

Ghana's Strategic Energy Stocks: A Policy Based Review

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Abstract

This study sought to assess Ghana's strategic stocks policy through the lens of the national energy policy and the realities and dynamics of the energy industry. Employing a theoretical policy appraisal approach and interviews with industry experts, the study established that strategic stock management faces challenges which primarily hinge on inadequate refinery and storage capacity, and inadequate strategic stock of petroleum and refined products. The study recommends nationwide strategic stock policy education, regulations to ensure order with the policy framework, and alternative models such as public-private partnerships (PPPs) to ensure a reliable supply of petroleum products, and to support the maintenance and upgrade of the storage infrastructure.

Keywords: Ghana Energy Policy, Strategic Stocks Policy, Petroleum Regulation, National Energy Plan

1. Introduction

Strategic stocks are critical to the energy security architecture of countries around the world. They can be described as both petroleum and petroleum products or refined products, physical in nature, held by a state through its government machinery and/or oil companies to cater for catastrophes or severe and major product supply disruptions (Chapman, 2022; Difiglio, 2014). The scope of what constitutes strategic stocks excludes pipeline fills, refined products in road and rail tankers, deadstock in tanks, stocks held on behalf of the army, commercial and safety stocks held by the oil industry which is within the energy security space referred to as Commercial Stocks. Some of the products kept as strategic stocks include but are not limited to diesel, liquified petroleum gas (LPG), petrol and jet fuel. They are mostly only released upon a sanctioned release by the appropriate agencies and officials of the state clothed with such powers under law and policy.

The policy of strategic stocks traces its origins to the 1973 embargo levied by the Organization of Petroleum Exporting Countries (OPEC) which drastically reduced the global supply of petroleum products. However, the historical origins of certain countries such as the U.S. national petroleum reserves dates back to 1910 (Chapman, 2022). This highlighted and emphasised the interdependence of countries in the global market, and how nations were rendered vulnerable amid such energy security crises (Bouchouev, 2022; Difiglio, 2014). These disruptions in the supply mix of crude and refined products may result from home-grown logistical hitches, international crude disruptions or global logistical disruptions. Home-grown logistical hitches include any local logistical constriction that would adversely affect the transport of products from the coast to inland, for example, transportation, pipeline size, port infrastructure and storage. International crude disruptions may be due to significant disruptions in the supplier nation's capacity for production. Global logistical disruptions mainly present themselves in key interruptions in supply routes, for instance, a situation of piracy in the Indian Ocean.

2. Literature Review

Luciana and Henry (2011) reviewed the legislation related to the International Energy Agency's (IEA) strategic stocks usage and the systems in place for contingency response in the European Union and United States. The study concludes that these response systems are not employed frequently and on these rare occasions, the process has not been adequately transparent. The study prescribes a less popular view of having principal consumers and corporations storing considerable inventory and exploring agreements with oil supplier nations, with a sense of global communal stock management.

Oliveira et al. (2023) examined the issue of petroleum stock management in the Association of Southeast Asian Nations (ASEAN), estimating the optimal draw-down and build-up policies under different scenarios. Studying the dynamics of oil production and imports, petroleum prices, and GDP, examining the effect of the planning period, and the price elasticity of demand on the optimal policy and discount rate, it emerged that potential net benefits of up to \$125 billion could accrue to ASEAN members from such a strategic

petroleum stock. The recommended stockpile target agreed with the IEA's prescription of the equivalent of net imports of 90 days.

Difiglio (2014) established from a data-driven trend of 40 years that an oil price shock consistently precedes slow economic growth. In the realm of oil security, the study established that supply volatilities which seem persistent could be addressed with strategic petroleum stocks. This mechanism could guard the global economy against disturbances stemming from distortions in oil supply, while adequate strategic quantities could further control price hikes.

