



# STRATEGIC ACTION PLAN FOR THE NATIONAL MEDICAL OXYGEN POLICY







**MINISTRY OF HEALTH**

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**STRATEGIC ACTION PLAN FOR THE  
NATIONAL MEDICAL OXYGEN POLICY  
2023 - 2027**

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**JANUARY 2023**

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## **FOREWORD**

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Medical oxygen is an essential medicine used to manage a wide range of diseases where hypoxemia (insufficient oxygen in the blood) arises as a complication. The only treatment for hypoxemia is medical oxygen therapy. Medical oxygen therapy, also known as supplemental oxygen therapy, is the use of inhaled oxygen as an essential medicine in medical treatment. The purpose of supplying additional oxygen is to eliminate hypoxemia that may lead to tissue hypoxia and death. Oxygen supplementary treatment works by increasing oxygen content in the blood in patients with low levels of oxygen in the blood, in an attempt to oxygenate the vital organs in the body and avoid tissue hypoxia and death.

In Ghana, hypoxemia-related morbidity and mortality is a common event, which was exacerbated by the outbreak of the COVID-19 pandemic. In 2020, institutional deaths associated with respiratory diseases contributed to 15.5% of deaths across all ages. For children under five years, 16.5% died due to respiratory diseases. It is reported that there are about 5,000 pneumonia-related deaths annually in new-born and children younger than 5 years in Ghana (the third highest cause of death in this age group). Studies have shown that improved supply and utilization of oxygen in the healthcare setting has the potential to reduce mortality from childhood pneumonia by 35%. In summary, the ability to quickly detect and treat hypoxemia is critical to patient care.

COVID-19 pandemic brought to light the inadequacies in the production, supply, distribution, and use of medical oxygen globally, regionally, and in Ghana specifically. It has accelerated global demand for medical oxygen by 3-7 folds and made the delivery of oxygen supplies more urgent than ever.

It is against this background that, the Ministry of Health, its Agencies, Development Partners and Key Stakeholders (including the Private Sector) have come together to develop the Strategic Action Plan, to establish the framework and lay the foundation for a national strategy for scaling-up production, availability, access, and use of medical oxygen across the country.

As the Minister responsible for Health, I have a strong belief that if this Strategic Action Plan for the implementation of the National Medical Oxygen Policy is implemented effectively and efficiently by all sector players, Ghana will reduce drastically hypoxemia related morbidity and mortality deaths especially pneumonia related morbidity and mortality to the barest level.



Kwaku Agyeman-Manu (MP)  
Minister for Health

## **ACKNOWLEDGEMENT**

The Strategic Action Plan for the National Medical Oxygen Policy (2023) has seen the light of day because of collaborative efforts of the Ministry of Health and its Agencies, Development Partners, and other Key Stakeholders (*refer to APPENDIX II: Table 13*).

The Ministry of Health would like to appreciate the Minister for Health, Honourable Kwaku Agyeman-Manu; the Deputy Ministers for Health, Honourable Tina Mensah and Honourable Mahama Asei Seini, and the Chief Director, Kwabena Boadu Oku-Afari, and all Heads of Agencies for their strategic leadership.

Our deepest gratitude also goes to the Director, Policy Planning Monitoring and Evaluation Directorate (PPMED); Director, Infrastructure Directorate; Director, Technical Coordination; Head, Biomedical Engineering Unit as well as the Technical Working Group (TWG) members (*refer to APPENDIX II: Table 12*) who provided the technical guidance in the development of the National Medical Oxygen Policy and the Technical Working Group and all stakeholders whose effort have resulted in the development of this Strategic Action Plan.

We also wish to acknowledge the efforts of various institutions such as UNICEF, WHO and Clinton Health Access Initiative (CHAI) for their financial and technical assistance to the process.

## **ACRONYMS**

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AfCFTA	African Continental Free Trade Area
AGI	Association of Ghana Industries
ASU	Air Separation Unit
AU	African Union
BEU	Biomedical Engineering Unit
CHAG	Christian Health Association of Ghana
CHAI	Clinton Health Access Initiative
CHPS	Community-Based Health Planning and Services
CMA	Common Management Arrangement
CPESDP	Coordinated Programme of Economic and Social Development Policies
DHIMS 2	District Health Information Management System
DP	Development Partners
EPA	Environmental Protection Agency
FBO	Faith Based Organization
FDA	Food and Drug Authority
GHS	Ghana Health Service
GMP	Good Manufacturing Practices
GoG	Government of Ghana
GPP	Good Production Practices
GSA	Ghana Standards Authority
HCW	Healthcare Worker
HeFRA	Health Facilities Regulatory Agency
HMIS	Health Management Information System
ICU	Intensive Care Unit
ID	Infrastructure Directorate
IHR	International Health Regulations
LMIS	Logistics Management Information System
LOX	Liquid Oxygen
LPM	Litres Per Minute
MDAs	Ministries, Departments and Agencies
MELR	Ministry of Employment and Labour Relations
MoE	Ministry of Energy
MoF	Ministry of Finance
MoH	Ministry of Health
MoI	Ministry of Information
MoTI	Ministry of Trade and Industry
NCCE	National Commission for Civic Education
NGO	Non-Governmental Organization
NHIA	National Health Insurance Authority
NHIS	National Health Insurance Scheme



## **ACRONYMS**

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NHP	National Health Policy
NICU	Neonatal Intensive Care Unit
Nm <sup>3</sup> /hr	Normal Cubic Meter/Hour
NSAP	National Strategic Action Plan
O <sub>2</sub>	Oxygen (Molecule)
PHC	Primary HealthCare
PPM	Planned Preventive Maintenance
PPMED	Policy Planning, Monitoring and Evaluation Directorate
PSA	Pressure Swing Adsorption
QoL	Quality of Life
SDG	Sustainable Development Goals
SOP	Standard Operating Procedure
UHC	Universal Health Coverage
UN	United Nations
UNICEF	United Nation International Children's Emergency Fund
WFP	World Food Programme
WHO	World Health Organization

# GLOSSARY

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Agency of MoH	Authorities/ institutions established by law that work directly or indirectly under MoH e.g., GHS, FDA, HeFRA, GSA, etc.
Asphyxia	The condition arising when the body is deprived of oxygen leading to suffocation, unconsciousness, and even death
Collaborators of MoH	International organizations that supports the activities of MoH e.g. UNICEF, CHAI, WHO, GHS, GSA, FDA etc.
Hypoxemia	Insufficient or low level of oxygen in the blood
Medical oxygen	Oxygen gas without contaminants which is classified as essential medicine used to treat or prevent hypoxia.
Medical oxygen systems	Systems set up for the Production/ manufacturing, procurement, installation, distribution/supply, transportation, and the required expertise to ensure the availability of quality medical oxygen for health care delivery
Oxygen flow rate	The flow rate of oxygen required to achieve specific saturation
Oxygen source	Cylinders, concentrators, plants
Private sector	Consist of private bodies including the private health sector
Pulse oximeter	A device for measuring oxygen saturation level in the body
Quality of life	Individuals' standard of health and comfort

# **1.0 CHAPTER 1 - INTRODUCTION**

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## **1.1 BACKGROUND**

Medical oxygen is an essential medicine used to manage a wide range of diseases where hypoxemia (insufficient oxygen in the blood), arises as a complication. The only treatment for hypoxemia is medical oxygen therapy. Medical oxygen therapy, also known as supplemental oxygen therapy, is the use of inhaled oxygen as an essential medicine in medical treatment. The purpose of supplying additional oxygen is to eliminate hypoxemia that may lead to tissue hypoxia and death. Oxygen supplementary treatment works by increasing oxygen content in patients with low levels of oxygen in the blood, in an attempt to oxygenate the vital organs in the body and avoid tissue hypoxia.

Medical oxygen is crucial and essential for the treatment of patients with diseases that affect lung function, shortness of breath, or difficulty in breathing which hampers the supply of oxygen to various parts of the body, others include pneumonia, birth asphyxia, sepsis, malaria, asthma, heart disease and other lung diseases, amongst others. Pneumonia is a major cause of hypoxaemia leading to death among all age groups. Pneumonia resulted in 1.4 million deaths globally among all age groups in 2010 (7% of the world's yearly total) and 3.0 million deaths in 2016 (the 4th leading cause of death in the world<sup>[1][2]</sup>). In 2015, pneumonia was responsible for the deaths of 473,000 African children under the age of five years old.[5] In Sub-Saharan Africa, there are an estimated four million cases and 200,000 deaths in adult populations per year.<sup>[3]</sup>

It is estimated that 20–40% of these deaths could be prevented with the availability of oxygen therapy<sup>[4]</sup>. Oxygen is used across all levels of the healthcare; it is essential in safe surgery, anaesthesia, obstetric, and emergency care, within several units of the health system including Neonatal (New-Born) Intensive Care Units (NICU), Paediatric Units, General wards, Emergency transport (Ambulance), Delivery Units, and Intensive Care Units (ICUs).

The COVID-19 pandemic brought to bear, the inadequacies in the production, supply, distribution and use of medical oxygen globally, regionally, and in Ghana specifically. It has accelerated global demand for medical oxygen by 3-7 folds and made the delivery of oxygen supplies more urgent than ever.<sup>5</sup>

Ghana still faces a high burden of deaths due to lack of access to oxygen. Despite numerous World Health Organization (WHO) guidelines emphasising the importance of oxygen across the continuum of care, availability and supply of medical oxygen to patients have been inadequate, especially to those who need it most.

Specific barriers to availability and supply of oxygen resources in Ghana include limited production capacity, inefficient logistics management (especially transportation), limited oxygen cylinders and high production cost. Additionally, an erratic payment system, inadequate human resources capacity (for use, maintenance, and management), inadequate technical training, poor quality and unreliable power supply, high electricity tariffs, erratic supply chain systems and logistics, few medical oxygen-producing plants, and poor maintenance including spare parts availability compound the issues.

Additionally, the availability of medical oxygen in public and private health facilities as well as pre-hospital care services, highly depends on a facility's geographic location and their proximity to oxygen generation sources. In urban centres and high -population regions, medical oxygen is more readily available whereas in remote areas, supply chain and logistical challenges along with infrastructural limitations (e.g., electricity availability and road network) limit access to medical oxygen. There is therefore the need to address the availability of oxygen delivery and monitoring devices as vital health commodities and as part of the measures to scale up medical oxygen access and use in the country.

To mitigate these aforementioned challenges, there have been multiple initiatives by the Ministry of Health, its Agencies and Partners, the Private Sector, and other health care providers (including the private and Quasi-Governmental providers) to improve medical oxygen availability in the country. These initiatives have included the installation of onsite Oxygen Pressure Swing Adsorption (PSA) plants, procurement, and distribution of medical oxygen and therapy commodities to health facilities and ambulances.

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1 <https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death>, ^ Jump up to:a b “The top 10 causes of death”. *www.who.int*. Retrieved 2018-12-07.

2 Ruuskanen O, Lahti E, Jennings LC, Murdoch DR (April 2011). “Viral pneumonia”. *Lancet*. 377 (9773): 1264–75. doi:10.1016/S0140-6736(10)61459-6. PMC 7138033. PMID 21435708.

