b>
Jul	4,638	2,861	2,052	<b>9,551</b>
Aug	3,786	2,926	1,717	<b>8,429</b>
Sep	3,702	2,627	1,716	<b>8,045</b>
Oct	4,827	2,906	1,738	<b>9,471</b>
Nov	4,576	3,023	1,781	<b>9,380</b>
Dec	5,520	3,398	1,993	<b>10,911</b>
<b>Total</b>	<b>56,571</b>	<b>28,423</b>	<b>22,144</b>	<b>107,138</b>

Source: GNGC, VRA

## 4.3 Petroleum Product

### 4.3.1 Petroleum Products Production

Total petroleum products produced<sup>25</sup> reduced from 669 kilotonnes in 2019 to 580 kilotonnes in 2020. The reduction may be due to challenges of securing the necessary financing to procure crude oil for the state-owned Tema Oil Refinery (TOR). Table 19 presents the monthly quantities of petroleum products refined in 2020.

<sup>25</sup> Currently, there are three refineries that process crude oil into the various petroleum products in the country. these are the state-owned Tema Oil Refinery (TOR) and two privately owned refineries namely Platon Gas Oil Limited and Akwaaba Oil Limited

Table 18: Petroleum products produced in the country in 2020, Kilotonnes

Month	Gasoil	Gasoline	LPG	Kerosene	ATK	RFO	Total
Jan	23.19	10.58	4.36	-	12.45	28.86	<b>79.43</b>
Feb	2.56	0.68	0.80	0.01	0.94	3.62	<b>8.61</b>
Mar	13.24	8.65	0.93	0.27	9.49	26.26	<b>58.84</b>
Apr	8.84	4.69	7.43	-	4.73	9.97	<b>35.66</b>
May	25.06	9.60	8.77	8.17	-	35.10	<b>86.70</b>
Jun	34.91	12.67	8.97	11.50	-	47.78	<b>115.83</b>
Jul	26.02	8.11	8.59	7.13	-	36.38	<b>86.23</b>
Aug	-	-	8.99	-	-	-	<b>8.99</b>
Sep	-	-	7.85	-	-	-	<b>7.85</b>
Oct	0.49	-	8.75	-	-	0.85	<b>10.10</b>
Nov	5.43	3.22	8.92	2.82	-	8.69	<b>29.08</b>
Dec	9.90	8.28	10.48	5.58	-	18.34	<b>52.58</b>
<b>Total</b>	<b>149.65</b>	<b>66.48</b>	<b>84.85</b>	<b>35.47</b>	<b>27.61</b>	<b>215.85</b>	<b>579.91</b>

Source: NPA, GNGC

Gasoil (diesel) produced was 150 kilotonnes in 2020, a decrease of 24.5% from production in 2019. While gasoline (petrol) production witnessed a drastic decline to 66 kilotonnes in 2020, representing 46.8% decrease from 2019 production. About 85 kilotonnes (1.4% produced by TOR and 98.6% produced by AGPP) of liquefied petroleum gas (LPG) was produced in 2020 as against 49 kilotonnes produced in 2019. Aviation Turbo Kerosene (ATK) witnessed a reduction in production, from 80 kilotonnes in 2019 to 28 kilotonnes in 2020. Kerosene production was 35 kilotonnes in 2020 compared to 12 kilotonnes in 2019, while Residual Fuel Oil (RFO) produced was 216 kilotonnes in 2020, down from 205 kilotonnes produced in 2019.

#### 4.3.2 Petroleum Product Import

There was a marginal increase in the total petroleum products imported in 2020. Total import increased from 3,839 kilotonnes in 2019 to 3,966 kilotonnes in 2020, representing an increase of 3.6%. Table 20 presents monthly quantities of petroleum products imported into the country in 2020.

Table 19: Monthly quantity of petroleum products imported into the country in 2020, Kilotonnes

Month	Gasoil	Gasoline	LPG	ATK	HFO	Total
Jan	117	162	28	-	-	307
Feb	169	148	20	-	19	355
Mar	171	70	26	17	10	294
Apr	108	153	31	5	-	297
May	137	171	18	-	10	337
Jun	154	135	15	-	10	314
Jul	194	147	20	36	-	396
Aug	158	90	27	-	-	276
Sep	165	74	19	11	5	273
Oct	241	103	22	-	-	366
Nov	131	222	22	-	-	375
Dec	193	150	13	11	9	376
<b>Total</b>	<b>1,937</b>	<b>1,625</b>	<b>261</b>	<b>80</b>	<b>63</b>	<b>3,966</b>

Source: NPA

Gasoil recorded the highest import of 1,937 kilotonnes in 2020, which is 11.2% increase over its import in 2019. Gasoline is next with an import of 1,625 kilotonnes in 2020, a 28.4% increase over its 2019 import. LPG import was 262 kilotonnes in 2020, a reduction of 4.9% of import in 2019. ATK witnessed a reduction in import, from 181 kilotonnes in 2019 to 80 kilotonnes in 2020. HFO, mainly used for power generation, witnessed an import of 63 kilotonnes in 2020, down from 366 kilotonnes imported in 2019.

#### 4.3.3 Petroleum Product Consumption

Major petroleum products marketed in Ghana are gasoil, gasoline, LPG, ATK, kerosene, premix, RFO and marine gas oil (MGO). Over the last decade, gasoil and gasoline have dominated petroleum products' consumption as can be seen in Figure 35.

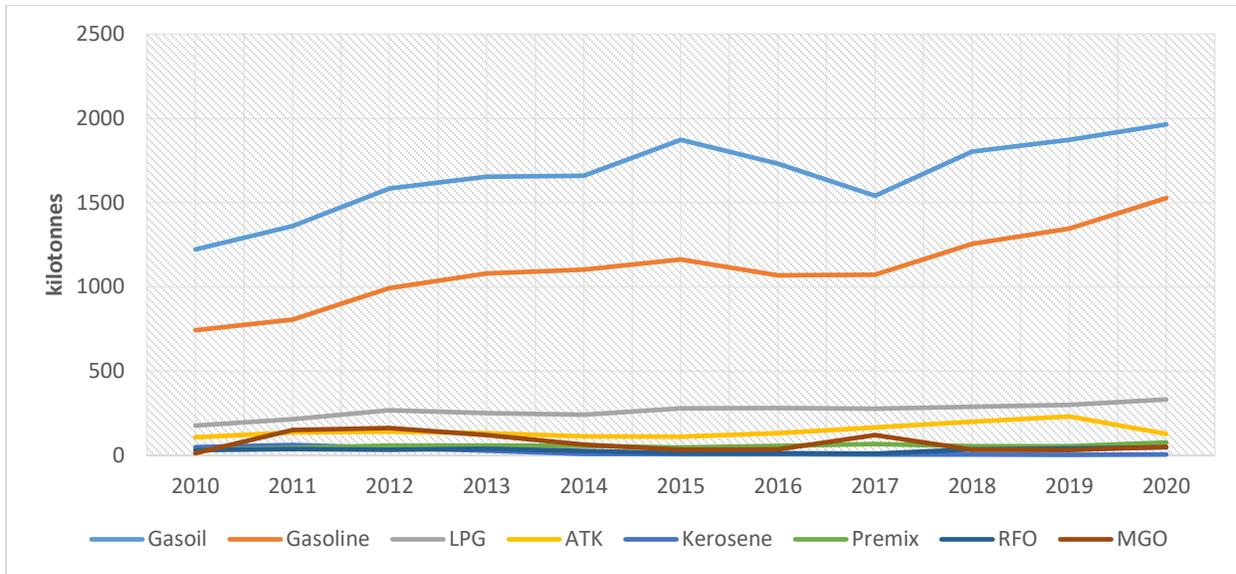


Figure 35: Trend in petroleum products consumption from 2010-2020

Source: NPA

Gross petroleum products consumed in 2020, increase by about 6.5%, from 3,882.2 kilotonnes in 2019 to 4,133.4 kilotonnes in 2020. The projected consumption in 2020 and the actual outturn are presented in Table 21.