2.1 Experience from Selected Regional and National Economies

The United States has the largest contingency stock of crude oil globally. The Strategic Petroleum Reserve (SPR) was instituted five decades ago in the wake of the Oil Embargo of 1973 by OPEC. The SPR ensured the required buffer to stem the impact of potential shocks to the supply of petroleum. The SPR was also meant to deliver the commitments of the United States under the International Energy Program. Four salt caverns in underground settings in Louisiana and Texas hold the federal stocks, with a realised brim capacity of 727 million barrels at the end of 2009 (Bouchouev, 2022). Given that Ghana also has abandoned mining sites and smaller salt caverns, these could be explored to follow the US reserve management approach.

Germany's national strategic response to addressing oil supply shortages in exigencies is administered by the 1975 Energy Security of Supply Act, the Mineral Oil Data Act and the 2012 Petroleum Stockholding Act. The country has limited internal oil resources because only 3% of consumption is produced locally. Strategic reserves have been in force since 1960. The country has tank farms for reserves; but significantly, reserves are stored in underground caverns, largely salt domes with capacity below ground level of up to 1500 metres, which have been retrofitted to serve as storage media. There were 58 of such caverns, culminating into reserves of 12.5 million cubic metres by the close of 2012 (EBV, 2014). This contrasts with the Ghanaian strategic stock management where storage facilities are inadequate and requires expansion.

Nigeria's Strategic Stocks Regulations, 2023 requires the approach of incremental stocking, to maintain a maximum of 60 days' national demand reserve of a designated petroleum product as national strategic stock. This is to be accompanied by a maximum national strategic stock levy of 5% of the retail price of petroleum products which is mobilised by the Midstream and Downstream Petroleum Regulatory Authority on a wholesale basis at wholesale points (Federal Republic of Nigeria, 2023). This is at par with Ghana's average stockpile by days.

Kenya instituted strategic reserves through the Petroleum Strategic Stock Regulations, 2008; which requires oil marketing firms to hold 21 days of oil reserves. Beyond this industry mechanism, the operationalisation of strategic stocks has not seen much traction in Kenya. The present dependency on private oil marketing companies poses risk and threatens energy security.

According to the Taiwanese experience, the Petroleum Administration Act regulates Taiwan's strategic stocks, which requires importers of oil and operators of oil refineries to hold a minimum storage of sixty days. The estimation of the volume of supply is a function of the mean of private consumption and local sales of the last one year. Oil, in this context, comprises petroleum and crude oil products, such as jet fuel, naphtha, liquefied petroleum gas, diesel oil, fuel oil, gasoline, and kerosene. Beyond the sixty-day industry policy, the state is also required by legal statutes to hold a 30-day minimum oil stock. The state, on an annual basis, pays in excess of \$72 million using the Petroleum Fund, for storage financing (McGillis & Yu, 2022).

The energy mix in Portugal predominantly comprises imports of fossil fuels, which form a relatively greater part of the energy mix than the paltry energy contribution of hydro and wind. It is worth noting that electricity generation from hydro and wind has increased steadily over time. Oil and natural gas dominate the host of energy sources in Portugal. Beginning in 2012, the country has been a net exporter of oil, though figures have been declining in the last half decade. The mix of state-managed stocks and mandatory stocks held by industry, through regulation, form the cornerstone of the contingency policy for oil in Portugal. These stocks are held locally, and partly in neighbouring European countries. Portugal has consistently complied with a stock holding period of 90 days without default in recent years (IEA, 2022).

Rwanda realised its inadequacy to provide the minimum strategic storage for 60 days of commercial stocks as required by the National Energy Policy, but that minimum was increased to 90 days in the Energy Sector Strategic Plan (ESSP) of 2017. The Ministry of Infrastructure, in 2015, commenced a 60-million-litre National Strategic Stocks project (MININFRA, 2017). This is favourable relative to Ghana's range of 42 to 72 days.