3 Child health”. WHO | Regional Office for Africa. Retrieved 2020-11-12

4 The life-saving power of medical oxygen | by World Health Organization | World Health Organization, <https://medium.com/who/the-life-saving-power-of-medical-oxygen-9f8385c4c613>. Date accessed: 25th May 2021

5 Based of off various WHO clinical guidelines

Additionally, the government and its development partners have led the procurement of portable oxygen concentrators and cylinders across all levels of healthcare, especially referral hospitals at the height of the COVID-19 pandemic. Oxygen concentrators and cylinders remain the most common modalities of oxygen provision to patients in Ghana.

Despite these efforts, most health facilities and ambulances in the country have limited availability of a continuous source of medical oxygen. It is therefore appropriate that the Ministry of Health ensures that medical oxygen production and access is adequately funded, always available and captured in health plans and budgets.

The National Medical Oxygen Policy (2023) was developed to establish the strategic framework and lay the foundation for this Strategic Action Plan for scaling-up production, availability, access and use of medical oxygen across the country.

## **1.2 SITUATIONAL ANALYSIS**

In Ghana, hypoxemia-related morbidity and mortality is a common event, which was exacerbated by the outbreak of the COVID-19 pandemic. In 2020, institutional deaths associated with respiratory diseases contributed to 15.5% of deaths across all ages. For children under five years, 16.5% died due to respiratory diseases<sup>6</sup>. It was reported that there were about 5,000 pneumonia-related deaths annually in new-born and children under 5 in Ghana (the third highest cause of death in this age group)<sup>7</sup>. Studies have shown that improved supply and utilization of oxygen in the healthcare setting has the potential to reduce mortality from childhood pneumonia by 35%<sup>8</sup>. In summary, the ability to quickly detect and treat hypoxemia is critical to patient care.

After the declaration of the novel COVID-19 as a pandemic by the President of the Republic of Ghana in March 2020, Ghana experienced three waves of COVID-19 infections within 18 months: from May to August 2020, and again from January to March 2021, then July to September 2021. The second and third waves were characterized by an increase in severe and critical cases of COVID-19 infections. This led to increase in demand for medical oxygen therapy.

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6 DHIMS 2 data for 2020

7 Mercy Abbey, Seth Kwaku Afagbedzi, Jane Afriyie-Mensah, David Antwi-Agyei, Kirchuffs Atengble, Ebenezer Badoe, James Batchelor, Eric S Donkor, Reuben Esena, Bamenla Q Goka, Michael G Head, Appiah-Korang Labi, Edmund Nartey, Isabella Sagoe-Moses, Edem M A Tette, *Pneumonia in Ghana—a need to raise the profile*, *International Health*, Volume 10, Issue 1, January 2018, Pages 4–7, <https://doi.org/10.1093/inthealth/ihx062>

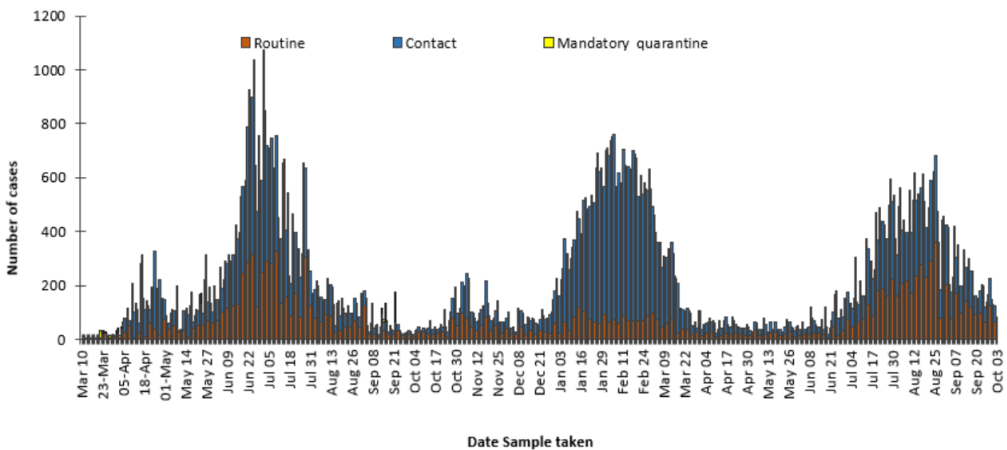
8 Duke T et al. *Improved oxygen systems for childhood pneumonia: a multihospital effectiveness study in Papua New Guinea*. *Lancet* 2008; 372(9646):1328-1333.

## Strategic Action Plan

The second and third waves resulted in an increase in the case fatality rate from 0.6% in December 2020 to 2.4% in September 2021 (**Figure 1**).

During these periods, the demand for medical oxygen was very high with reported shortages in all healthcare facilities. Patient admissions into healthcare facilities for COVID-19 treatment were largely influenced by availability of medical oxygen.

In line with the country's Strategic Response Plan for COVID-19, which aimed to: contain the virus; slow down and manage community spread; provide medical and psychosocial care for COVID-19 cases; and minimize the impact on social and economic life, it was imperative for Ghana to adequately prepare for a surge. The country's experience during the second and third waves illustrated the growing demand for therapeutics, including medical oxygen.



*Figure 1- COVID-19 related deaths in Ghana; March 2020-September 2021*

Limited access to and use of effective diagnostic tools and medical oxygen for diagnosis, treatment and management of hypoxemia, as well as the absence of supportive clinical governance and equipment maintenance systems, were prevalent in Ghana. Diagnostic tools such as pulse oximeters, which support the diagnosis of hypoxemia, and monitors the patients' response to oxygen therapy, were also not readily available.

### 1.2.1 OXYGEN DELIVERY METHODS

Oxygen delivery methods – sources and storage modalities - include oxygen cylinders, concentrators and oxygen plants (*Table 1*). In Ghana, there are four main oxygen supply methods: onsite oxygen production plants, liquid oxygen tanks, pressurised oxygen cylinders and portable oxygen concentrators. Health facilities across the country use a combination of these medical oxygen supply options to ensure both access and cost-effectiveness.

*Table 1 - Medical Oxygen Production and Storage Equipment*









	Cylinders	Concentrators	Oxygen Plant	Liquid Oxygen Tank
<b>Images</b>				
<b>Description</b>	High-pressure gas supplied via portable canisters delivered to facilities	Self-contained, electrically powered, bedside medical device designed to deliver concentrated oxygen via PSA technology	Oxygen is provided via larger PSA Plant and is delivered to facilities via direct piping onsite or via cylinders	Bulk liquid oxygen is generated offsite, stored in a large tank, and supplied to a facility either through a facility’s pipeline system or high-pressure gas cylinders (after conversion and filling)

Table 1 (cont.) - Medical Oxygen Production and Storage Equipment

	Cylinders	Concentrators	Oxygen Plant	Liquid Oxygen Tank
<b>Images</b>				
<b>Optimal use case</b>	Facilities without steady electricity but reachable via a cylinder transport mechanism	Facilities with steady electricity or without easy access to cylinder transport	Higher-level facilities with substantial demand and with steady electricity	Higher-level facilities where power is unreliable and/or space is not available for a PSA plant.
<b>Advantages</b>	<ul style="list-style-type: none"> <li>• No associated running cost</li> <li>• No need for electricity</li> <li>• Delivery flow up to 25 LPM</li> </ul>	<ul style="list-style-type: none"> <li>• Lower running cost, but the limited output</li> <li>• Can serve several patients (if flow requirements are low)</li> </ul>	<ul style="list-style-type: none"> <li>• Cost-effective for larger facilities</li> <li>• High-pressure oxygen can be installed in remote locations</li> <li>• Potential for income generation</li> </ul>	<ul style="list-style-type: none"> <li>• Cost-effective for larger facilities</li> <li>• High-pressure oxygen</li> <li>• Nominal electricity needed (for controls and alarms only)</li> </ul>
<b>Drawbacks</b>	<ul style="list-style-type: none"> <li>• High costs associated with transport</li> <li>• Can be hard to move within a facility</li> <li>• Cylinder presents associated risks (weight and pressure)</li> </ul>	<ul style="list-style-type: none"> <li>• Requires steady power</li> <li>• Service and spare parts needed</li> </ul>	<ul style="list-style-type: none"> <li>• The high capital investment needed</li> <li>• Continuous electricity needed</li> <li>• Service and spare parts needed</li> <li>• The tank has associated risk</li> </ul>	<ul style="list-style-type: none"> <li>• Requires contract for regular refilling</li> <li>• Maintenance requirements for piping</li> <li>• The tank has associated risk</li> </ul>



## **1.2.2 STRUCTURE OF THE HEALTH SYSTEM AND CRITICAL ISSUES**

The Ministry of Health (MoH), like other Ministries, Departments, and Agencies (MDAs) takes its mandate from the Civil Service Act, 1993 (PNDCL 327) for policy formulation, monitoring, and evaluation, resource mobilization and allocation, financing, health training, health research and regulation of the health sector. This mandate is performed through the public agencies under the MoH, other public agencies under other ministries and private not-for-profit and private-for-profit organisations.

Service delivery public agencies and organisations under the MoH include Ghana Health Service, National Blood Service, National Ambulance Service, Saint John's Ambulance Brigade, Ghana Red Cross Society, Komfo Anokye Teaching Hospital, Korle-Bu Teaching Hospital, Cape Coast Teaching Hospital, Tamale Teaching Hospital and Ho Teaching Hospital. Other public agencies which are not under the MoH include the Quasi-Governmental Health Institutions. Not-for-profit private sector service providers include the Christian Health Association of Ghana (CHAG) and the Ahmadiyya Muslim Mission Health Services, and the Society of Private Self-Financing Facilities which are for profit.

The Food and Drugs Authority, Health Facility Regulatory Agency, Mental Health Authority, Traditional and Alternative Medicine Practice Council, Medical and Dental Council, Allied Health Professions Council, Nursing and Midwifery Council, Psychology Council, Pharmacy Council, Ambulance Council, Mortuaries and Funeral Facilities Agency, are some of the regulatory agencies involved in regulating aspects of the health sector. The National Health Insurance Authority was established to attain universal health insurance coverage for all people living in Ghana and to provide financial access to healthcare services to persons covered by the National Health Insurance Scheme.

The health system operates at the national, regional, district, sub-district, and community levels. The apex facility along the continuum of care is at the tertiary level, represented by Teaching Hospitals, while the regional hospitals are the secondary level facilities with the district hospital serving as the primary level of care. The primary level of the healthcare system includes: 1) Community-Based Health Planning and Services (CHPS) serving as the close-to-client and first point-of-call facility; 2) the sub-districts with the Health Centres as the point-of-care at the sub-district level and 3) the district hospital or Polyclinic as the apex point of care at the district level.

As of December 2020, Ghana had 8,887 health facilities, which by ownership are categorised as follows: 7,216 public health facilities (of which 79 are Quasi-Governmental facilities), 280 private not-for-profit, and 1,331 Private Self-Financing for profit. These 8,887 health facilities are further categorised by levels of care: 4 Special Hospitals (1 Quaternary and 3 mental Hospital), 5 Tertiary (Teaching) hospitals, 7 Secondary Referral/Regional Hospitals, 478 Primary Referral hospitals (Public and Private), 992 Polyclinics and Health Centres, 5,998 CHPS Compounds, 1,403 Maternity Homes and Clinics.