Table 20: Projected and actual consumption of major petroleum products in 2020, kilotonnes

Product	2020 Projected Consumption	2020 Actual Consumption
Gasolines (incl. <i>premix</i> )	1,250.5 – 1,333.8	1,603.70
Total Diesel	1,653 – 1,754.5	1,964.10
Kerosene	2.5 – 3.3	5
ATK	206.2 – 242.1	128.7
LPG	294.1 – 313.2	332.4
RFO	154.9 – 196.2	48.3
<b>Total</b>	<b>3,561-3,843</b>	<b>4,082.20</b>

On a product-by-product basis, gasoil consumption was 1,964.1 kilotonnes in 2020, an increase of 4.8% over 2019 consumption of 1,872.8 kilotonnes. Similarly, gasoline consumption in 2020 was 1,526.9 kilotonnes, up by 13.5% that of 2019, being 1,345.6 kilotonnes. At the same time, LPG, kerosene, premix, RFO and MGO consumptions were 332.4 kilotonnes, 5.0 kilotonnes, 76.8 kilotonnes, 48.3 kilotonnes and 51.3 kilotonnes representing 10.9%, 31.1%, 41.2%, 16.7% and

56.0% increases over 2019 consumption of 299.6 kilotonnes, 3.8 kilotonnes, 54.4 kilotonnes, 41.4 kilotonnes and 32.9 kilotonnes respectively. However, ATK consumption witnessed a reduction by 44.5%, from 231.7 kilotonnes in the 2019 to 128.7 kilotonnes in 2020. Figure 36 depicts the trend in petroleum products consumption month by month in 2020.

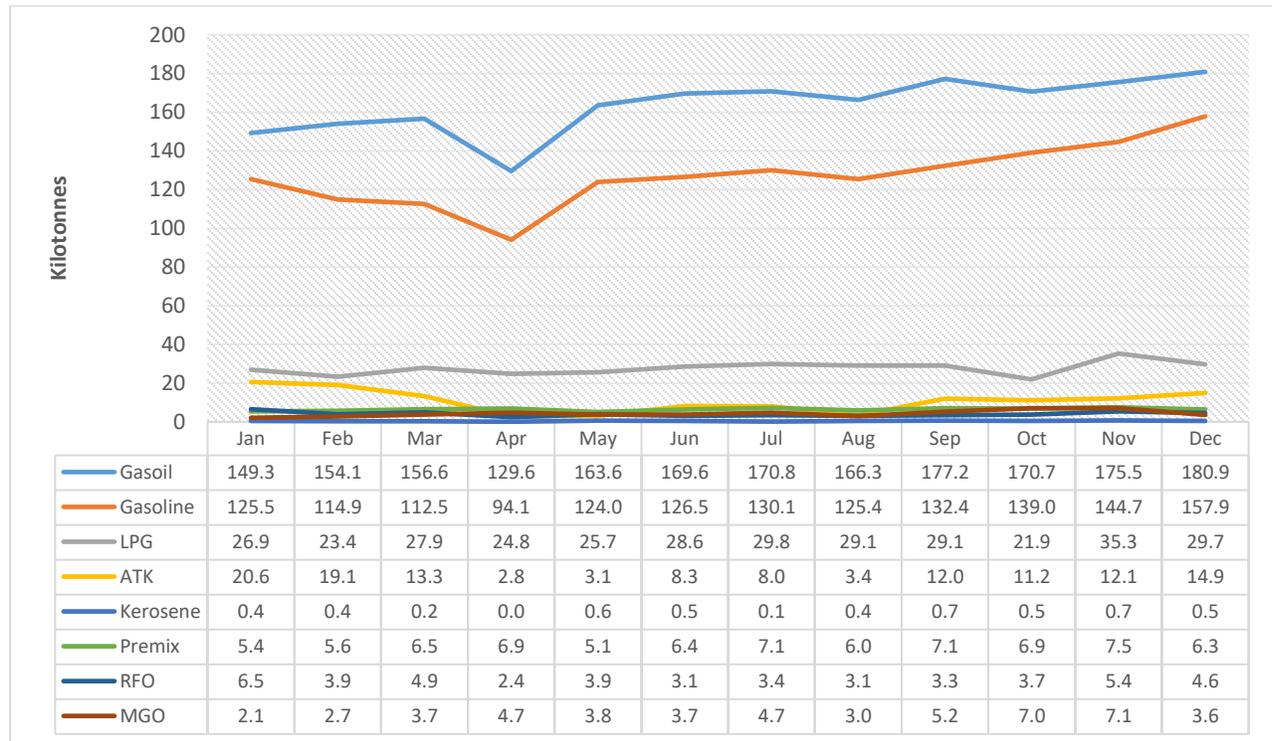


Figure 36: Monthly consumption of petroleum products in 2020

Source: NPA

Between March and May 2020, consumption of major petroleum products witnessed a setback due to restrictions on road travels in the wake of the global health pandemic. A trend analysis of petroleum products supplies in 2020 shows a reduction in gasoil and gasoline consumption for the month of April. Similar observation is made for ATK (Figure 36). This could be attributed to the lockdown measures instituted by government during the month of March and April to curtail the spread of COVID-19.

### 4.3.4 Petroleum Product Prices

The price of gasoline averaged GH¢4.75 per litre in 2020, a decline of about 9.3% from the 2019 average price of GH¢5.24 per litre. Gasoil price averaged GH¢4.76 per litre in 2020, witnessing a reduction of about 10.1% from 2019 average price of GH¢5.30 per litre. The price of LPG on the hand averaged GH¢5.18 per kilogram in 2020, representing a marginal decrease of about 0.9% from 2019 average price of GH¢5.22 per kilogram. Kerosene witnessed a reduction in the average price in 2020. It reduced from GH¢4.71 per litre in 2019 to GH¢4.25 per litre in 2020. MGO sold locally has its price averaging GH¢3.79 per litre, a decline of about 16.9% from 2019 average price of GH¢4.57 per litre. Premix price was about GH¢1.59 per litres. Figure 37 presents bi-weekly prices of some petroleum products in 2020.

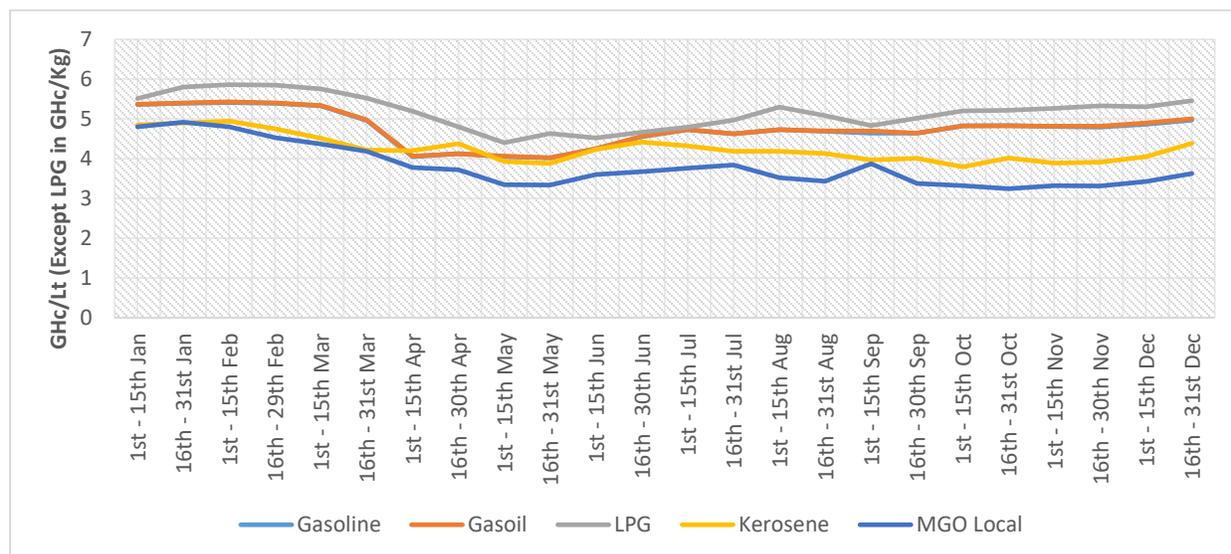


Figure 37: Trend in bi-weekly petroleum products prices

Source: NPA

In order to mitigate the negative impact of COVID-19, prices of petroleum products were reduced by government. This saw prices plunging in March and April, which started to recover somewhere in May (Figure 37). A modest recovery in consumption drove the recovery in price as lockdown measures were eased, resulting in increasing transportation needs for goods and persons in major cities.