South Africa's Department of Energy estimated the national loss of having no fuel for a day at approximately ZAR1 billion, following severe fuel shortages between December 2005 and January 2006. Before 1994, the Strategic Fuel Fund (SFF) was charged with purchases of all crude oil supplies for the oil industry; thus, SFF held both strategic and commercial stocks. After 1994, SFF managed strategic stocks for the South African Government. The Strategic Stocks Policy of 2013 required the Government to keep 60 days of strategic stocks: 18 days for refined products, and 42 days for crude oil. The recommendation as of 2014 was to institute a 14-day reserve policy for refined products for oil companies (Department of Energy SA, 2014). This compares woefully with Ghana's range of 42 to 72 days.

Oliveira et al. (2023) used Autoregressive Integrated Moving Average, co-integration and time series analysis to churn out an array of future scenarios for oil imports, oil prices, population, oil production, and GDP growth in member countries of the ASEAN block. Using a decision model of strategies for reserve build-up and draw-down for reducing the effect on the cost of building strategic stocks and GDP from oil shocks, the model further displays considerations for inter-generational equity for estimating the optimal strategies for reserve management. The study concludes that countries from the ASEAN block could reap gains from a regional reserve for petroleum; against the reasoning that without a policy for

minimum reserves, stock reserve strategies would not be optimised. The model returns a reserve target of 112 days and 53 days of net oil imports for social discount factors of 0.99 and 0.95 respectively. This range is superior to Ghana's 42 to 72 days.

3. Methods

This review employs a theoretical policy appraisal approach, literature review and comparative case study analysis. Comparative cases were purposively sampled to provide a blend of developed and developing countries, as well as successful and less successful strategic stock management cases. The policy evaluation of Ghana's Strategic Stock Policy in this review is anchored on an analysis of policy efficiency, effectiveness and weaknesses. Extensive consideration is given to variables such as Policy Implementation, Monitoring and Evaluation, Consumer Education, Legislations (Acts of Parliament and Subsidiary Legislations), and Learnings from other jurisdictions.

Expert opinions were sourced through oral interviews with two senior officials each from the Ministry of Energy, the Ghana National Petroleum Corporation (GNPC), Bulk Oil Storage and Transportation Company Limited (BOST), and two oil marketing companies.

Relevant laws, policies and regulations pertinent to Ghana's strategic stocks were consulted and reviewed. Extant literature on the subject was also reviewed to lend relevant previous knowledge and comparability to the study.

The review commences with a historical and chronological assessment of Ghana's Strategic Stocks Policy and how Ghana has implemented the policy over the years, and the active players involved in the implementation and monitoring phases of this policy. This historical analysis draws out the challenges encountered in Ghana's bid to ensure energy security as a country. Reference is made to standardised best practices from other jurisdictions, against which Ghana's policy is juxtaposed.

4. Ghana's Strategic Stock Policy

From a comprehensive historical perspective, Ghana's strategic stock policy has undergone series of developments and transitions from one programme to the other, from one policy to the other, and through various institutional arrangements and restructurings based on laws, regulations, programs and policy directions.

4.1 Early Phase

Ghana's strategic stock policy for petroleum products was developed with the definitive objective of ensuring a reliable supply of petroleum products during times of crisis, such as natural disasters or geopolitical tensions. The government of Ghana appropriately recognised the need for a comprehensive strategic stock policy for petroleum products to safeguard the country from adverse impacts of the volatility of the global oil market. The policy outlined the minimum volumes of petroleum products that must be held in reserve, and the maximum duration that the petroleum products held in reserve can be utilised. The policy in its early

stages was managed by the Ghana National Petroleum Corporation (GNPC) on behalf of the government of Ghana (Acheampong & Ackah, 2015; Energy Commission Ghana, 2006).

The GNPC was tasked with the management and maintenance of the strategic stock of petroleum products. This involved procuring, storing, and distributing petroleum products to ensure that there is a consistent supply of petroleum products in Ghana. The GNPC ensured that the petroleum products were kept at a minimum quality standard, and that they were strategically located near major demand centres, such as cities and towns, to ensure prompt and efficient delivery of petroleum products (Acheampong & Ackah, 2015; Energy Commission Ghana, 2006).