Generally, the health of the population has improved over the years. Life expectancy has improved from 57 years in 1990 to 64 years in 2017. In the same vein, the Maternal Mortality Ratio dropped to 310 per 100,000 live births in 2017 from 315 per 100,000 in 2007; the Under-5 mortality rate which in 2005 was 72 per 1000 live births, has reduced to 56 per 1000 live births in 2017. These outcome indicators show positive returns on health investments made over the years. However, the impact of COVID-19 on these health indices is yet to be ascertained.

### ***1.2.2.1 SYSTEMIC CHALLENGES***

Systemic challenges remain, including

1. Inadequate and inequitable distribution of human resources;
2. Inadequate health infrastructure;
3. Inadequate sustainable financing;
4. Lack of comprehensive general data governance and reporting system;
5. Cross-programmatic inefficiencies;
6. Low compliance to regulations and standards; and
7. Obsolete medical equipment and weak framework for medical oxygen.

These challenges affect the ability of the health system to provide responsive and quality care to the population who need it.

### **1.2.3 PRODUCTION AND SUPPLY LANDSCAPE**

As of August 2021, twenty-seven (27) known commercial oxygen producers have set up Oxygen Production Plants in Ghana (*refer to table 2*), out of which seventeen (17) installed Cryogenic technology plants to produce oxygen at 99.5% while nine (9) had PSA technology plants installed to produce oxygen at 95% (or  $93 \pm 3\%$ ). Information gathered indicated that twelve (12) of the oxygen producers have stopped production due to several reasons of which high electricity tariff was the major reason. Ten (10) of the remaining fifteen (15) producers in operation were using Cryogenic technology.

Among the fifteen (15) active oxygen producers in operation, three (3) were steel production companies whose core mandate was to produce oxygen for refining steel. However, due to the spike in the oxygen demand during the COVID-19 pandemic, the steel production companies dedicated some of their oxygen plants to supply health institutions with medical oxygen. These steel production companies supplied oxygen to the health facilities either at no cost or at a subsidized rate. The rest of the commercial oxygen producers supplied oxygen to health facilities at a commercial rate.

Air Liquide has been the leading and the longest-serving oxygen production company in Ghana. It was the only liquid oxygen producing company in Ghana and the sub-region. Unfortunately, the company relocated its in-country Cryogenic Liquid Oxygen Production Plant to Nigeria in 2017 due to high electricity tariffs and unstable power supply in Ghana. Currently, the company imports liquid oxygen from Cote D'Ivoire, which is stored in a Vacuum Insulated Evaporator (VIE) tank in its factory and refills cylinders for distribution in Ghana. Air Liquide's experience brings to the fore some of the challenges with commercial oxygen production in Ghana.

The challenges of the commercial oxygen production include:

- High electricity tariffs and unstable power supply for commercial production of medical oxygen;
- High water tariffs for commercial production of medical oxygen;
- High tax regime on the sale of medical oxygen, production equipment and spare parts;
- Limited in-country maintenance capacity for medical oxygen systems and equipment;
- Delayed, unreliable and unpredictable payment system especially from the public health facilities;
- High cost of transportation for medical oxygen cylinders and tanks;
- Non-standardized and unapproved tariffs for cost recovery for medical oxygen administered to patients;
- Inconsistent supply of medical oxygen by vendors;
- High debt burden from purchases of medical oxygen;
- Lack of or insufficient oxygen piping network systems coupled with leakages;
- Increase in demand due to COVID-19 pandemic;
- High cost of medical oxygen; and
- Inadequate quantity of medical oxygen cylinders for refilling.

*Table 2 - Oxygen Production Companies in Ghana and their Production Capacities as of August 2021*

<b>ID</b>	<b>Company</b>	<b>Location</b>	<b>Production Method</b>	<b>Capacity (Nm<sup>3</sup>/hr) (Medical Oxygen)</b>	<b>Remarks</b>
1	RikAir	Accra	PSA	15	Active
2	Indo-Ghana Industries Ltd	Accra	ASU	100	Active
3	PanAir	Accra	ASU	100	Active
4	Atmo Gas	Accra	PSA	25	Active
5	Takoradi Gas Ltd	Takoradi	ASU	300	Active
6	Oxygen Dynamics	Kumasi	PSA	30	Active
7	Apex Global Ltd	Kumasi	ASU	120	Active
8	Oxygen Dynamics	Kumasi	PSA	30	Active

ID	Company	Location	Production Method	Capacity (Nm <sup>3</sup> /hr) (Medical Oxygen)	Remarks
9	Airmate Co. Ltd	Kumasi	ASU	120	Active
10	Christy Air	Accra	ASU	100	Active
11	Tamale Air (Along Kintampo road)	Tamale	ASU	100	Active
12	Air Liquide	Tema	LOX Imports	875	Active (Importing)
13	Tema Steel	Tema	ASU	350	Active (Steel)
14	Ferro Fabrik	Tema	ASU	600	Active (Steel)
15	B5 Plus	Tema	ASU	600	Active (Steel)
16	RikAir	Kpone	ASU	50	Not in service
17	Kumoxigen	Accra	PSA	30	Not in service
18	Baako's Oxygen Ltd	Accra	PSA	40	Not in service
19	Tamale (Along Sarlugu road)	Tamale	PSA	22	Not in service
20	OxyAir Ltd	Accra	PSA	100	Not in service
21	Western Castings	Accra	ASU	200	Not in service
22	Joku Maks	Kumasi	PSA	100	Not in service
23	Western Castings	Kumasi	ASU	200	Not in service
24	Wahome Steel	Tema	ASU	160	Not in service
25	Western Castings	Tema	ASU	200	Not in service
26	Park Air	Tema	ASU		Not in service
27	Western Castings	Takoradi	ASU	200	Not in service

In addition to the commercial oxygen production in the country, twenty-seven (27) hospitals (both public and private) had installed Pressure Swing Adsorption (PSA) Plants for in-hospital medical oxygen production (*refer to Table 3 below*) and deliver the oxygen directly to the clinical areas through the central oxygen piping system within the respective hospitals, as of August 2021. The number of hospitals with the oxygen-producing plants is increasing. As of the year 2000, there were only three (3) hospitals (KBTH, KATH and CCTH) that had onsite oxygen-producing plants. These plants have different capacities and are at varying levels of functionality. The hospitals that do not have the onsite oxygen producing plant depend solely on the supply of oxygen in cylinders from the commercial market.

*Table 3 - Health Facilities with onsite Medical Oxygen Production Plants in Ghana*

HOSPITALS WITH OXYGEN PRODUCTION PLANTS					
ID	Region	Facility	Level	Capacity (Nm <sup>3</sup> /hr)	Remarks
1	Accra	Korle Bu Teaching Hospital	Tertiary	134.8	Active
2	Accra	Ga East Municipal Hospital	Primary	27.6	Active
3	Accra	Shai Osudoku Hospital, Dodowa	Primary	12	Active
4	Accra	Trust Mother & Child Hospital in Osu	Primary	8	Active
5	Accra	Bank of Ghana Hospital at Cantonment	Primary	8	Active
6	Accra	International Maritime Hospital, Tema	Primary	15	Active

Table 3 (cont.) - Health Facilities with onsite Medical Oxygen Production Plants in Ghana

HOSPITALS WITH OXYGEN PRODUCTION PLANTS					
ID	Region	Facility	Level	Capacity (Nm <sup>3</sup> /hr)	Remarks
7	Accra	37 Military Hospital, Accra	Primary	52	Active
8	Accra	Greater Accra Regional Hospital	Secondary	90	Active
9	Accra	University of Ghana Medical Centre, Legon	Tertiary	25	Active
10	Accra	UN Field Hospital (WHO-WFP)	Primary	90	Active
11	Ashanti	Komfo Anokye Teaching Hospital	Tertiary	120 (2x60)	Active
12	Ashanti	Tepa Hospital	Primary	15.6	Active
13	Ashanti	Bekwai Hospital	Primary	13.4	Active
14	Ahafo	Nsawkaw Hospital	Primary	15.6	Active
15	Central	Cape Coast Teaching Hospital	Tertiary	20	Active
16	Central	Twifo Praso Hospital	Primary	15.6	Active
17	Eastern	Koforidua Regional Hospital	Secondary	20	Active
18	Eastern	Somanya Hospital	Primary	9.4	Active

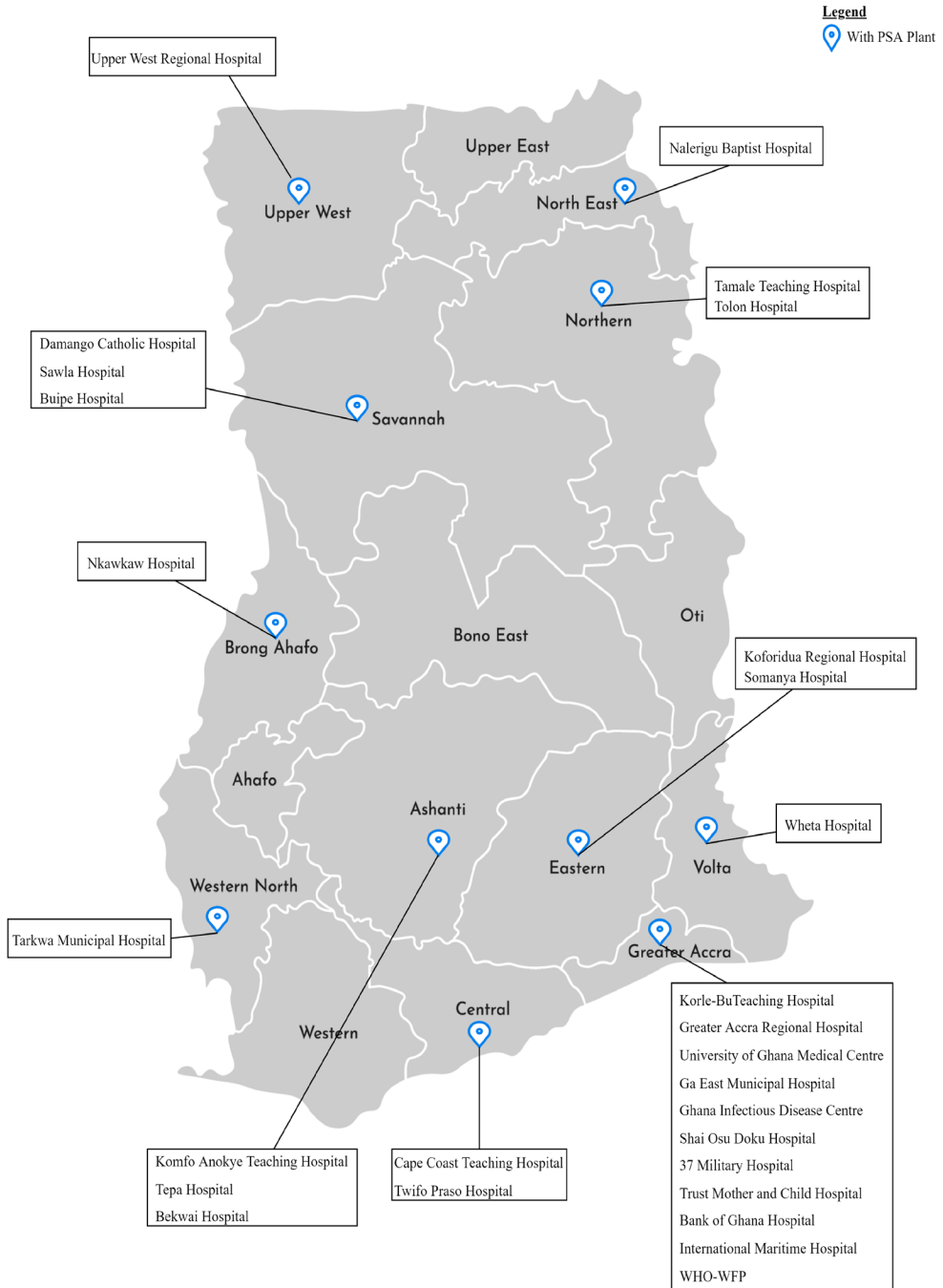
Table 3 (cont.) - Health Facilities with onsite Medical Oxygen Production Plants in Ghana