## Chapter Five: 2021 Petroleum Outlook

### 5.0 Introduction

The chapter presents the outlook for petroleum. Section 3.1 presents the outlook for crude oil production and prices, while Section 3.2 presents the outlook for natural gas export and import. The final section presents the outlook for petroleum products consumption.

### 5.1 Outlook for Crude Oil

#### 5.1.1 Crude Oil Production

With the coming on stream the OP-9 and OP-10 producer wells on the Sankofa field and Ntomme-09 well on the TEN field, oil production is expected to increase. However, other issues such as facility downtime, may curtail the anticipated increase in production. Table 22 presents the outlook for crude oil production for 2021.

Table 21: Outlook for Ghana's crude oil production profile for 2021, barrels/day

Month	Jubilee	TEN	OCTP	Total
Jan	80,387	42,385	44,660	167,432
Feb	80,015	41,641	43,880	165,536
Mar	79,733	40,923	43,000	163,656
Apr	79,467	40,181	43,380	163,027
May	78,829	39,452	43,640	161,921
Jun	78,483	38,737	42,740	159,960
Jul	77,961	38,034	41,840	157,835
Aug	77,534	37,334	41,140	156,008
Sep	36,051	36,656	36,540	109,247
Oct	83,400	35,992	43,540	162,932
Nov	85,186	35,339	42,660	163,185
Dec	85,492	34,698	41,880	162,070
<b>Annual Daily Ave.</b>	<b>76,878</b>	<b>38,448</b>	<b>42,408</b>	<b>157,734</b>

Source: GNPC

With relatively stable operation going into 2021, Jubilee field is expected to produce 76,878 barrels/day. On the other hand, TEN is expected to produce 38,448 barrels/day in 2021, while

Sankofa production is expected to be 42,408 barrels/day. Overall crude oil production is expected to be about 157,734 barrels per day in 2021.

### 5.1.2 Crude Oil Price

According to World Bank, crude oil prices are expected to average US\$44 per barrel in 2021, a slight increase from a projected US\$41 per barrel in 2020, but still significantly lower than their 2019 level of US\$61 per barrel. This is primarily reflecting a gradual improvement in global growth outlook, as well as a stronger-than-expected supply response<sup>26</sup>. The International Monetary Fund (IMF) on the other hand, put crude oil prices to average US\$50 per barrel<sup>27</sup> in 2021. US Energy Information Administration (EIA) 2021 crude oil price forecast for US West Texas Intermediate (WTI) and Europe Brent crude oil are presented in Figure 38.

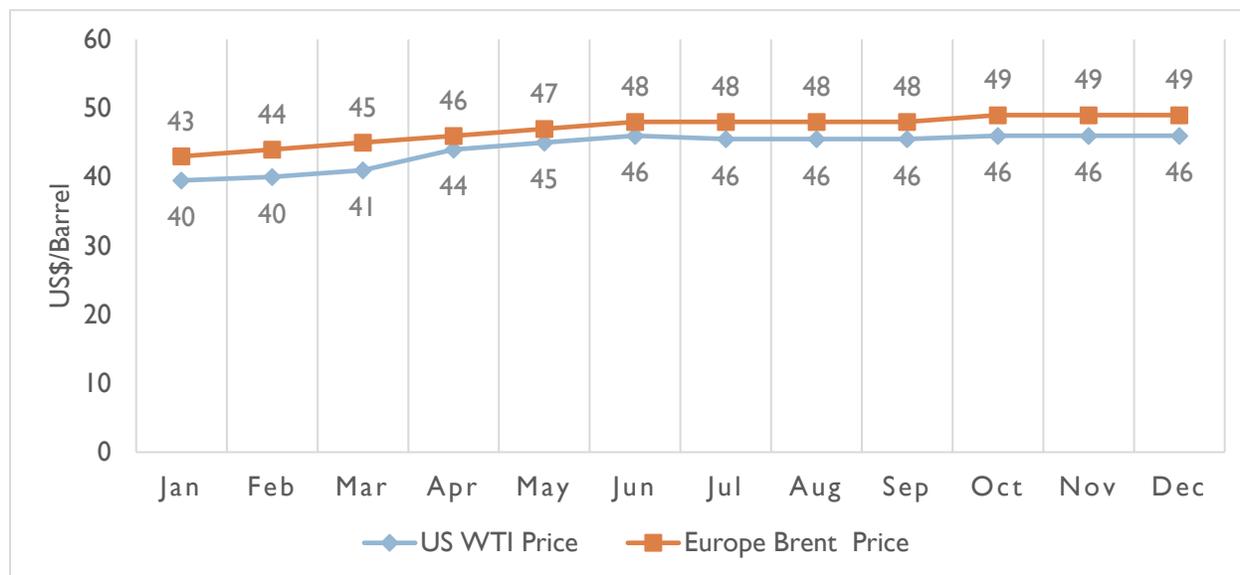


Figure 38: Monthly crude oil price forecast for 2021, US\$ per barrel

Source: US Energy Information Administration

The US EIA expects that as global oil demand rises, forecast inventory draws in 2021 will cause some upward oil price pressures<sup>28</sup>. The price of West Texas Intermediate crude oil will average

<sup>26</sup> World Bank Group. 2020. Commodity Markets Outlook, October 2020. World Bank, Washington, DC. © World Bank. <https://openknowledge.worldbank.org/handle/10986/34621> License: CC BY 3.0 IGO.

<sup>27</sup> International Monetary Fund: World Economic Outlook Update <https://www.imf.org/en/Publications/WEO/Issues/2021/01/26/2021-world-economic-outlook-updat>

<sup>28</sup> US Energy Information Administration

US\$45 per barrel, while Europe Brent crude oil price is expected to average US\$47 per barrel in 2021. These projections are in close range with the World Bank and IMF projections.

On the Ghanaian front, crude oil prices are expected to 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 is projected to average US\$ 50 per barrel. Thus, the positive outlook for crude oil prices in 2021 will greatly increase Ghana's revenue earnings from crude oil.

## **5.2 Outlook for Natural Gas**

---

### **5.2.1 Natural Gas Export from Production Fields**

Sankofa is expected to maintain its capacity to supply up to 180 MMscf per day, whilst Jubilee and TEN together are expected to supply 125 MMscf per day in 2021.

### **5.2.2 Natural Gas Import**

Natural gas import from Nigeria and the LNG facility are expected to be about 50 MMscf/day and 125 MMscf/day respectively. Gas import is mainly for electricity generation. The advent of the Tema LNG project is a welcome development regarding gas supply security particularly for electricity generation.

## **5.3 Outlook for Petroleum Products**

---

### **5.3.1 Petroleum Products Demand**

Total petroleum products consumption in 2021 is projected to be 4,464 kilotonnes, an increase of 8.0% over 2020 consumption. Table 23 presents monthly forecast for petroleum products consumption for 2021.