Over the years, the GNPC, in the performance of this management and maintenance role, took deliberate steps to ensure the implementation of the strategic stock policy. The GNPC built and maintained petroleum storage facilities across the country. The facilities are strategically located to ensure effective delivery of petroleum products to consumers in different parts of the country. In addition, the GNPC diversified its sources of petroleum products to reduce reliance on a single supplier. The GNPC built strategic partnerships with international petroleum companies and explored local production possibilities to ensure that there is always a reliable source of petroleum products. The strategic stock policy also required that the GNPC carry out periodic reviews and updates of the policy to ensure that it remains relevant and effective. The policy is regularly reviewed to take into account emerging trends in the global oil market and other relevant factors (Ministry of Energy Ghana, 2021; Energy Commission Ghana, 2006).

4.2 Introduction of Bost

Incorporated in 1993, the Bulk Oil Storage and Transportation Company Limited (BOST) was created to build tanks for storage, pipelines and ancillary infrastructure for bulk transport nationwide. The creation of BOST was a conscientious response to the risk of rampant strike actions posed by employees of Tema Oil Refinery (TOR), Ghana's sole fuel supplier and refinery. This mandate in relation to the facilities and storage infrastructure extends to leasing and rental services to generate income. BOST also keeps Ghana's strategic stocks (CBOD, 2019). Consequently, BOST is duty-bound to accrue a short-to-medium-term strategic stocks floor of six weeks and a long-term incremental build-up to twelve weeks of active national demand (BOST, 2024).

BOST initiated a Strategic Stock Programme (SSP) in the early years of the decade 2000-2010, with the initiative to renew stocks every three months. The rationale for renewal was for refreshment and assurance of the physical quality of storage products. Products due for renewal were traded at the pre-set market. Revenues from renewal sales were used to restock reserves. In the event of losses, emerging from renewal prices trailing cost prices of sold stock, the losses are offset by the Government of Ghana through the Strategic Stocks Levy (Abudu & Sai, 2020).

4.3 Strategic National Energy Plan (2006 – 2020)

The National Energy Policy (2021) was preceded by the Strategic National Energy Plan (2006 – 2020). Under the 2006 Plan, strategic stocks were manned by BOST with an initial expectation of three weeks of strategic stocks, which will eventually be upgraded to six weeks of national consumption for petroleum products. At the time of instituting the 2006 Plan, storage capacity was inadequate for a six-week cover (Energy Commission Ghana, n.d.; Energy Commission Ghana, 2006).

The 2003 petroleum price construct took the maintenance cost for strategic stocks into cognisance, but this was scrapped in 2006. Miscellaneous activities of BOST were funded using a BOST margin in the petroleum price construct. Technocrats and industry actors, at the time, largely agreed that there were no strategic reserves for crude oil. Under the plan, the objective was achieving a strategic stock capacity of a floor of 8 weeks of national consumption by 2015, and 12 weeks of national consumption by 2020 for refined products. These targets and durations also apply to crude oil (Energy Commission Ghana, n.d.; Energy Commission Ghana, 2006).

Most economies, against the rationale of security in fuel supply and price fluctuations, have instituted strategic stocks for refined products and crude oil. In the developing world and the OECD at large, a floor of six months has gained wide acceptance for strategic stocks. Ghana had followed this measure since the 1990s with an institution of an average of three weeks under the Plan for strategic stocks for refined products.

4.4 National Energy Policy (2021)

The Ministry of Energy produced a first draft of a novel National Energy Policy for industry's review in 2019, and eventually published officially in 2021. The energy sector is wholly covered by the policy, with an overarching vision of self-sufficiency and energy sustainability for Ghana. This lends support to energy export for the country, beside local energy market stability. The policy also lends support to the country's quest for environmental sustainability and the realisation of Sustainable Development Goal 7. This is achieved with more reliable and higher energy supply from the contingency buffer, which triggers stable prices and hence, relatively cheaper and more accessible energy. The policy dedicates a section to provide much needed operational guidelines for the petroleum downstream sub-sector, thereby enhancing the possibility of meeting local and foreign product quality assurance tests for refined products. The operational guidelines in the policy are embedded with the thinking of strategic stock management (Ministry of Energy Ghana, 2021).