HOSPITALS WITH OXYGEN PRODUCTION PLANTS					
ID	Region	Facility	Level	Capacity (Nm <sup>3</sup> /hr)	Remarks
19	Northern	Tamale Teaching Hospital	Tertiary	20	Active
20	Northern	Tolon Hospital	Primary	9.4	Active
21	North East	Nalerigu Baptist Hospital	Primary	30	Active
22	Western	Tarkwa Municipal Hospital	Primary	10	Active
23	Upper West	Upper West Regional Hospital	Secondary	36	Active
24	Savannah	Buipe Hospital	Primary	13.4	Active
25	Savannah	Sawla Hospital	Primary	9.4	Active
26	Savannah	Damango Catholic Hospital	Primary		Inactive
27	Volta	Weta Hospital	Primary	9.4	Active
<b>TOTAL Capacity =</b>				<b>829.6 m<sup>3</sup>/hr</b>	

As demonstrated in the *Table 3 above and the Figure 2* below, a disproportionate number of these facilities, sixteen (16) constituting 61.5% are located in the southern zone compared to four (4) constituting 15.4% in the middle zone and six (6) constituting 23.1% in the northern zone. The installed capacities of the onsite oxygen production plants range from about 8m<sup>3</sup>/hr to around 140m<sup>3</sup>/hr. Comprehensive data on oxygen plants, oxygen equipment inventories and maintenance records were limited. Information on oxygen resources should be established or improved for coordination of the supply and distribution of life-saving oxygen for patients.



**HOSPITAL WITH ON-SITE MEDICAL OXYGEN (PSA) PLANT**



*Figure 2 - Distribution of Hospital-based PSA oxygen producing plants*

Other hospitals, polyclinics, health centres, clinics, CHPS Compounds, maternity homes and ambulances rely on cylinders or portable oxygen concentrators for their oxygen needs. They procure their oxygen from the commercial oxygen production plants and transport them to their respective health facilities. With the oxygen production companies primarily located in the major cities in the southern

and middle belts, namely, Accra-Tema, Sekondi-Takoradi and Kumasi areas, health facilities in the other parts of the country sourcing oxygen from these areas must travel long distances to purchase their oxygen, thus resulting in higher transportation costs. The estimated transportation cost ranges from GHC 300.00 (equivalent to US\$51.28 at the rate of US\$1 = GHC5.85 as of 31st August 2021) to GHC 900.00 (equivalent to US\$153.85) per trip depending on location.

Several health facilities are confronted with challenges in oxygen access and sufficiency. These challenges include:

- High cost of oxygen producing plants;
- Lack of or inadequate oxygen cylinders;
- High oxygen cylinder transportation cost;
- Lack of funds to guarantee timely payment;
- Non-existent tariff regime for cost recovery for oxygen administered to patients;
- Inconsistent supply/delivery of oxygen by vendors;
- High debt burden from purchases of oxygen;
- Insufficient capacity to maintain oxygen systems;
- Lack of or insufficient oxygen piping network systems coupled with leakages; and
- Increase in demand due to COVID-19 pandemic.

All these challenges contribute to frequent stock out and shortages in oxygen supply in many health facilities across the country.

#### ***1.2.4 PROCUREMENT LANDSCAPE***

The responsibility for procuring medical oxygen and related equipment lies primarily with the individual health facilities. Decentralised procurement to this effect makes it difficult to coordinate the use, negotiate and standardize the prices for medical oxygen and efficiently provide training to end-users and maintenance professionals. For example, hospitals can procure medical oxygen and related equipment independently using their budgets. There is a need for a national guideline with technical specifications to guide procurement practices across the country.

There are three types of oxygen production companies in Ghana:

1. Commercial oxygen producers;
2. Steel manufacturers and;
3. Other industrial manufacturers (e.g. mining companies).

As of August 2021, steel companies sold their oxygen around GHC5.00 (equivalent to US\$0.85) per cubic meter of oxygen whilst the commercial oxygen producers sold their oxygen between GHC10.00(equivalent to US\$1.71) to GHC20.00(equivalent to US\$3.42) per cubic meter, depending on the technology they use in producing the oxygen. The wide variation in the prices between the steel companies and the commercial oxygen producers is due to the special subsidized electricity tariffs and tax incentives offered to the steel companies, to which the commercial oxygen producers are not entitled. For example, whilst the steel companies pay around 50p/kWh of electricity, the commercial medical oxygen producers pay close to GHC20.00/kWh of electricity. Thus, the pricing of medical oxygen in Ghana is highly influenced by the electricity tariff.

In addition to the local production of oxygen, some companies import oxygen for use in Ghana. According to the World Bank, the top exporting countries of medical oxygen into Ghana in 2019 included Cote D'Ivoire, the European Union, and China<sup>8</sup>. The table below illustrates details of exporters of medical oxygen to Ghana.

*Table 4 - Top Exporters of Medical Oxygen to Ghana*

Reporter	Trade Flow	Product Code	Product Description	Year	Partner	Trade Value 1000USD
Cote d'Ivoire	Export	280440	Medical oxygen	2019	Ghana	279.42
European Union	Export	280440	Medical oxygen	2019	Ghana	10.33
China	Export	280440	Medical oxygen	2019	Ghana	6.39
South Africa	Export	280440	Medical oxygen	2019	Ghana	5.88

<sup>8</sup> <https://wits.worldbank.org/trade/comtrade/en/country/All/year/2019/tradeflow/Exports/partner/GHA/nomen/h5/product/280440>, Accessed 15th September 2021

Table 4 - Top Exporters of Medical Oxygen to Ghana

Reporter	Trade Flow	Product Code	Product Description	Year	Partner	Trade Value 1000USD
United Kingdom	Export	280440	Medical oxygen	2019	Ghana	3.96
United States	Export	280440	Medical oxygen	2019	Ghana	3.53
Spain	Export	280440	Medical oxygen	2019	Ghana	2.38
Belgium	Export	280440	Medical oxygen	2019	Ghana	3.75

Major challenges with procurement of oxygen include high cost of oxygen, inadequate or lack of oxygen cylinders for refilling and delayed and unpredictable payment. This has increased the debt burden of health facilities.

### 1.2.5 FINANCING LANDSCAPE

Medical oxygen is captured as essential Medicine on the Ministry of Health's Seventh Edition, 2017 Essential Medicines List<sup>9</sup> but the National Health Insurance Authority does not currently reimburse it as a medicine separately, but rather as bundled charge.

Government, as part of the capital investment program, finances the initial set up of the medical oxygen as part of the medical gas systems in some health facilities. It provides assistance for the installation of onsite medical oxygen production plants, installation of the central piping network for distribution of oxygen, provision of oxygen concentrators, oxygen cylinders and related equipment or accessories. On the other hand, facilities are responsible for the maintenance and refilling of the oxygen cylinders using their facility's Internal Generated Fund (IGF).

<sup>9</sup> Ministry of Health, Ghana National Drugs Programme, Essential Medicines List Seventh Edition, 2017

Higher-level facilities including the secondary and tertiary levels are able to finance oxygen supply and undertake oxygen plant and oxygen concentrator maintenance (both planned and corrective) to some extent. On the other hand, majority of the Primary Health Care facilities (from District Hospitals down to CHPS Compounds) which depend heavily on the NHIS reimbursement for their IGF are challenged with funding for oxygen supply. Since the NHIS does not currently reimburse oxygen as a medicine separately, but rather as bundle charges, the facilities are not able to realistically recover the cost of medical oxygen consumed by the patients. This results in insufficient funding for medical oxygen.

Also delays in the NHIS reimbursement causes health facilities to be consistently in payment arrears. For example, facilities that rely on oxygen supply in cylinders often face oxygen stock-outs as some suppliers will not refill oxygen cylinders if an account has an outstanding balance. With undue delays, some facilities are denied supply of medical oxygen, which results in stock-outs of oxygen.

Similarly, the National Ambulance Service also faces challenges in procuring oxygen from vendors to manage patients during transport. Oxygen for ambulance services delivery is financed by the GoG annual budget allocation, however, the amounts budgeted for are not released on time and are inadequate to support the procurement of oxygen and they are always in arrears.

### ***1.2.6 REGULATORY LANDSCAPE***

Essential medicines, including medical oxygen, are regulated under sections 111 to 132 of Part Seven of the Public Health Act, 2012 (Act 851). Medical oxygen is listed on the Essential Medicines List, 2017. However, enforcement of regulation on medical oxygen systems production and standards are limited.

Although medical oxygen is packaged in pressure vessels (cylinders) and could be regulated under the Factories, Offices, and Shops (Boiler and Pressure Vessels) Safety Act, 1970 (Act 663), the Act does not take into consideration medical oxygen cylinders. To regulate medical oxygen cylinders or pressure vessels for medical oxygen, the Act needs to be reviewed.

### 1.2.7 AVAILABILITY AND UTILIZATION LANDSCAPE

Reference to the section on oxygen production landscape, oxygen is available on the commercial market but at a higher cost. Health facilities purchase oxygen in cylinders and transport them to their facility. The high cost of oxygen results in an inadequate supply of oxygen in these health facilities.

Unfortunately, medical oxygen is an important resource for the survival of patients especially COVID-19 patients and patients in respiratory distress. Before the COVID-19 pandemic, oxygen stock-out in health facilities existed but was not a major issue. With the COVID-19 pandemic, oxygen demand has increased by 3-7 folds. This has worsened the already existing situation and health facilities are challenged with frequent oxygen shortages. Table 5 below, shows the severity of COVID-19 conditions and amount of oxygen demand for effective treatment. The table illustrates that for 75 patients with severe illness (individuals who have SpO<sub>2</sub> <94% on room air at sea level, a ratio of arterial partial pressure of oxygen to fraction of inspired oxygen (PaO<sub>2</sub>/FiO<sub>2</sub>) <300 mm Hg, a respiratory rate >30 breaths/min, or lung infiltrates >50%) and 25 patients with critical COVID-19 illness presentation (individuals who have respiratory failure, septic shock, and/or multiple organ dysfunction), in a hypothetical 100 bed COVID-19 treatment facility, approximately 90m<sup>3</sup>/hr of oxygen supply would be required. The potential scale and need of oxygen supply has affected the supply of oxygen in many health facilities escalating the already fragile situation.