Table 22: Monthly outlook for petroleum product consumption, kilotonnes

Month	Gasoil	Gasoline	LPG	ATK	Kerosene	Premix	RFO	MGO	Total
Jan	155.7	140.5	28.4	12.3	0.7	6.1	4.6	3.7	352
Feb	162.6	131.7	24.9	11.0	0.6	5.9	4.4	3.7	345
Mar	169.3	140.4	27.5	15.5	0.6	6.0	3.7	4.3	367
Apr	164.6	135.1	26.4	14.8	0.4	6.5	4.2	4.3	356
May	168.7	144.1	28.9	17.6	0.6	6.2	3.9	4.2	374
Jun	167.4	136.2	27.6	19.1	0.6	6.6	5.3	4.5	367
Jul	165.6	139.5	28.9	19.9	0.5	6.7	4.9	4.1	370
Aug	168.0	140.1	32.0	18.3	0.5	8.5	5.9	3.2	377
Sep	157.2	140.4	29.2	18.5	0.7	7.0	5.7	5.0	364
Oct	165.0	150.9	30.7	18.0	0.4	7.1	6.0	5.6	384
Nov	169.5	153.7	31.2	18.0	0.8	6.4	6.0	6.0	392
Dec	177.7	165.8	33.1	23.9	0.6	5.7	5.7	3.9	416
<b>Total</b>	<b>1,991</b>	<b>1,718</b>	<b>349</b>	<b>207</b>	<b>7</b>	<b>79</b>	<b>60</b>	<b>53</b>	<b>4,464</b>

Source: Energy Commission

Road transport is the largest consumer of gasoil and gasoline in the country. With road transport in full operation after removal of COVID-19 restrictions on passenger travel in major cities, gasoil and gasoline consumption is expected to regain their pre-pandemic levels and continue to rise. Gasoil consumption is therefore forecasted to be about 1,991 kilotonnes in 2021, an increase of about 1.4% over the 2020 consumption. Gasoline consumption on the other hand, is expected grow to about 1,718 kilotonnes in 2021, up by 12.5% from the 2020 consumption.

LPG<sup>29</sup> witnessed considerable growth in consumption in 2020. It is expected to increase by 5.0%, from 332 kilotonnes in 2020 to about 349 kilotonnes in 2021. ATK consumption is expected to surge in 2021 towards its pre-pandemic levels as COVID-19 restriction world-wide on international travels are lifted. As a result, ATK consumption for 2021 is expected to be 207 kilotonnes. Kerosene consumption has witnessed a considerable increase from 4 kilotonnes in 2019 to 5 kilotonnes in 2020. For 2021, kerosene consumption is expected to further increase to about 7 kilotonnes. Consumption of other petroleum products such as Premix, RFO and MGO is expected to increase to 79 kilotonnes, 60 kilotonnes and 53 kilotonnes respectively in 2021.

<sup>29</sup> Refers to LPG butane for residential, commercial and industrial use

## Chapter Six: Woodfuel Sub-sector

### 6.0 Introduction

---

Notwithstanding measures to promote substitution of woodfuel with LPG, many households in Ghana still rely on woodfuel for cooking and heating<sup>30</sup>. The woodfuel sub-sector further supports many enterprises including bread-baking, processing of oil-palm, local brewery, the traditional textiles industry, traditional soap making, fish smoking and local catering services. The continuous dependence on woodfuel may be attributable to a number of factors from relatively easy accessibility to lower price as compared to LPG.

Actual data on woodfuel production over the years has been limited. However, in this chapter, some estimates for woodfuel production and consumption are given<sup>31</sup>. In addition, price of woodfuel, specifically charcoal is also presented based on survey data collected in 2020.

### 6.1 Woodfuel Production and Consumption

---

#### 6.1.1 Woodfuel Production

In 2010, wood extracted for use directly as fuel (firewood) and for the production of charcoal was estimated to be 1,490 ktoe and 1,687 ktoe respectively. The quantity of wood for firewood was estimated to reduce by 0.4% to 1,438 ktoe in 2020. The wood extracted for the production of charcoal on the other hand has been increasing at an annual average growth rate of 5.2% to 2,807 ktoe in 2020. The production of other biomass (mainly crop residue) was also estimated to be 30 ktoe in 2010 and roughly maintaining this estimate till 2020 (Figure 39).

---

<sup>30</sup> Energy Commission 2014: <http://energycom.gov.gh/files/snep/WOOD%20FUEL%20final%20PD.pdf>

<sup>31</sup> 2020 National Energy Statistics: <http://energycom.gov.gh/files/2020%20ENERGY%20STATISTICS-revised.pdf>

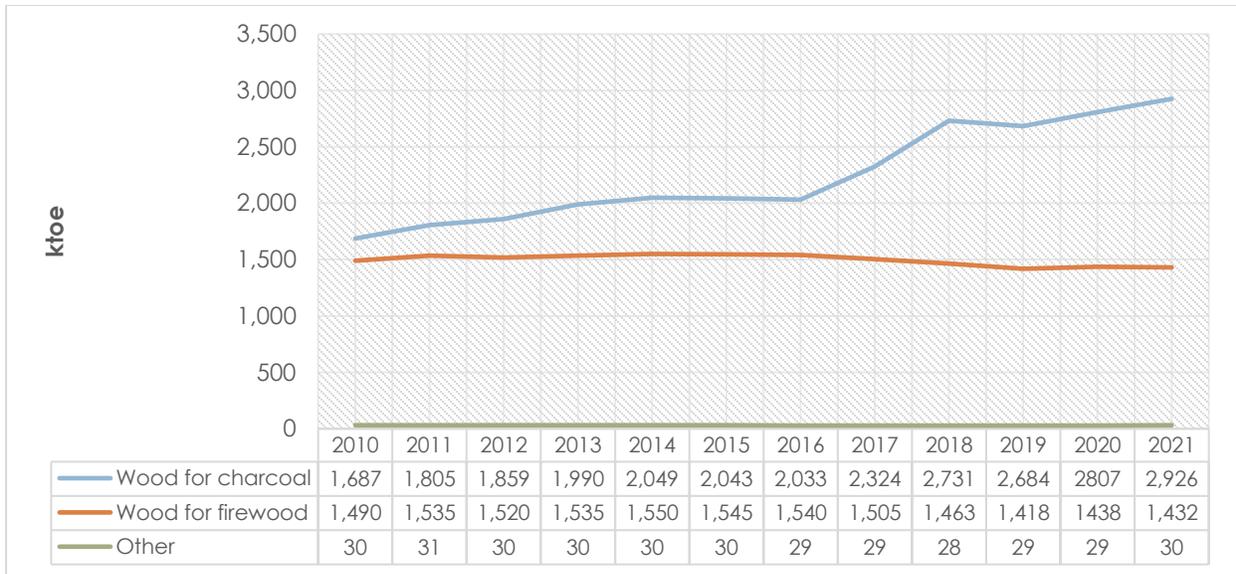


Figure 39: Woodfuel production<sup>32</sup>

The estimated wood to be extracted for use as firewood in 2021 would be 1,432 ktoe, a decrease of 0.4% from the estimated extraction in 2020. Also, wood to be extracted for charcoal production would be 2,926 ktoe, increasing by 4.2% over estimated extraction in 2020. The production of other biomass (mainly crop residue) would be about 30 ktoe in 2021.

### 6.1.2 Biomass Consumption

Biomass consumption is estimated to have increase at an average annual rate of 2.1%, from 2,464 ktoe in 2010 to 2,977 ktoe in 2020.