The policy objectives, among others, are to increase the national aggregate refinery capacity for petroleum and enhance operational efficiency of storage, transportation, and distribution of petroleum and refined products countrywide, while safeguarding supply of refined products and petroleum. The Policy identifies nine (9) fundamental challenges in the petroleum downstream with guidance on dealing with the challenges. The key issues in the policy document include the low storage and refinery capacity and insufficient strategic stock of refined products and petroleum. The policy is purposed to offer a blueprint, direction and framework for outlining a plan for holding strategic petroleum stocks in Ghana (Ministry of Energy Ghana, 2021).

5. Strategic Stock Challenges in Ghana

The strategic stock policy for petroleum products in Ghana has been a vital and intrinsic constituent of the country's energy security framework. The policy has helped to ensure that there is a stable supply of petroleum products in the country, while also promoting energy efficiency and environmental sustainability. The effectiveness of Ghana's Petroleum Strategic Stock Policy in achieving its objectives is subject to ongoing evaluation. However, it is important to observe as a matter of importance that the policy has made significant progress in its bid to ensure that an energy security crisis doesn't occur in this jurisdiction.

The implementation of Ghana's Petroleum Strategic Stock Policy has, however, and continues to face several challenges undermining its efficacy as a policy. Some of these challenges are captured in the ensuing.

One of the major challenges is the lack of adequate storage facilities. The country's existing storage facilities are insufficient to meet the required six weeks of national petroleum consumption. As a result, the GNPC has had to lease additional storage facilities to meet the storage requirements of the policy. Another challenge is the cost of importing petroleum products. The state incurs significant costs in importing petroleum products, including transportation costs, storage costs, and insurance costs. These costs are passed on to consumers in the form of higher prices, which can affect the affordability of petroleum products for some Ghanaians (Abudu & Sai, 2020, Ministry of Energy, 2021; CBOD, 2019).

Another significant challenge worth mentioning has been funding the maintenance and upgrade of the storage infrastructure to meet the minimum volumes required for the strategic stock policy. The agencies and institutions responsible for implementing the policy's provisions have struggled to fund the infrastructure upgrades and maintenance due to the high cost involved. In addition to the financial burden, there has also been a lack of a clear enforcement mechanism for companies to comply with the stockholding obligations. This has resulted in a situation where some companies have been unable or unwilling to maintain the required stock levels, leading to concerns about the overall effectiveness of the policy (Ministry of Energy, 2021; CBOD, 2019; Acheampong & Ackah, 2015).

Another challenge is related to the quality of the petroleum products being held in reserve, particularly in the case of gasoline. The gasoline being held in reserve has a relatively low octane rating, which makes it unsuitable for some vehicles. This has led to a situation where some companies have opted not to utilise the gasoline held in reserve, even during difficult supply circumstances, which can undermine the policy's aims.

The lack of clear regulations regarding Petroleum Stock Management continues to erode the gains made in the area of Strategic Stocks since it has the resultant effect on monitoring and enforcement especially with BOST remaining focused on its mandate (Sulemana & Ennin, 2024; 2022; Atta-Botchwey et al., 2023; Blay & Hoffman, 2023; CBOD, 2019; Ali-Nakyea, 2019; Adam, 2014). There is clearly a lack of adequate communication or low consumer education on the policy. This is evident in how consumers react to supply disruptions in the Ghanaian market.

6. Conclusion and Recommendations

This study sought to assess Ghana's strategic stocks policy through the lens of the national energy policy and the realities and dynamics of the energy industry. Employing a theoretical policy appraisal approach and interviews with industry experts, the study established that strategic stock management faces challenges which primarily hinge on inadequate refinery and storage capacity, as well as inadequate strategic stock of petroleum and refined products. Core challenges enumerated include the quality of the petroleum products being held in reserve, and funding the maintenance and upgrade of the storage infrastructure to meet the minimum volumes required for the strategic stock policy.