Table 5 - W.H.O. Oxygen demand estimates for COVID 19 Case Management

Hypothetical 100 Bed Covid-19 Treatment Facility				
Disease Severity	Avg.. O <sub>2</sub> flow rate		Size of Solutions of scale*	
	per patient	Total	PSA Plant	Bulk liquid
Severe 75 Patients	10L/min	75 * 10 * 60 = 45 m <sup>3</sup> /hr	= 45 m <sup>3</sup> /hr	= 1.25 m <sup>3</sup> /day
Critical 25 Patients	30L/min	25 * 30 * 60 = 45 m <sup>3</sup> /hr	= 45 m <sup>3</sup> /hr	= 1.25 m <sup>3</sup> /day
			= 90 m <sup>3</sup> /hr	= 2.5 m <sup>3</sup> /day
1m <sup>3</sup> of gaseous oxygen is approximately 0.8L of liquid oxygen				

**Table 6** below shows a sample of the monthly consumption of oxygen in 7.5m<sup>3</sup> cylinders in selected hospitals in Ghana. These hospitals depend solely on oxygen in cylinders with the exception of Ho Teaching Hospital and Cape Coast Teaching Hospital which had Liquid Oxygen and PSA Plant respectively.

*Table 6 - Sample of Hospitals that Depended on Oxygen in Cylinder for Oxygen Supply and their Average Monthly Consumption as of February 2021*

<b>Hospital</b>	<b>Region</b>	<b>Average Monthly Consumption (No. of 7.5m<sup>3</sup> Cylinders)</b>	<b>Equivalent volume in m<sup>3</sup></b>
Agogo Presbyterian Hospital	Ashanti	100 cylinders	750
Berekum Catholic Hospital	Bono	300 cylinders	2,250
Techiman Holy Family Hospital	Bono East	330 cylinders	2,475
Nkoranza Catholic Hospital	Bono East	140 cylinders	1,050
Police Hospital	Accra	160 cylinders	1,200
Effia Nkwanta Regional Hospital	Western	720 cylinders	5,400
Cape Coast Teaching Hospital	Central	400 cylinders	3,000
Ho Teaching Hospital	Volta	2400 cylinders	18,000

Though there is no scientific data to fully quantify the utilization of medical oxygen in health facilities in Ghana, the recent UNICEF-supported Oxygen Quantification Assessment, which covered 59 health facilities in eight regions, has provided some evidence on the medical oxygen demand in various types of health facilities.

The **Table 7** below provides an estimated volume of oxygen required in different types of public health facilities in Ghana.

*Table 7 - Estimated Oxygen Need*

Facility type	Number of facilities	The average number of beds	<sup>9</sup> Estimated oxygen demand by the level of care (in Nm <sup>3</sup> /h at current bed occupancy rate)
Quaternary	1	600	600
Tertiary Hospitals	5	850	135
Secondary	7	200	90
Primary	157	80	15
Polyclinic	48	30	7
Health Centres	933	8	0.6
CHPS	5526	1	0.3
Clinic	218	5	0.6

Supply of medical oxygen in CHPS Compounds, Clinics and Health Centres do not require piping to deliver medical oxygen within the health facility to patients. On the other hand, hospital and polyclinics require a central oxygen piping network to efficiently deliver medical oxygen to patients.

Unfortunately, most hospitals do not have the appropriate medical oxygen piping systems. This compels such hospitals to resort to the delivery of medical oxygen in cylinders directly to the patient, a practice which is characterised with serious safety consequences. The UNICEF/GHS Quantification Assessment further confirmed the extent of dependence on oxygen cylinder utilisation at patients' bedside.

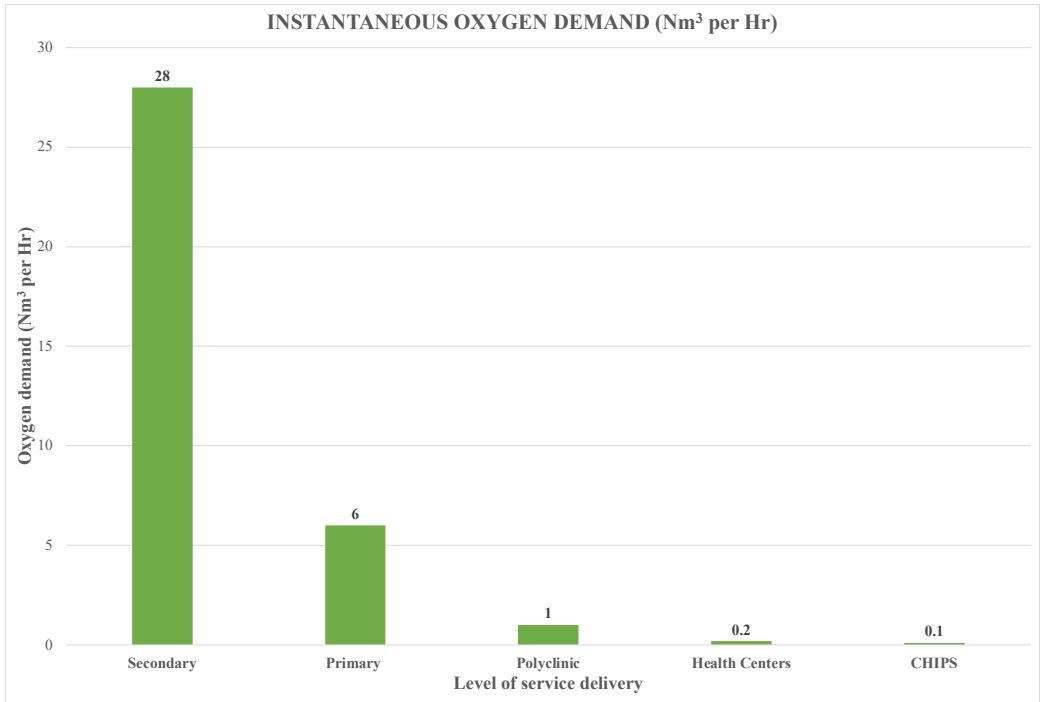
Provision of piping system in the hospitals is essential in eliminating the unsafe practice of using high-pressure oxygen cylinders at the patients' bedside.

Fortunately, newly constructed hospitals are equipped with medical oxygen piping systems, a practice that must be sustained and replicated in all hospitals.



*Strategic Action Plan*

The UNICEF quantification exercise also revealed gaps in the competencies in the maintenance personnel’s capabilities to maintain oxygen systems to ensure safety and continuous availability of oxygen. Other observations included the absence of fault reporting, calibration, preventive and corrective maintenance. All these have contributed to the inefficiencies in the management of oxygen resources and could result in wastage of medical oxygen resources.



*Figure 3 - Hypoxemic bed-based instantaneous oxygen demand by facility type*

## **2.0 CHAPTER TWO - COUNTRY RESPONSE**

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The Policy recognizes several global, regional, and sub-regional compacts and policy frameworks. The following, among others, were mentioned here: the United Nations Sustainable Development Goals (SDGs) on the theme, “Transforming our World: the 2030 Agenda for Sustainable Development”. The International Health Regulations (IHR 2005), the Astana Declaration on Primary Health Care (PHC), the African Union (AU) Vision 2063: “The Africa We Want”, the African Health Strategy (2016-2030), and Global Strategy on Human Resources for Health: Workforce 2030. Medical oxygen is on the WHO Essential Medicine List 21st Edition 2019. It is also aligned to the WHO-UNICEF Technical Specifications and Guidance for Oxygen Therapy Devices, 2019.

### **2.1. STRATEGIC FRAMEWORK**

The Strategic Action Plan for the National Medical Oxygen Policy has been prepared to harmonise activities in the implementation of the National Medical Oxygen Policy to improve medical oxygen production, manufacturing, supply, access, transport, and use. Additionally, it aligns the implementation efforts across key stakeholders, from the national to the facility level for effective and efficient medical oxygen delivery systems at all levels of the health sector, both public and private.

In line with the Policy, this Strategic Action Plan is intended for use by:

1. Manufacturers of medical oxygen in both the private and public sectors,
2. Manufacturers and suppliers/distributors of medical oxygen equipment and accessories in both the private and public sectors,
3. Professionals involved in the production, transport, and maintenance of medical oxygen systems,
4. Financiers and all stakeholders involved in resource mobilisation,
5. Suppliers of medical oxygen,
6. Regulatory bodies,
7. All health facilities, ambulances, clinicians, and health practitioners involved in the administration of oxygen,
8. End users and the public who require oxygen, at home, in health facilities, and ambulances.
9. Health strengthening and implementing partners.

### **2.1.1 SPECIFIC OBJECTIVE:**

1. To create an enabling environment for the production, distribution and rational use of medical oxygen in health facilities in Ghana;
2. To establish a regulatory system for the production, procurement, installation, distribution and rational use of medical oxygen in Ghana;
3. To strengthen supply chain management of medical oxygen systems in Ghana;
4. To strengthen the capacity of all relevant staff on management, maintenance and use of medical oxygen;
5. To strengthen collaboration and partnership across the entire medical oxygen value chain; and
6. Establish a robust monitoring and evaluation system for medical oxygen.

The following guiding principles underpin the Strategic Action Plan for the Policy:

- Multi-sectoral Collaboration;
- Strategic Partnerships;
- Equity;
- Professionalism;
- Regulations, Ethical Standards, and Client Rights; and
- Fairness and Transparency.

## 3.0 CHAPTER THREE - IMPLEMENTATION FRAMEWORK AND PLAN

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The National Strategic Action Plan (NSAP) shall provide details for the implementation of the strategic interventions in the National Medical Oxygen Policy. This edition of the NSAP is for five years (2023-2027) with an implementation cost of **Thirty- one million Ghana Cedis, Five Hundred and Forty-Three Thousand, Five Hundred and Seventy (GHC31,543,570.00)** as of October 2021. This excludes the capital cost of establishing medical oxygen plants at the major facilities which was estimated to cost the Ghana cedi equivalent of Sixty Million US Dollars (US\$ 60 Million).

### 3.1. RESOURCE MOBILISATION AND FINANCING

Mobilising the requisite resources including financial, capital, and human resources is key to the successful implementation of the NSAP (2023-2027). The Ministry of Health in collaboration with relevant stakeholders shall mobilise the needed resources for the implementation of this policy in a bid to achieve the objectives.

Financing options will include, but not limited to:

- GoG Budgetary Support;
- Internally Generated Funds;
- Development Partners;
- Social Strategic Partnership;
- Corporate Bodies;
- Civil Society/ Non-Governmental Organisations;
- Public-Private Partnerships; and
- National Health Insurance Scheme.

## **3.2 INSTITUTIONAL ARRANGEMENTS FOR IMPLEMENTATION**

The implementation of the Strategic Action Plan for the National Medical Oxygen Policy shall be a collective action by all stakeholders led by the MoH through the Common Management Arrangement (CMA) of the health sector. The Ministry shall continue to play its role in leading the development of policies/strategies, planning, regulating, coordinating, monitoring, and evaluating the sector and all its activities. The Minister for Health shall provide the overall political direction in the execution and implementation of the Policy by all relevant agencies and partners. The MoH shall work with and through frontline Agencies, MDAs, and other stakeholders whose mandate covers respective areas of the Policy using existing systems and structures including;

1. The Inter-Agency Leadership Committee (IALC);
2. The Health Sector Working Group (HSWG) meetings;
3. Inter-Agency Committees and Standing Committees;
4. Business Meetings;
5. Annual Health Summit;
6. Decentralised Level Dialogue; and
7. Annual Policy Dialogue.