<sup>32</sup> 2020 National Energy Statistics: <http://energycom.gov.gh/files/2020%20ENERGY%20STATISTICS-revised.pdf>

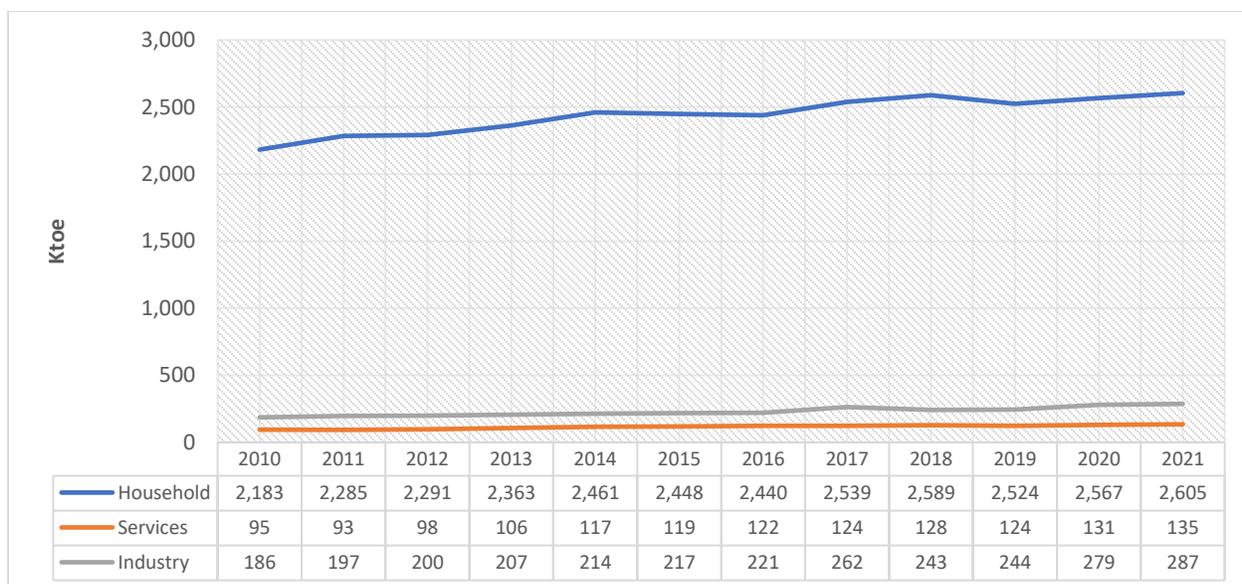


Figure 40: Biomass consumption by sectors

The residential sector has undoubtedly been the largest consumer of biomass in the country. In 2020, households consumed an estimated 2,567 ktoe of biomass constituting 86.2% of the total biomass consumed in the country. This is followed by the industrial sector which consumed 279 ktoe of biomass constituting 9.4% of the total consumption (Figure 40). The services sector also consumed 131 ktoe in 2020. Over the period 2010 to 2020, biomass consumption in the residential sector is assumed to be increasing at an annual average rate of 1.8% whereas that of the industrial and services sectors are estimated to be increasing at an annual average rate of 4.6% and 3.6% respectively. This trend could be reverse if government intensify measures that will increase LPG penetration especially in rural areas.

In 2021, household consumption of biomass is expected to rise to an estimated value of 2,60 ktoe, while the services and industrial sectors are each expected to consume 135 ktoe and 287 ktoe respectively.

## 6.2 Woodfuel Prices

### 6.2.1 Weight and Retail Price of Bag of Charcoal

In recent times, the main bag to package charcoal is the one from woven polypropylene (popularly called fertilizer bag). The fertilizer bag is preferred because of its durability, low water absorption

and retention capabilities. The maxi and mini of fertilizer bags are most preferred due to ease of handling. The average weights of maxi and mini bag of charcoal are shown in Figure 41.

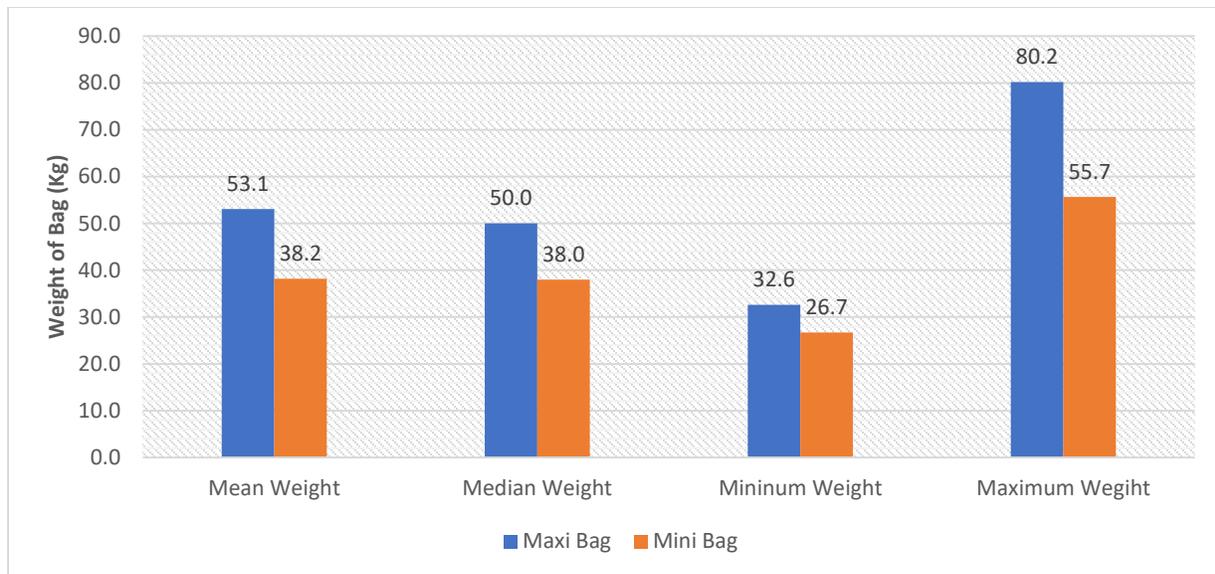


Figure 41: Average weight of maxi and mini bags of charcoal

Source: Survey data

The highest and least recorded weights of maxi bags of charcoal were 80.2 kg and 33.6 kg respectively, resulting in a mean weight of 53.1 kg. For a mini bag of charcoal, the highest and the least recorded weights were 55.7 kg and 26.7 kg respectively, with a mean weight of 38.2 kg. The average weights of different bag sizes of charcoal were used in determining the retail price of charcoal. Figure 42 gives the mean price of charcoal in the ecological zones of Ghana in 2020.

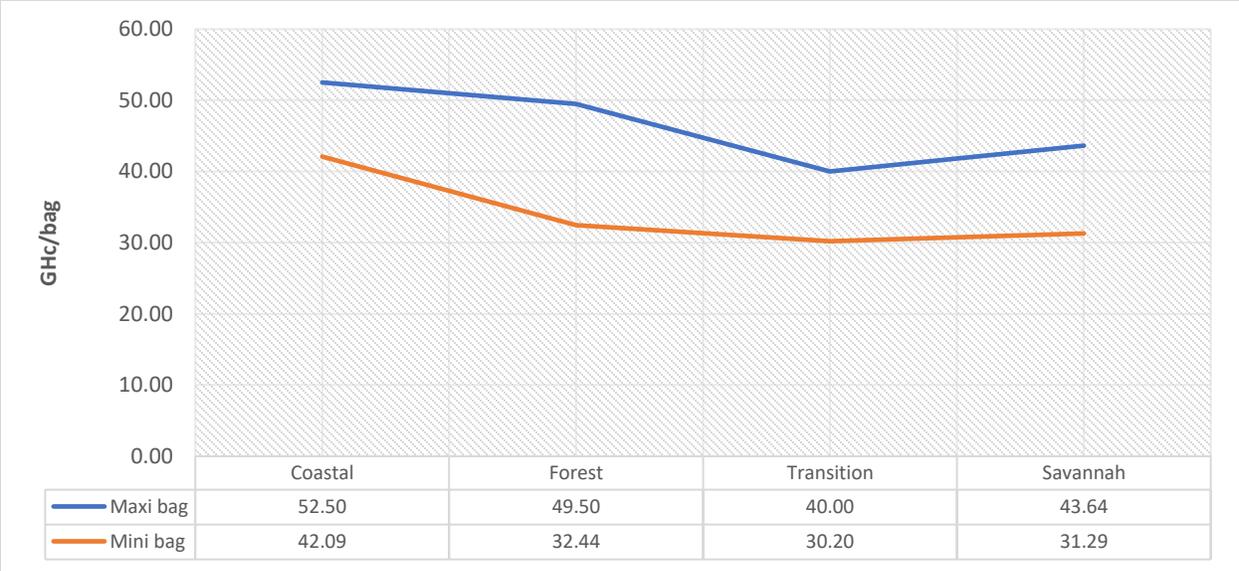


Figure 42: Average price per bag of charcoal in the ecological zones of Ghana in 2020

Source: Survey data

The national mean price for maxi bag of charcoal in 2020 was GH¢47.81, while mean price for mini bag of charcoal was GH¢36.00. The high-price zone was along the Coastal areas (Greater Accra, Central and Volta Regions). As expected, lower prices were observed in the Forest, Transition and Savannah zones, where charcoal is usually produced. The lowest-price areas were the Transition zone of Bono and Bono-East regions followed by the Savannah zone (Oti, Northern, Savannah, North-East, Upper East and Upper West regions).