Based on the preceding discussions and review of the state of Ghana's Strategic Stock Policy through its mutable phases and transitions in terms of law, regulations, institutional evolutions, programmes and policies, the following are recommended for implementation to offer the country's Strategic Stock a robust system to operate in.

Firstly, BOST at present, averagely retains gasoline for the short term (three months) to prevent the emergence of gum in the more perishable crack gasoline, relative to straight-run fuel. The necessity of storing the straight-run type is brought to bear in BOST's operations, in addition to the need to penetrate other international spot markets for economical prices (Energy Commission Ghana, n.d.).

Consequently, it is suggested that Ghana explores alternative models for ensuring a reliable supply of petroleum products, which could be the consideration of public-private partnerships (PPPs) to support the maintenance and upgrade of the storage infrastructure, thus reducing the financial burden on the state agencies carrying that burden. PPPs could help leverage private sector expertise and investment to improve the storage infrastructure and ensure its efficient operation (Moradi et al., 2023; Filatova et al., 2021; Nel, 2018; Cui et al., 2018; Fantozzi et al., 2014).

Another solution could be to explore more stringent enforcement mechanisms for companies to comply with their stockholding obligations, as well as measures to ensure that the quality of the products held in reserve meets the required standards. This could involve closer monitoring of stock levels and quality by government regulators, and imposing penalties for non-compliance.

In respect of considering alternative storage sources, it is recommended as was stated in the Energy Plan (2006-2020) that Underground Crude oil storage be considered as is the practice in Germany and the United States (Tang et al., 2023; Wang et al., 2023; Chimmani & Lokhande, 2022; Wang et al., 2015; Ajay, 2012).

Dominantly in the developed world, crude oil forms part of strategic stocks which are stored in caverns underground. The United States commenced underground cavern storage in the 1980s, reaching a capacity high, in 2005, of 700 million barrels (S&P, 2021). Being third in the global oil importer chart, China completed its first strategic oil reserve in 2006, with a capacity of 33

million barrel for about 30% of China's contingency reserves. Ghana's old mining sites lie deserted and redundant and could be recycled to serve as underground storage. Advancing with this plan would require a technical estimation of the capacities of these archaic mining sites and relevant suitability or fit-for-purpose assessments. Alternatively, these archaic mining sites could be leased to nations with an interest in offshore strategic stock storage in underground settings (Energy Commission Ghana, n.d.; Yi-Ming et al., 2008).

An emerging practice which has received widespread approval is the offshore floating storage system. This system requires offshore storage systems to be set up largely to service spot market demands. For instance, given the hold-up of Iran's re-entry into the global oil market in the face of sanctions and a lagging nuclear deal, stockpiling on water has become the new haven. As of August 2022, Iran held condensate and crude oil in excess of 60 million barrels at sea (S&P, 2022). Irrespective of the brisk and dominant order of private firms exploiting current market prices to undertake purchases, store as inventory and resell at the margin; it is a good precautionary measure for BOST to explore the option of strategic storage in offshore domains. This could be structured as a joint venture between BOST and private sector actors to exploit spot market opportunities.

Finally, the country needs to pass the necessary regulations to regulate the policy framework and, also importantly, enforce the obligations of various stakeholders and parties under the policy which will streamline the role of BOST to focus mainly on its primary mandate for its establishment, and discourage any deviation to focus on other secondary commercial engagements. The Government needs to intensify education on the country's Strategic Stock Policy to effectively sensitise consumers.

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Authors' contributions

Leo Andoh Adjei Gyimah was responsible for study design, data collection and revision. Adjei Gyamfi Gyimah was responsible for drafting the manuscript, literature review and analysis of the data. All authors read and approved the final manuscript.

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