The Minister for Health shall designate a directorate(s) to coordinate and manage the implementation of the Policy.

## **3.3 IMPLEMENTATION OF BUDGET AND ACTION PLAN**

The Ministry of Health recognises that the implementation of the Policy and strategy will require financial support. To this end, the Ministry shall mobilise and allocate the required budget towards its successful implementation. Details of the budget and the implementation plan for this Strategic Action Plan have been provided in **Table 8** below. Also, the performance indicators for monitoring the implementation of the Policy and the Strategic Action Plan detailed in **Table 9** below.

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
1	<b>Objective 1:</b> To create an enabling environment for the production, procurement, installation, distribution and rational use of medical oxygen in health facilities in Ghana.		6,451,100.00							
	<b>Intervention 1.1:</b> Establish a functional coordination mechanism for the medical oxygen system at national, regional, district and sub-district levels		2,464,600.00							
	<b>Activity 1.1.1:</b> Set up the desk at MOH to coordinate the implementation of the Policy. This includes: - Office space, supplies and equipment	1	651,000.00	MoH, GHS	Agencies of MoH, DPs, Private Sector, GSA, FDA, HeFRA	X				

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
1	<ul style="list-style-type: none"> <li>- <i>Vehicle for transportation</i></li> <li>- <i>Staff recruitment (advertisement, interviews etc.)</i></li> </ul>									
	<p><b>Activity 1.1.2:</b>  <i>Coordinate activities of the ministries, agencies, MDAs, development partners and other private sector players.</i>  <b>This includes:</b>                      - Steering committee meetings (2 times per year)                      - Technical Working Group (4 times per year)</p>	5	1,011,500.00	MoH	MDAs, Agencies, development partners (DPs) Private Entities	X	X	X	X	X

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
1	<ul style="list-style-type: none"> <li>- <i>Quarterly Monitoring Field visits to health facilities (accommodation, DSA, transport)</i></li> <li>- Logistics</li> <li>- <i>Other meetings</i></li> </ul>									
	<p><b>Activity 1.1.3:</b> Develop, maintain and update a database of oxygen production plants and medical oxygen systems (concentrators, cylinders etc.) in the country - public and private.</p>	<b>5</b>	<b>327,500.00</b>	MoH	GSA, HeFRA, FDA, Customs	X	X	X	X	X



Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
1	<i>Activity 1.1.4: Establishment of a steering committee</i>	1	2,100.00	MoH	Agencies	X				
	<i>Activity 1.1.5: Establishment of a technical working group</i>	1	2,100.00	MoH	Agencies	X				
	<i>Activity 1.1.6: Review minimum requirement for health infrastructure to include medical oxygen systems.</i>	1	117,600.00	MoH	Agencies	X				
	<i>Activity 1.1.7: Developing systems for oxygen infrastructure for the production, distribution and delivery of oxygen.</i>		117,600.00	MoH						

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GH¢)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
1	<b>Activity 1.1.8:</b> Putting systems in place for larger facilities (teaching and regional hospitals) to have on-site plants.		117,600.00	MoH	Agencies					
	<b>Activity 1.1.9:</b> Development of systems for commercial oxygen production in the 16 regions		117,600.00	MoH	Agencies					
	<b>Intervention 1.2:</b> Develop a reporting mechanism for medical oxygen systems			762,000.00						
	<b>Activity 1.2.1:</b> Maintain records and all relevant information pertaining to the implementation of the Medical Oxygen Policy	5	390,000.00	MOH	Agencies	X	X	X	X	X

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GH¢)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
1	<i>Activity 1.2.2: Develop and train focal persons on the Developed Protocol</i>	1	82,000.00	MOH	Agencies	X				
	<i>Activity 1.2.3: Train relevant personnel on the developed protocol at sub national level</i>	5	290,000.00	MOH	Agencies	X	X	X	X	X
	<i>Intervention 1.3: Develop a comprehensive resource mobilisation tool for the management of medical oxygen systems</i>			1,525,000.00						
	<i>Activity 1.3.1: Provide technical assistance for forecasting and quantification of oxygen needs</i>	5	430,000.00	MOH	Agencies, DPs	X	X	X	X	X

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
	<b>Activity 1.3.2:</b> Assess resources (domestic and otherwise) necessary to address identified need and gap to ensure continued availability of oxygen in health facilities	1	1,095,000.00	MOH	MDAs, Agencies, DPs	X				
1	<b>Intervention 1.4:</b> Formulate appropriate administrative instrument(s) to guide compliance and adherence to standards		1,151,600.00							
	<b>Activity 1.4.1:</b> Development of legal framework for the establishment of medical oxygen production plant facilities	1	226,000.00	MOH	Oxygen Producers, FDA, GSA,	X				

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GH¢)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
1	<i>Activity 1.4.2: Develop technical and functional requirements for oxygen systems</i>	1	470,400.00	MOH		X				
	<i>Activity 1.4.3: Provide technical assistance for oxygen plant installation, maintenance and standardization</i>	4	411,000.00	MOH	GSA, EPA, DPs, private entities	X	X	X		X
	<i>Activity 1.4.4: Strengthen coordination between relevant agencies in the establishment of Medical Oxygen production sites.</i>		44,200.00	MOH	Agencies,					

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
	<i>Intervention 1.5: Advocate for waivers for the importation of medical oxygen equipment, spare parts as well as sales of medical oxygen in Ghana.</i>		<b>135,600.00</b>							
<b>1</b>	<i>Activity 1.5.1: Develop an advocacy proposal for tax exemption and subsidies for medical oxygen manufacturers and producers. This includes: Register medical oxygen manufacturers under pharmaceutical manufacturers, Development of guidelines for tax exemption for medical oxygen manufacturers</i>	<b>1</b>	<b>226,000.00</b>	MOH	GIPC, GRA, MOF, MOTI, Parliamentary select committee on health, Oxygen Producers	X				

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
1	<i>Activity 1.5.2: Engagement with relevant stakeholders to advocate for tax waiver, electricity subsidies and provision of reliable power supply for medical oxygen producers</i>	2	<b>18,000.00</b>	MOH	MOF, MOEn, MOTI, GRA, ECG, GridCo, VRA, AGI, Energy Commission, Agencies, Oxygen Producers,	X	X			

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
	<b>Intervention 1.6:</b> Develop a mechanism for the timely payment of Oxygen suppliers.		<b>186,000.00</b>							
<b>1</b>	<b>Activity 1.6.1:</b> Review the EML and Standard Treatment Guidelines (STG) by GNNDP to make Oxygen Reimbursable (Oxygen is currently non-reimbursable in the EML)	<b>1</b>	<b>150,000.00</b>	MOH	NHIA, Agencies, Oxygen producers	X				
	<b>Activity 1.6.2:</b> Engage stake holders to fix special tariffs for medical oxygen production		<b>18,000.00</b>	MOH	MoF, MoEn, GridCo, Oxygen Producer, GWC					



Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GH¢)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
	<b>Activity 1.6.3:</b> Engage relevant stakeholders to review guideline on the utilisation of Drug Revolving Fund to include medical oxygen	4	18,000.00	MOH	Agencies	X	X	X	X	
<b>1</b>	<b>Intervention 1.7:</b> Deployment of Oxygen plant at Designated locations and Health Facilities		<b>226,300.00</b>							
	<b>Activity 1.7.1:</b> Feasibility Studies for the Installation of medical oxygen production plant at designated places across the country		<b>208,300.00</b>	MOH	FDA, NHIA					

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
	<b>Activity 1.7.2:</b> <i>Engage the private sector to establish commercial oxygen plant in all regions.</i>		<b>18,000.00</b>	MOH	FDA, NHIA					
<b>1</b>	<b>Activity 1.7.3:</b> <i>Procurement and Installation of medical oxygen production plant in major hospitals in the country (Procurement)</i>		-	MOH	MoF, NHIA, GHS, Oxygen producers					

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
1	<i>Intervention 1.8: Availability of Oxygen delivery Accessories for Health Facilities</i>		-							
	<i>Activity 1.8.1: Procure Oxygen delivery Accessories for Health Facilities (Procurement)</i>	1	-	MOH						
	<i>Intervention 1.9: Develop guidelines for transportation and storage of medical oxygen.</i>		-	MoH, GHS						
	<i>Intervention 1.10: Develop and monitor a performance instrument for medical oxygen systems.</i>		-	MoH						
	<i>Intervention 1.11: Advocate for special electricity tariffs for commercial oxygen production in Ghana.</i>		-	MoH						

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GH¢)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
	<b>Objective 2: To establish a regulatory system for the production, procurement, installation, distribution, and rational use of medical oxygen in Ghana.</b>		<b>5,556,470.00</b>							
<b>2</b>	<b><i>Intervention 2.1: Develop guidelines on the production, supply, storage, and use of medical oxygen and its related devices.</i></b>		<b>2,185,050.00</b>							
	<b><i>Activity 2.1.1: Determine standards that the medical oxygen devices and systems should adhere to</i></b>	<b>1</b>	<b>124,600.00</b>	<b>MOH</b>	<b>FDA, GSA, ECG, EPA</b>	<b>X</b>				

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
2	<b>Activity 2.1.2:</b> <i>Development of appropriate guidelines based on standards and best practices governing production and supply of medical oxygen</i>	1	<b>617,650.00</b>	MOH	FDA, GSA, EPA	X				
	<b>Activity 2.1.3:</b> <i>Dissemination and Training on the developed guidelines</i>		<b>266,800.00</b>	MOH	Agencies					
	<b>Activity 2.1.4:</b> <i>Enforcement to ensure compliance to regulatory standards</i>	5	<b>1,176,000.00</b>	MOH	FDA, GSA, EPA	X	X	X	X	X

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
2	<i>Intervention 2.2: Resource the appropriate regulatory bodies to carry out their mandate effectively and efficiently.</i>		<b>647,520.00</b>							
	<i>Activity 2.2.1: Quantify Resources required by regulating bodies and include them into annual budgets.</i>	<b>5</b>	<b>647,520.00</b>	MOH	FDA, GSA MOF	X	X	X	X	X
	<i>Intervention 2.3: Establish and implement quality assurance systems for administering medical oxygen</i>		<b>1,159,150.00</b>							
	<i>Activity 2.3.1: Develop a quality assurance guidance for administering medical oxygen</i>	<b>1</b>	<b>522,000.00</b>	MOH	GSA, FDA,	X				

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
2	<i>Activity 2.3.2: Train personnel on the developed guidance document</i>	5	567,200.00	MOH	GSA, FDA,	X	X	X	X	X
	<i>Activity 2.3.3: Implement the developed quality assurance guidance document</i>	5	69,950.00	MOH	GSA, FDA,	X	X	X	X	X
	<i>Activity 2.1.4: Enforcement to ensure compliance to regulatory standards</i>	5	1,176,000.00	MOH	FDA, GSA, EPA	X	X	X	X	X