A number of factors influence the variation in price of charcoal including high/low price of LPG, shortage/availability of LPG and the inconvenience in the use of cookstoves. Also, scarcity of

woodfuel and availability of large supplies of charcoal influence the prices of charcoal. Figure 43 compares the unit price of charcoal and LPG.

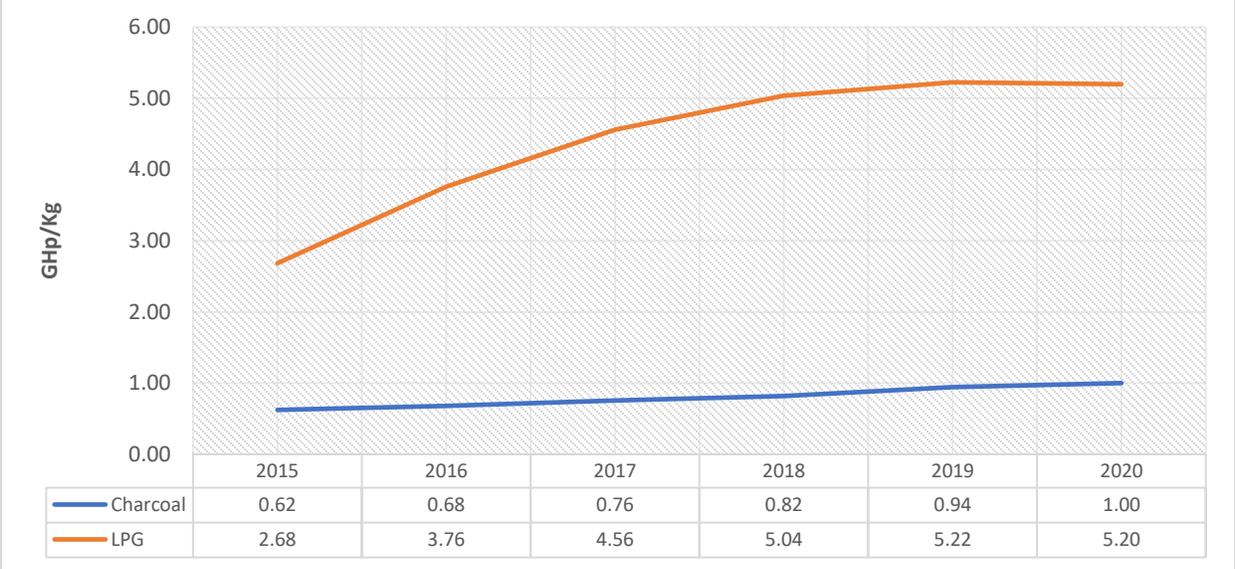


Figure 43: Comparison of unit price of charcoal and LPG from 2015-2020

Price of LPG per kg has been climbing since 2015, whilst price for charcoal per kg has only witnessed a modest increase over the period (Figure 50). This implies that price of charcoal tends to be stable compared to LPG. In 2021, charcoal consumption is expected to increase due to relatively high price of LPG. As a result, charcoal price is also expected to increase, but marginally. At worst charcoal price would grow at the same rate as the national inflation rate for the year.

## Chapter Seven: Conclusion and Recommendations

This report has presented the energy demand and supply outlook for Ghana for the year 2021. The advent of COVID-19 and measures to stop the spread of the disease, disrupted the demand and supply of some energy forms in the year 2020. However, with the expected arrival of COVID-19 vaccine in 2021, is expected that the global economy and national economies will gradually bounce back to their pre-pandemic state. As such, modest growth in Ghana's energy demand and supply is expected at least to their pre-pandemic levels in 2021 and beyond.

### 7.1 Conclusions

---

#### 7.1.1 Electricity

The system peak demand in 2021 is projected to increase by 6.9% to 3,304 MW. The corresponding projected energy consumption for 2021 is projected to be 21,266 GWh, an increase of 7.8% over 2020 consumption. Domestic consumption (includes VALCO and losses) will constitute 92.8% of total consumption, while energy export will constitute 8.2% of total consumption. VALCO is expected to operate on two potlines with projected energy consumption of 1,055 GWh.

The hydropower and thermal plants are projected to generate 7,001 GWh (32.9%) and 14,112 GWh (66.4%) of total energy consumption. The remaining energy of 152 GWh, representing 0.7%, is expected to be met by renewables, including solar PV and biogas.

Power generation capacity of 5,328.1 MW with a dependable capacity of 4,928 MW will be available for power generation in 2021. The bulk (68.5%) of the dependable capacity will come from thermal sources. However, considering planned units' maintenance and fuel supply situation, it is anticipated that up to 4,054 MW of capacity will be made available to meet the expected system peak demand of 3,304 MW.

Fuel for thermal power plants in 2021 will be mainly natural gas to be sourced from indigenous and import sources. The total natural gas consumption for 2021 is projected to be about 123.9

TBtu. An estimated 121,849 barrels of HFO will be required by AKSA plant for the period January to June 2021. It is expected to switch to natural gas from July 2021. The total cost of fuel is estimated to be \$758.8 million in 2021. About \$753.3 will be used to procure natural gas and the remainder for the procurement of HFO to fuel the AKSA plant.

### 7.1.2 Petroleum

Crude oil production from the three fields - Jubilee, TEN and Sankofa is expected to be 157,734 barrels per day in 2021. Jubilee field is expected to produce about 76,878 barrels/day, while TEN is expected to produce 38,448 barrels/day in 2021. The third field, Sankofa, would produce 42,408 barrels/day. Crude oil price is expected to bounce back in 2021 after the collapse in 2020. The IMF put crude oil prices to average US\$50 per barrel in 2021. It is expected that the market price of crude oil from Ghana's fields – Jubilee, TEN and Sankofa will hover around the US\$50 per barrel benchmark in 2021.

Sankofa is expected to maintain its capacity to supply up to 180 MMscf per day to the ORF in 2021. Jubilee and TEN together are expected to supply 125 MMscf per day to the AGPP in 2021. The expected import from Nigeria is pegged at 50 MMscf per day. LNG import is forecast to be about 125 MMscf per day. In 2021, lean gas from AGPP (Jubilee/TEN), ORF (Sankofa), N-Gas and Tema LNG for power generation is expected to assume the WACOG of \$US6.08 per MMBtu determined by PURC.

Total petroleum products consumption in 2021 is projected to be 4,464 kilotonnes, an increase of 8.0% over 2020 consumption. Out of this, gasoil consumption is forecast to be about 1,991 kilotonnes, increasing by 1.4% over the 2020 consumption, while gasoline will be 1,718 kilotonnes in 2021, up by 12.5% from the 2020 consumption. LPG consumption is expected to grow by 5.0% from 332 kilotonnes in 2020 to about 349 kilotonnes in 2021. ATK and kerosene consumption for 2021 are expected to be 207 kilotonnes and seven (7) kilotonnes respectively. Other petroleum products such as Premix, RFO and MGO will have a combined consumption of 192 kilotonnes in 2021.

### 7.1.3 Woodfuel

Wood to be extracted for use as firewood in 2021 is estimated to be 1,432 Ktoe, a decrease of 0.4% from the estimated extraction in 2020. Also, wood to be extracted for charcoal production would be 2,926 Ktoe, increasing by 4.2% overestimated extraction in 2020. The production of other biomass (mainly crop residue) would be about 30 Ktoe in 2021.

Household consumption of biomass is expected to rise to an estimated value of 2,656 Ktoe in 2021, while the services and industrial sectors are each expected to consume 131 Ktoe and 312 Ktoe, respectively. The national mean price for a maxi bag of charcoal in 2020 was GH¢47.81, while the mean price for a mini bag of charcoal was GH¢36.00. In 2021, charcoal consumption is expected to rise, due to relatively high price of LPG. As a result, charcoal price is also expected to increase in 2021, but marginally. At worst it would grow at the same rate as the national inflation for the year.