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
2	<i>Intervention 2.4: Develop safety protocols on medical oxygen systems.</i>		<b>1,034,200.00</b>							
	<i>Activity 2.4.1: Develop safety protocols on medical oxygen systems</i>	<b>1</b>	<b>522,000.00</b>	MOH	GSA, FDA,	X				
	<i>Activity 2.4.2: Train relevant personnel on the developed safety protocols</i>	<b>5</b>	<b>512,200.00</b>	MOH	Agencies	X	X	X	X	X
	<i>Intervention 2.5: Standards on medical oxygen systems to include security issues</i>		<b>522,000.00</b>							
	<i>Activity 2.5.1: Develop standards on medical oxygen systems to include security issues</i>	<b>1</b>	<b>522,000.00</b>	MOH	Agencies		X			



Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
2	<i>Intervention 2.6: Enforce developed regulations and guidelines</i>		<b>8,550.00</b>							
	<i>Activity 2.6.1: Monitoring for compliance</i>	<b>5</b>	<b>8,550.00</b>	MOH	Agencies	X	X	X	X	X
3	<b>Objective 3: To strengthen supply chain management of medical oxygen systems in Ghana.</b>		<b>15,090,800.00</b>							
	<i>Intervention 3.1: Ensure compliance to the procurement processes on medical oxygen to the national procurement guidelines</i>		<b>2,159,100.00</b>							
	<i>Activity 3.1.1: Develop appropriate medical oxygen procurement guidelines and or adhere to them</i>	<b>1</b>	<b>341,550.00</b>	MOH	MDAs, Agencies, Private Entities		X			

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
3	<i>Activity 3.1.2: maintain, and track audit reports to ensure compliance in procurement processes</i>	5	567,200.00	MOH	GSA, FDA,	X	X	X	X	X
	<i>Activity 3.1.3: Provide technical assistance for forecasting and quantification of oxygen</i>	5	57,550.00	MOH	Agencies DPs	X	X	X	X	X
	<i>Intervention 3.2: Develop guidelines and specifications for the acquisition of medical oxygen systems</i>			280,000.00						
	<i>Activity 3.2.1: Develop standard specifications for medical oxygen systems</i>	1	280,000.00	MOH	Agencies		X			

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
3	<i>Intervention 3.3: Incorporate Oxygen management specifics into the existing human resource for medical oxygen management</i>		<b>7,783,200.00</b>							
	<i>Activity 3.3.1: Train clinicians to diagnose hypoxemic patients and prescribe appropriate oxygen therapy</i>	5	<b>619,200.00</b>	MOH	Agencies	X	X	X	X	X
	<i>Activity 3.3.2: Identify, train and equip engineers to perform routine PPM and corrective maintenance on oxygen equipment</i>	5	<b>7,164,000.00</b>	MOH	Agencies	X	X	X	X	X

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
3	<i>Intervention 3.4: Develop training guidelines on medical oxygen supply chain processes.</i>		-							
	<i>Intervention 3.5: Develop Standard Operating Procedures (SOPs), protocols and guidelines for management, maintenance and use of Medical Oxygen</i>		4,052,000.00							
	<i>Activity 3.5.1: Develop and Disseminate SOPs for management, maintenance and use of medical oxygen</i>	2	2,292,000.00	MOH	Agencies	X	X			

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
3	<b>Activity 3.5.2:</b> <i>Rollout supportive supervision mechanisms to provide on-the-job mentoring and monitor progress/ adherence to guidelines.</i>	5	1,760,000.00	MOH	Agencies	X	X	X	X	X
	<b>Intervention 3.6:</b> <i>Develop a strategic procurement plan for medical oxygen</i>									
	<b>Activity 3.6.1:</b> <i>Map existing supply chain systems (from generation to delivery) for oxygen systems across regions</i>	1	752,000.00	MOH	Agencies		X			

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
3	<b>Activity 3.6.2:</b> <i>Develop procurement plan based on mapping for oxygen delivery systems</i>	5	4,500.00	MOH	Agencies	X	X	X	X	X
	<b>Intervention 3.7:</b> <i>Monitor compliance to procurement processes for medical oxygen.</i>		-	MOH	Agencies of MoH, Private health sector, GAQHI, CHAG, AMHS					
	<b>Intervention 3.8:</b> <i>Mainstream medical oxygen issues into the health sector medium-term and medicine procurement plans.</i>		-	MOH	Agencies of MoH, MoF					

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
3	<i>Intervention 3.9: Review minimum requirements for health infrastructure to include medical oxygen systems, across the different levels of care</i>		<b>60,000.00</b>							
	<i>Activity 3.9.1: Develop facility level models for optimal oxygen delivery systems for each level of the health care system</i>	<b>2</b>	<b>60,000.00</b>	MOH		X	X			

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
	<b>Objective 4:</b> To strengthen the capacity of all relevant staff on management, maintenance, and use of medical oxygen.		<b>15,090,800.00</b>							
	<b>Intervention 4.1:</b> Develop training packages for all relevant staff on the acquisition, rational use, service, repair, maintenance and management of medical oxygen systems, and related equipment and their documentation, including their electronic management system.		<b>1,994,500.00</b>							
<b>4</b>	<b>Activity 4.1.1:</b> Develop health provider and maintenance professionals training modules and job aides	<b>1</b>	<b>30,000.00</b>	MOH	Agencies of MoH, Private health sector, GAQHI, CHAG, AMHS		X			



Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
4	<b>Activity 4.1.2:</b> <i>Train clinicians and health providers on hypoxemia diagnosis and clinical use of medical oxygen</i>	5	<b>646,500.00</b>	MOH	Agencies of MoH, Private health sector, GAQHI, CHAG, AMHS	X	X	X	X	X
	<b>Activity 4.1.3:</b> <i>Train maintenance professionals on maintenance and management of medical oxygen</i>	5	<b>1,233,000.00</b>	MOH	Agencies of MoH, Private health sector, GAQHI, CHAG, AMHS	X	X	X	X	X
	<b>Activity 4.1.4:</b> <i>Train M&amp;E data collectors to collect oxygen-relevant indicators and transfer into HMIS</i>	5	<b>85,000.00</b>	MOH	Agencies of MoH, Private health sector, GAQHI, CHAG, AMHS	X	X	X	X	X

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
4	<i>Intervention 4.2: Review of the existing pre-service training curriculum to include medical oxygen system.</i>		<b>34,000.00</b>							
	<i>Activity 4.2.1: Engage Training Institutions to include medical oxygen Production, Maintenance, distribution, utilization &amp; Management of oxygen resources in the training program</i>	<b>1</b>	<b>34,000.00</b>	MOH	Agencies of MoH, this		X			

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
4	<i>Intervention 4.3: Train relevant staff on electronic management system for the acquisition, maintenance and management (including spare parts, maintenance and consumables) of medical oxygen resources.</i>		<b>546,000.00</b>							
	<i>Activity 4.3.1: Develop, review and adapt clinical guidelines, and protocols, and SOPs for the safe and rational use of medical oxygen</i>	<b>1</b>	<b>273,000.00</b>	MOH	Agencies of MoH, GAQHI, CHAG, Private Health Sector, AMHS		X			
	<i>Activity 4.3.2: Develop BME/T content for the maintenance and repair of medical oxygen generating devices and ancillary medical devices</i>	<b>1</b>	<b>273,000.00</b>	MOH	Agencies of MoH, GAQHI, CHAG, Private Health Sector, AMHS		X			

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
4	<i>Intervention 4.4: Develop management systems for the maintenance of medical oxygen systems and train relevant staff.</i>		-	MoH	Agencies of MoH, Private Sector,					
	<i>Intervention 4.5: Train technical staff for the service, repair, maintenance and management of medical oxygen and related equipment.</i>		-	MoH	Agencies of MoH, GAQHI, CHAG, Private Health Sector, AMHS					

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
	<b>Objective 5:</b> To strengthen collaboration and partnership across the entire medical oxygen value chain.		766,000.00							
	<b>Intervention 5.1:</b> Develop sustainable financing arrangement for medical oxygen		442,000.00							
5	<b>Activity 5.1.1:</b> Develop a resource Mapping and budget for the procurement of medical oxygen commodities and equipment	1	124,000.00	MOH, MOF	Agencies of MoH, DPs, MoTI, GIPC, MoFARI, AGI		X			

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
5	<b>Activity 5.1.2:</b> Institute a sustainable financing for medical oxygen systems at the facility level (Advocate for the use of a percentage of the 1% COVID levy for medical oxygen from MoH)	1	318,000.00	MOH	Agencies of MoH, DPs, MoTI, GIPC, MoFARI, AGI		X			
	<b>Intervention 5.2:</b> Develop a mechanism for Private sector engagement to ensure sustained improvement in medical oxygen generation and usage.		216,000.00							
	<b>Activity 5.2.1:</b> Facilitate and engage private entities to collaborate on a PPP model	4	216,000.00	MOH	Agencies of MoH, DPs, Private sector, AGI, MOTI, GIPC, MoF	X	X	X	X	

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
5	<i>Intervention 5.3: Establish mechanisms for Development Partner engagement on medical oxygen systems</i>		<b>76,500.00</b>							
	<i>Activity 5.3.1: Develop proposals for DP engagement on medical Oxygen</i>	<b>4</b>	<b>76,500.00</b>	MOH	Agencies of MoH, DPs, Private sector, MoF, GIPC, MoFARI	X	X	X	X	
	<i>Intervention 5.4: Develop strategic social partnerships at all levels of healthcare delivery to sustain medical oxygen systems.</i>		<b>15,500.00</b>							
	<i>Activity 5.4.1: Meeting to engage social partners on sustenance of medical oxygen systems</i>		<b>15,500.00</b>	MoH	Agencies of MoH, Private Sector, MoTI, GIPC, MoFARI					

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
5	<i>Intervention 5.5: Advocate for the inclusion of medical oxygen reimbursements into the National Health Insurance Scheme.</i>		<b>16,000.00</b>							
	<i>Activity 5.5.1: Engage with NHIA to include Oxygen on the NHIS medicine list</i>	<b>4</b>	<b>16,000.00</b>	MOH, MOF	Agencies of MoH, NHIA, DPs, Private sector	X	X	X	X	
6	<b>Objective 6: Establish a robust monitoring and evaluation system for medical oxygen.</b>		<b>1,104,700.00</b>							
	<i>Intervention 6.1: Update data gathering tools (e.g., patient records, observation charts, etc.) to include medical oxygen use at all levels of healthcare delivery.</i>		<b>54,000.00</b>							



Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
6	<b>Activity 6.2.1:</b> <i>Integrate equipment and commodities into existing commodity supply chains</i>	1	<b>3,500.00</b>	MOH	Agencies of MoH, Private health sector	X				
	<b>Activity 6.2.2:</b> <i>Revise M&amp;E tools including DHIMS to include relevant hypoxemia indicators</i>	-	-	MOH	Agencies of MoH, Private health sector	X	X	X	X	
	<b>Activity 6.2.3:</b> <i>Train relevant M&amp;E officers to collect and input oxygen-related indicators into existing LMIS and HMIS platforms.</i>		<b>619,200.00</b>	MOH	Agencies of MoH, Private health sector					

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
	<i>Intervention 6.3: Improve data visibility for use in decision-making and assess and evaluate the efficacy of the system.</i>		<b>128,000.00</b>							
	<b>Activity 6.3.1:</b> <i>Analyze data to inform decision making at facility, regional and national levels</i>	<b>4</b>	-	MOH	Agencies of MoH, Private health sector	X	X	X	X	
<b>6</b>	<b>Activity 6.3.2:</b> <i>Conduct facility level data quality assessments</i>	<b>4</b>	<b>128,000.00</b>	MOH	Agencies of MoH, Private health sector	X	X	X	X	
	<b>Activity 6.3.3:</b> <i>Support dissemination of data and learning reviews to increase data visibility for decision making and assess efficacy</i>		-	MOH	Agencies of MoH, Private health sector					

Table 8: Budget and Implementation Plan

ID	Strategic Objectives, Interventions and Key Activities	Frequency (Per 5 Year)	TOTAL (GHC)	Lead	Collaborators	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
6	<i>Intervention 6.4: Train relevant monitoring and evaluation officers to collect and input oxygen-related indicators into existing logistics and health management information systems.</i>		-	MoH	Agencies of MoH, Private health sector					
	<i>Intervention 6.5: Environmental impact of commercial oxygen production</i>		<b>300,000.00</b>							
	<i>Activity 6.5.1: Undertake research to study environmental impact of commercial oxygen production in Ghana</i>		<b>300,000.00</b>	MOH	EPA, Agencies of MoH, Private health sector					
<b>GRAND TOTAL =</b>			<b>31,543,570.00</b>							

# APPENDICES

Appendix I: Table 9: Performance Indicators

Indicator	Indicator level (e.g., output, outcome)	Definition	Target	Source
<b>Patient outcomes</b>				
Oxygen coverage	Outcome	% of patients with SpO <sub>2</sub> < 90% that received oxygen	100%	HMIS
Pulse oximetry coverage	Outcome	% of patients with a blood oxygen saturation measurement (SpO <sub>2</sub> )	100%	HMIS
<b>Objective 1: To create an enabling environment for the production, procurement, installation, distribution, and rational use of medical oxygen in health facilities in Ghana.</b>				
Coordinating mechanisms for medical oxygen systems established	Output	Oxygen Desk at MOH staffed and functional	By end of 2023	Administrative report
Medical oxygen monitoring indicators are integrated into the national health reporting system (e.g. HMIS, LMIS)	Output	HMIS and LMIS updated to include Medical Oxygen indicators	By end of 2023	HMIS

Indicator	Indicator level (e.g., output, outcome)	Definition	Target	Source
<b>Objective 1: To create an enabling environment for the production, procurement, installation, distribution, and rational use of medical oxygen in health facilities in Ghana.</b>				
Resources mobilized for the functioning of the oxygen system	Output	% of annual forecasted oxygen need that is budgeted for (through domestic or external sources)	100%	Administrative report
Standard Operating Procedures (SOPs) for oxygen system use and maintenance established.	Output	% of facilities with technical guidelines and SOPs	100%	Assessment Report Monitoring Report
Tax waiver applied to medical oxygen	Output	Enactment of policy to introduce tax waiver for medical oxygen production and sales	By end of 2023	Administrative report

Indicator	Indicator level (e.g., output, outcome)	Definition	Target	Source
<b>Objective 2: To establish a regulatory system for the production, procurement, installation, distribution, and rational use of medical oxygen in Ghana.</b>				
Oxygen quality standards met	Outcome	% of facilities whose primary oxygen source is sufficiently concentrated (>82%)	100%	Assessment report
<b>Objective 3: To strengthen supply chain management of medical oxygen systems in Ghana.</b>				
Oxygen availability	Outcome	% of facilities without oxygen stock outs during the reporting period	100%	Monitoring Report
Oxygen systems maintained	Output	% of oxygen equipment receiving scheduled preventative maintenance	100%	Monitoring Report
Up-to-date robust digital inventory systems for oxygen-related equipment developed	Output	% of facilities with all the necessary oxygen equipment	100%	LMIS, Stock Reports, Administrative Reports

Indicator	Indicator level (e.g., output, outcome)	Definition	Target	Source
<b>Objective 4: To strengthen the capacity of all relevant staff on management, maintenance, and use of medical Oxygen.</b>				
Healthcare workers trained on the use of medical oxygen	Output	% of healthcare workers who have completed medical oxygen training	100%	Administrative report Training report
Maintenance professionals trained on medical oxygen system maintenance	Output	% of maintenance professionals who have completed medical oxygen system maintenance training	100%	Administrative report Training report
Strengthen existing medical equipment maintenance system across the country	Output	% of facilities who have a maintenance system in place with frequency included	By end of 2023	Administrative report

Indicator	Indicator level (e.g., output, outcome)	Definition	Target	Source
<b>Objective 5: To strengthen collaboration and partnership across the entire medical oxygen value chain.</b>				
Revenue mobilization mechanism developed.	Output	Amount in budget mobilized/allocated	GHC 7,581,290 million (USD 789,323 equivalent) per year	MoH Financial reporting
Medical Oxygen reimbursed as part of NHIS	Output	Enactment of policy to reimburse medical oxygen as part of NHIS	End of 2023	
<b>Objective 6: Establish a robust monitoring and evaluation system for medical oxygen.</b>				
Facilities reporting into LMIS and HMIS	Output	% of facilities that report oxygen indicators through LMIS and HMIS	100%	HMIS, LMIS
Facilities reporting maintenance and Oxygen management updates on LMIS	Output	% of facilities reporting oxygen systems maintenance and management indicators through LMIS	100%	LMIS, administrative documents



*APPENDIX II: Table 10. - Strategic Leadership*

<b>Strategic Leaders</b>		
<b>S/N</b>	<b>Name</b>	<b>Designation/Organisation</b>
1	Hon. Kwaku Agyeman-Manu	Minister for Health
2	Hon. Tina Mensah	Dep. Minister for Health
3	Hon. Alhaji Mahama Asei Seini	Dep. Minister for Health
4	Mr. Kwabena Boadu Oku-Afari	Chief Director, Ministry of Health
5	Dr. Francis Chisaka Kasolo	Country Representative, WHO
6	Ms. Anne-Claire Dufay	Country Representative, UNICEF
7	Mr. Leslie Emegbuonye	Country Representative, CHAI

*APPENDIX II: Table 11. - Technical Leadership*

<b>Technical Leadership</b>		
<b>S/N</b>	<b>Name</b>	<b>Designation/Organisation</b>
1	Ben Ampomah Nkansah	Director Infrastructure, Ministry of Health
2	Dr. Emmanuel Odame Ankrah	Director, PPME, Ministry of Health
3	Dr. (Mrs.) Martha Gyansa-Lutterodt	Director, Technical Coordination, Ministry of Health
4	Dr. Nicholas Adjabu	Head, Biomedical Engineering Unit-ID, Ministry of Health
5	Benjamin Nyakutsey	Head, Policy Unit - PPME, Ministry of Health

## APPENDIX II: Table 12. - Technical Working Group (TWG)

Technical Working Group		
S/N	Name	Organisation
1	Dr. Nicholas Adjabu	Minister for Health
2	Alhaji (Dr.) Inua I. Yusuf, Esq	Ministry of Health
3	Mrs. Sally Pobee Tetteh	Ministry of Health
4	Dr. Angela Ama Ackon	World Health Organization
5	Dr. Priscilla Wobil	UNICEF
6	Dr. Jacob Abebrese	Ghana Health Service
7	Dr. Nicodemus K Gebe	Ghana Health Service
8	Dr. Ernest Asiedu	Ministry of Health
9	Dr. Baffour Awuah	Ministry of Health
10	Dr. Christian Owoo	UG Medical School/Korle-bu Teaching Hospital
11	Mr. Benjamin Nyakutsey	Ministry of Health
12	Mrs. Ruth N. Y. Appiah	Ministry of Health
13	Mr. Theodore Amponsah	Ministry of Health
14	Ms. Bless Yayra Darku	Ministry of Health
15	Mr. Philip Quayson	Ministry of Health
16	Mr. Prince Tuffour	Ministry of Health
17	Mr. Daniel Gyan	Ministry of Health
18	Mr. Samson Awudanjon	Ministry of Health
19	Mr. Cephas Denutsui	Ministry of Health
20	Elizabeth Adjei-Aquah	Ministry of Health
21	Mr. John Zienaa	Ghana Health Service
22	Ms. Yolanda Adwoa Adusei-Poku	Ghana Health Service
23	Mr. Gregory Peters	Komfo Anokye Teaching Hospital
24	Mrs. Adah Allotey-Pappoe	Food and Drugs Authority
25	Nicholas Amoah Owusu	Food and Drugs Authority
26	Mr. Vincent Arthur	Ghana Standards Authority
27	Mr. Edward Ofosuhene	Ghana Standards Authority
28	Mr. Tuffour Ampem Gyekye	Ghana Society of Biomedical Engineers

Technical Working Group		
S/N	Name	Organisation
29	Dr. Bernard A. Kwanin	HeFRA
30	Ms. Enyonam Marjorie Nudo	Clinton Health Access Initiative
31	Ms Mensimah Bentsi-Enchill	Clinton Health Access Initiative
32	Mr. Ebenezer Atto Brown Appiah	Clinton Health Access Initiative
33	Mrs. Irene Sarkodie	Clinton Health Access Initiative
34	Ms. Faustina Ofosua Mintah	Clinton Health Access Initiative

APPENDIX II: Table 13. Representatives of Key Stakeholders

Key Stakeholders		
S/N	Name	Organisation
1	Dr. Ali Samba	Korle-Bu Teaching Hospital
2	Dr. Eric Kofi Ngyedu	Cape Coast Teaching Hospital
3	Dr. Abass Adams	Tamale Teaching Hospital
4	Dr. Jacob Abebrese	Ghana Health Service
5	Dr. Philip Bannor	HeFRA
6	Dr. Mrunal Shetye	UNICEF
7	Dr. Adwoa T. Twum Barimah	National Health Insurance Authority
8	Dr. Frank Ankobea	Ghana Medical Association
9	Ms. Ruby Mac-Kafri	Ministry of Energy
10	Mr. Robert Yeboah	Energy Commission
11	Ing. Gregory Atta Peters	Komfo Anokye Teaching Hospital
12	Ing. John Zienaa	Ghana Health Service
13	Ing. Tuffour Ampem Gyekye	Ghana Society of Biomedical Engineers
14	Mr. Derek Wiredu	Ministry of Trade and Industry
15	Mrs. Olivia A. Gyamfi	Ghana Revenue Authority, Customs Division
16	Mr. James Nwinsayra	Ghana Association of Certified Registered Anaesthetists

<b>Key Stakeholders</b>		
<b>S/N</b>	<b>Name</b>	<b>Designation/Organisation</b>
17	Mr. Ansong F. Bridjan	National Ambulance Service
18	Mr. Vincent Arthur	Ghana Standards Authority
19	Mrs. Heidi-Marie Boakye	Office of the Attorney General
20	Mr. Emmanuel Kwame Asiedu	Christian Health Association of Ghana
21	Nana Yaw Asante	RikAir Company Limited
22	Philip Creech-Jones	RikAir Company Limited
23	Mr. Richard Rockson	AirLiquide Ghana
24	Mr. Samuel Assiaw	AirLiquide Ghana
25	Mr. Varun Tyagi	Indo-Ghana Industries Limited
26	Mr. George Dey	Indo-Ghana Industries Limited
27	Raymond Amoro	Atmo Gas
28	NVV Chalapathi Rao	B5 Plus Group
29	Mr. Kunwardeep Singh	Ferro Fabrik Ghana Ltd