## 7.2 Recommendations

---

The following recommendations are made.

### 7.2.1 Electricity

1. Based on projected electricity demand for 2021, there is no need for additional generation capacities aside the committed power plants.
2. Adopt a conservative dispatch of the Bui hydro plant to manage the use of its limited head water until the next inflow season.
3. Thermal plants fuel supply security and adequacy remains the single most important risk to power supply reliability in Ghana. In this regard, it is strongly recommended that all stakeholders work together to ensure that fuel supply is adequate and secure at all times. In addition, power plants maintenance should be well-coordinated to ensure uninterrupted power supply.

4. There is a need to install a third 161/34.5kV transformer at Anwomaso Substation to allow for the transfer of some load from the ECG substation at Ridge, Kumasi to Anwomaso in order to limit congestion on the 161 kV Anwomaso – Kumasi line especially when Bui is not running during off-peak periods.
5. Engage stakeholders and grid participants on loss reduction strategies which will ensure that system losses are minimised.
6. Transmission lines and substation expansion projects should be expedited and completed in the second half of 2021 to ensure that the peak demand can be supplied. These are:
  - Anwomaso – Kintampo 330 kV transmission line Project
  - 161 kV, Volta – Achimota-Mallam line reconstruction
  - 330/34.5 kV Pokuase Substation project
  - 161/34.5 kV Kasoia Substation
7. There is the need to create another generation enclave in Kumasi for network stability. This will help address voltage limit violations in the mid-sections of the Ghana power system in situations where Bui units are not in service and to reduce line loadings between Kumasi and the South East as well as the South West generation enclaves. This will further give Ghana a competitive advantage for power export to Burkina, Mali and other potential customers north of Ghana.

### 7.2.2 Petroleum

- I. Fuel supply security has compelled countries to set up strategic stocks both for crude oil and refined products. Crude oil storage, however, has the comparative advantage of a longer lifespan and could even be indefinite depending upon the blend and state. Many developed countries have such storage, and for OECD countries, minimum of six-month storage is mandatory. Thus, the Commission recommends the inclusion of crude oil in the country's strategic reserve.

2. National LPG penetration rate increased from 6% in 2000 to 18% in 2010 and is currently around 25%. The government is targeting 50% LPG penetration by 2030, but it is not likely to be achieved if limited distribution outlets nationwide remain the same and LPG prices continue to remain high. In this light, the government needs to consider investment incentives to encourage OMC and other interested investors to set up more LPG storage and distribution outlet nationwide to increase access and consumption. Further, there is the need to re-capitalise Ghana Cylinder Manufacturing Company (GCMC) to expand production capacity to include the production of smaller sized cylinders that would be portable and affordable to poorer and rural households.
3. Expand crude oil refinery capacity and make existing ones fully functional (i.e., resourcing TOR to procure crude oil) to reduce dependence on imported finished petroleum products. The equivalent of about 85,611 barrels per stream day refinery capacity would be required to enable the country to meet its projected petroleum products consumption for 2021. However, TOR (the only major refinery) has a capacity of just about 45,000 barrel per stream day.

### 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 biomass.

## Appendices

### Appendix A: 2021 Projected monthly electricity demand and supply balance, GWh

Customer Category	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Total
Domestic	1,585.01	1,498.52	1,620.28	1,612.59	1,598.38	1,481.26	1,476.36	1,494.0	1,480.66	1,568.43	1,603.83	1,663.75	<b>18,683.12</b>
VALCO	68.45	66.53	78.86	82.8	90.77	93.6	96.72	96.72	93.6	96.72	93.6	96.76	<b>1,055.13</b>
Export (CEB+SONABEL+CIE)	159.01	133.99	135.27	124.65	123.37	113.89	119.86	109.84	109.95	124.93	128.21	144.3	<b>1,527.27</b>
<b>Total Consumption</b>	<b>1,812.47</b>	<b>1,699.04</b>	<b>1,834.41</b>	<b>1,820.04</b>	<b>1,812.52</b>	<b>1,688.75</b>	<b>1,692.94</b>	<b>1,700.58</b>	<b>1,684.21</b>	<b>1,790.08</b>	<b>1,825.64</b>	<b>1,904.81</b>	<b>21,265.49</b>
<b>Generation Sources</b>													
Akosombo	479.9	433.4	479.9	464.4	479.9	464.4	479.9	479.9	464.4	479.9	464.4	479.9	<b>5,650.30</b>
Kpong GS	72.2	65.2	72.2	69.9	72.2	69.9	72.2	72.2	69.9	72.2	69.9	72.2	<b>850.20</b>
TAPCO	172.4	155.7	172.4	166.9	172.4	166.9	172.4	172.4	166.9	172.4	166.9	114.9	<b>1,972.60</b>
TICO	195.2	176.3	195.2	188.9	195.2	188.9	195.2	100.7	97.4	167.8	188.9	195.2	<b>2,084.90</b>
TT1PP	59.5	-	59.5	-	59.5	-	59.5	-	57.6	-	57.6	-	<b>353.20</b>
KTPP	-	57.1	-	61.2	-	61.2	-	63.2	-	63.2	-	63.2	<b>369.10</b>
TT2PP	9.5	8.6	9.5	9.2	9.5	9.2	9.5	9.5	9.2	9.5	9.2	9.5	<b>111.90</b>
AMERI	91.4	80.9	57.1	69.3	58.1	25.1	20	80.9	56	78.1	76.2	101.8	<b>794.90</b>
VRA Solar (Navrongo)	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.3	0.2	0.3	0.2	0.3	<b>3.10</b>
VRA Solar (Kaleo/Lawra)	0.9	0.8	0.9	2.6	2.7	2.6	2.7	2.7	2.6	2.7	2.6	2.7	<b>26.50</b>
Imports from Cote d'Ivoire	-	-	-	-	-	-	-	-	-	-	-	-	<b>0.00</b>
Bui Hydro	31	28	31	30	31	30	31	31	30	77	74	77	<b>501.00</b>
Bui Solar Farm	5.8	5.2	5.8	5.6	5.8	5.6	5.8	5.8	5.6	5.8	5.6	5.8	<b>68.20</b>
SAPP	187.5	169.3	187.5	181.4	187.5	162.5	155.5	187.5	181.4	187.5	181.4	197.5	<b>2,166.50</b>
CENIT	47.7	47.7	47.7	47.7	47.7	47.7	29.2	27.7	47.7	22.7	47.7	64.3	<b>525.50</b>
Karpower Barge	267.8	241.9	267.8	259.2	267.8	239.2	237.8	267.8	259.2	267.8	259.2	271.8	<b>3,107.30</b>
AKSA	9.5	8.6	9.5	9.2	9.5	9.2	9.5	9.5	9.2	9.5	9.2	19	<b>121.40</b>
CEN Power	107.5	97.1	107.5	104	107.5	104	107.5	107.5	104	101.3	104	107.5	<b>1,259.40</b>
Amandi	69.7	118.6	126	130.1	86	83.2	86	63	104	55.8	93	103.5	<b>1,118.90</b>

Customer Category	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Total
Early Power	-	-	-	15.7	15.2	14.4	14.3	14.4	14.3	12	11	14	<b>125.30</b>
BxC Solar	2.3	2.1	2.3	2.2	2.3	2.3	2.3	2.3	2.2	2.3	2.2	2.3	<b>27.10</b>
Meinergy	2.3	2.1	2.3	2.2	2.3	2.2	2.3	2.3	2.2	2.3	2.2	2.3	<b>27.00</b>
Safisana	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<b>1.20</b>
<b>Total Supply</b>	<b>1812.5</b>	<b>1698.9</b>	<b>1834.5</b>	<b>1820</b>	<b>1812.5</b>	<b>1688.8</b>	<b>1693</b>	<b>1700.7</b>	<b>1684.1</b>	<b>1790.2</b>	<b>1825.5</b>	<b>1904.8</b>	<b>21,265.50</b>



Customer Category	2021 Proj. Sys. Peak	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec
Genser	60	60	60	60	60	60	60	60	60	60	60	60	60
Safisana	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Meinergy	20	-											
Solar (Central Region)	20	-											
<b>Total Available Generation (MW)</b>	<b>4799.1</b>	<b>3924.1</b>	<b>4014.1</b>	<b>4014.1</b>	<b>4134.1</b>	<b>4134.1</b>	<b>4134.1</b>	<b>4104.1</b>	<b>3979.1</b>	<b>3979.1</b>	<b>4134.1</b>	<b>4134.1</b>	<b>4054.1</b>
<b>Surplus/deficit (MW)</b>	<b>1,495</b>	<b>660</b>	<b>823</b>	<b>758</b>	<b>851</b>	<b>875</b>	<b>1,080</b>	<b>1,157</b>	<b>1,128</b>	<b>949</b>	<b>963</b>	<b>850</b>	<b>750</b>
<b>Required Reserve (18%)</b>	<b>595</b>	<b>588</b>	<b>574</b>	<b>586</b>	<b>591</b>	<b>587</b>	<b>550</b>	<b>530</b>	<b>513</b>	<b>545</b>	<b>571</b>	<b>591</b>	<b>595</b>
<b>Actual Reserve Margin</b>	<b>45%</b>	<b>20%</b>	<b>26%</b>	<b>23%</b>	<b>26%</b>	<b>27%</b>	<b>35%</b>	<b>39%</b>	<b>40%</b>	<b>31%</b>	<b>30%</b>	<b>26%</b>	<b>23%</b>

## Appendix C: 2021 estimated monthly fuel requirements and associated costs

Estimated Thermal Fuel Requirement	Units	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Total
TAPCO-GAS	Tbtu	1.54	1.39	1.54	1.49	1.54	1.49	1.54	1.54	1.49	1.54	1.49	1.03	17.64
TICO-GAS	Tbtu	1.54	1.39	1.54	1.49	1.54	1.49	1.54	0.80	0.77	1.33	1.49	1.54	16.48
TT1PP-GAS	Tbtu	0.70	0.00	0.70	-	0.70	0.00	0.70	-	0.67	-	0.67	-	4.13
KTPP-GAS	Tbtu	-	0.67	-	0.72	0.00	0.72	-	0.74	0.00	0.74	0.00	0.74	4.35
TT2PP-GAS	Tbtu	0.11	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	1.32
AMERI Power Plant - GAS	Tbtu	1.03	0.91	0.64	0.78	0.66	0.28	0.23	0.91	0.63	0.88	0.86	1.15	8.97
Karpower Barge -GAS	Tbtu	2.16	1.95	2.16	2.09	2.16	1.93	1.92	2.16	2.09	2.16	2.09	2.20	25.10
SAAP-GAS	Tbtu	1.55	1.40	1.55	1.50	1.55	1.35	1.29	1.55	1.50	1.55	1.50	1.64	17.95
CENIT-GAS	Tbtu	0.56	0.56	0.56	0.56	0.56	0.56	0.34	0.33	0.56	0.27	0.56	0.76	6.21
AMANDI-GAS	Tbtu	0.57	0.98	1.04	1.07	0.71	0.69	0.71	0.52	0.86	0.46	0.77	0.85	9.22
CENPOWER-GAS	Tbtu	0.88	0.80	0.88	0.86	0.88	0.86	0.88	0.88	0.86	0.83	0.86	0.88	10.36
Early Power - GAS	Tbtu	-	-	-	0.18	0.17	0.16	0.16	0.16	0.16	0.14	0.13	0.16	1.43
AKSA-GAS	Tbtu	-	-	-	-	-	-	0.11	0.11	0.11	0.11	0.11	0.22	0.76
AKSA-HFO	barrels	20,869	18,850	20,869	20,196	20,869	20,196	-	-	-	-	-	-	121,849.0
<b>Total Natural Gas</b>	<b>Tbtu</b>	<b>10.66</b>	<b>10.17</b>	<b>10.74</b>	<b>10.86</b>	<b>10.59</b>	<b>9.64</b>	<b>9.54</b>	<b>9.83</b>	<b>9.82</b>	<b>10.13</b>	<b>10.64</b>	<b>11.28</b>	<b>123.90</b>
<b>Estimated Fuel Cost</b>														
Total Natural Gas Cost @ US\$ 6.08/MMBtu	MMUS\$	64.83	61.83	65.29	66.04	64.42	58.64	57.98	59.75	56.69	61.58	64.69	68.59	750.3
Total HFO Cost @ US\$ 45/bbl	MMUS\$	0.94	0.85	0.94	0.91	0.91	0.91	-	-	-	-	-	-	5.5
<b>Total Fuel Cost (US\$ Million)</b>	<b>MMUS\$</b>	<b>65.77</b>	<b>62.68</b>	<b>66.23</b>	<b>66.95</b>	<b>65.33</b>	<b>59.55</b>	<b>57.98</b>	<b>59.75</b>	<b>56.69</b>	<b>61.58</b>	<b>64.69</b>	<b>68.59</b>	<b>755.8</b>

## Appendix D: Historical petroleum products consumption, tonnes

Year	Gasoil	Gasoline	LPG	ATK	Kerosene	Premix	RFO	MGO	Total
1999	693,836	451,329	43,503	91,498	127,365	32,197	63,797	48,445	<b>1,551,970</b>
2000	668,139	527,371	45,000	96,732	67,437	31,429	60,608	50,336	<b>1,547,052</b>
2001	687,769	538,172	42,519	76,230	70,391	27,707	55,227	33,639	<b>1,531,653</b>
2002	720,374	573,474	49,955	90,277	74,695	27,507	55,101	34,420	<b>1,625,804</b>
2003	757,930	482,583	56,708	89,618	68,640	29,697	48,498	33,867	<b>1,567,541</b>
2004	851,878	578,931	65,667	107,201	73,015	28,313	48,041	18,787	<b>1,771,833</b>
2005	883,507	540,889	70,461	119,033	74,178	32,234	50,829	37,234	<b>1,808,366</b>
2006	937,332	514,875	87,957	114,456	76,373	34,665	60,309	39,199	<b>1,865,165</b>
2007	1,151,023	547,363	93,286	122,582	63,213	42,124	54,454	44,344	<b>2,118,388</b>
2008	1,095,900	548,146	117,577	118,965	34,506	52,108	50,867	57,074	<b>2,075,143</b>
2009	1,284,926	705,422	220,603	124,438	89,068	56,651	42,779	38,395	<b>2,562,281</b>
2010	1,222,005	743,017	177,192	108,188	49,243	33,287	32,788	13,436	<b>2,379,157</b>
2011	1,360,491	807,007	214,430	135,315	62,315	45,564	37,529	150,872	<b>2,813,524</b>
2012	1,583,132	992,726	268,486	141,344	45,632	58,883	33,500	162,651	<b>3,286,356</b>
2013	1,654,325	1,080,646	251,759	131,928	27,786	58,337	39,328	120,011	<b>3,364,120</b>
2014	1,659,295	1,102,263	241,548	113,903	9,143	56,248	26,812	64,536	<b>3,273,749</b>
2015	1,873,224	1,162,088	279,020	112,026	6,852	47,190	13,425	33,547	<b>3,527,373</b>
2016	1,731,072	1,069,175	281,474	132,211	8,061	55,980	12,943	36,310	<b>3,327,226</b>
2017	1,540,405	1,072,567	276,703	166,645	5,586	68,755	10,786	121,069	<b>3,262,516</b>
2018	1,802,372	1,255,143	288,329	200,337	4,966	55,335	35,754	34,319	<b>3,676,554</b>
2019	1,872,760	1,345,633	299,575	231,729	3,783	54,408	41,433	32,886	<b>3,882,208</b>
2020	1,964,085	1,526,890	332,370	128,660	4,958	76,821	48,344	51,312	<b>4,133,440</b>