

**PUBLIC UTILITIES
REGULATORY COMMISSION**



REGULATORY BRIEF

ISSUE 8

An analysis of Ghana's
electricity distribution losses
in recent years (2021-2023)

MARCH 2024

KEY HIGHLIGHTS

- ECG often experiences higher losses in quarter 1 of each year and then sees improvements in losses for quarters 2 and 3.
- Although ECG's losses may have improved over the period (2021-2023), the losses are still above the regulatory benchmarks.
- NEDCo often experiences higher losses in quarters 1 and 4 of each year while quarters 2 and 3 sees improvements.
- The year 2022 was NEDCo's best performing year for the period (2021-2023) with an average system loss of 26.92%, however, this was still above the regulatory benchmark of 22.6%.
- EPC's losses have consistently met the regulatory benchmark of 3% since 2021.

1.0 Introduction

According to Osei-Appiah & Arthur (2022), system losses refer to the quantity of power pushed through transmission and distribution networks but not accounted or paid for by customers. The difference between energy input (purchases) and energy collected (sales) is thus considered a loss. These system losses are classified as technical and non-technical (commercial). Mahmood et al., (2014) argues that, technical losses are caused by power dissipation in electrical system components such as transmission and distribution lines, transformers, and measuring equipment. Commercial losses, on the other hand, are caused by external acts such as energy theft, failure to pay for use, and errors in accounting and record-keeping (Mahmood et al., 2014; Abrokwa, et al, 2017).

System losses (transmission and distribution losses) remain a serious concern for Ghana's electricity sector. Metering issues, power theft, and the long distribution sagging and transmission lines to rural areas, especially, have all been apparent over the years. Overall, these factors have resulted in increased systemic losses in the country's electricity sector, which, has contributed significantly to the sector's growing cashflow and reliability concerns. The Institute of Statistical, Social, and Economic Research (ISSER) estimates that the economic impact of these losses ranges from \$320 million to \$920 million per year (Osei-Appiah and Arthur, 2022).

Adom (2016) opines that system (transmission and distribution) losses were less than 12% of the total power generated between 1971 and 1999, however after 2000, the rate rose dramatically to above 20%. This is totally undesirable for a nation that aspires to attain sustainable economic development, especially when contrasted with the best practices in developed countries, which ranges from 4% -12%. Technically, system losses cannot be completely eliminated, but can be reduced to manageable levels which will not negatively impact the production of power.

Whiles these losses have significant impact on revenues and by extension profitability of the utility companies, it is worth mentioning that it equally puts excessive pressure on consumers, whose tariffs typically include variables accounting for energy losses. While efforts are made to invest in the infrastructure of the various distribution companies, it is critical as a regulator to analyse system losses and take remedial action to best use available power. As the economic regulator, the PURC has over the past two years made accessible to the public, information on the operation and performance of the public utilities through the Public Utilities Regulatory Information System (PURIS). This brief therefore conducts a simple analysis of the losses (technical and commercial) incurred by the various distribution utilities over a period of three years (2021 to 2023).

2.0 Goal of the Policy Brief

This brief seeks to examine the operational performance of the distribution utilities with respect to system losses against the regulatory benchmarks set by the Commission. In particular, the brief intends to highlight the utilities' performance in system losses against the pre-major tariff review (2021- third quarter of 2022) and the post-major tariff review (fourth quarter of 2022 to fourth quarter of 2023) benchmarks.

3.0 Scope and Methodology of Study

The brief reviews and analyzes the quarterly performance data submitted to the Commission by the regulated utilities. The analysis is centred on system losses of distribution companies within Ghana's electricity supply industry, namely the Electricity Company of Ghana (ECG), Northern Electricity Distribution Company (NEDCo) and Enclave Power Company (EPC). The analysis covers system losses between the period, 2021 through 2023. The analysis took cognisance of the downward review of the distribution benchmark from 22.6% to 21.4% during the major tariff review period in September 2022.

4.0 Benchmarking in Regulation

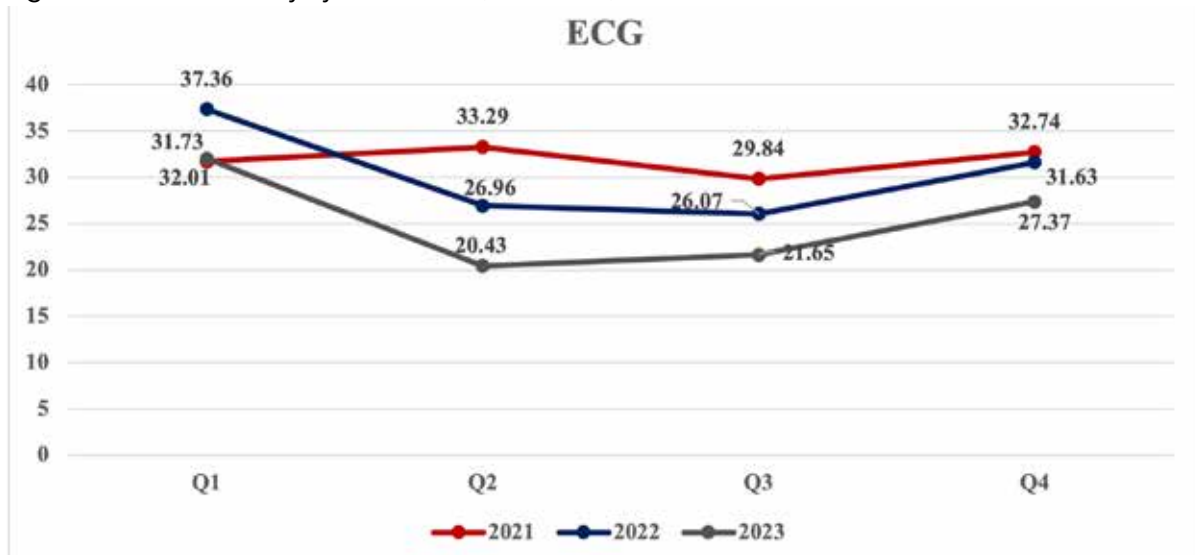
Benchmarking is the process of comparing the efficiency of enterprises to a reference point, which is often the best observed practice. Benchmarking methods are widely and increasingly used in energy utility regulatory frameworks, either as part of a specific 'yardstick regulation' framework for setting regulated revenues, or more broadly in combination with other methods for assessing the efficient cost of supply. The purpose of benchmarking in regulation is to offer incentives for firms to enhance their efficiency and, eventually, achieve best practices. In the energy sector of Ghana, distribution utilities are benchmarked on a number of indicators. While the Energy Commission sets the technical benchmarks, such as the System Average Interruption Duration Index (SAIDI), System Average Interruption Frequency Index (SAIFI) and Customer Average Interruption Duration Index (CAIDI), the Public Utilities Regulatory Commission is responsible for benchmarking and monitoring the utilities' performance on losses.

5.0 Benchmarking in Regulation

5.1 Electricity Company of Ghana

Data analysed on system losses between 2021 and 2023 shows that ECG often experiences higher losses in the first quarter of each year (see Figure 1). There is often an improvement in system losses in the second and third quarters of each year except in 2021, where the system losses marginally increased after the first quarter. Generally, quarterly system losses in 2021 painted a wave-like appearance around the trend as shown in Figure 1. At the same time, it can be observed that ECG recorded increases in system losses in the last quarters of 2021 and 2023. This regulatory brief is however limited in scope and data to be able to assign possible reasons for the higher system losses in the first quarter and fourth quarter

Figure 1: ECG's Quarterly System Losses (2022-2023)

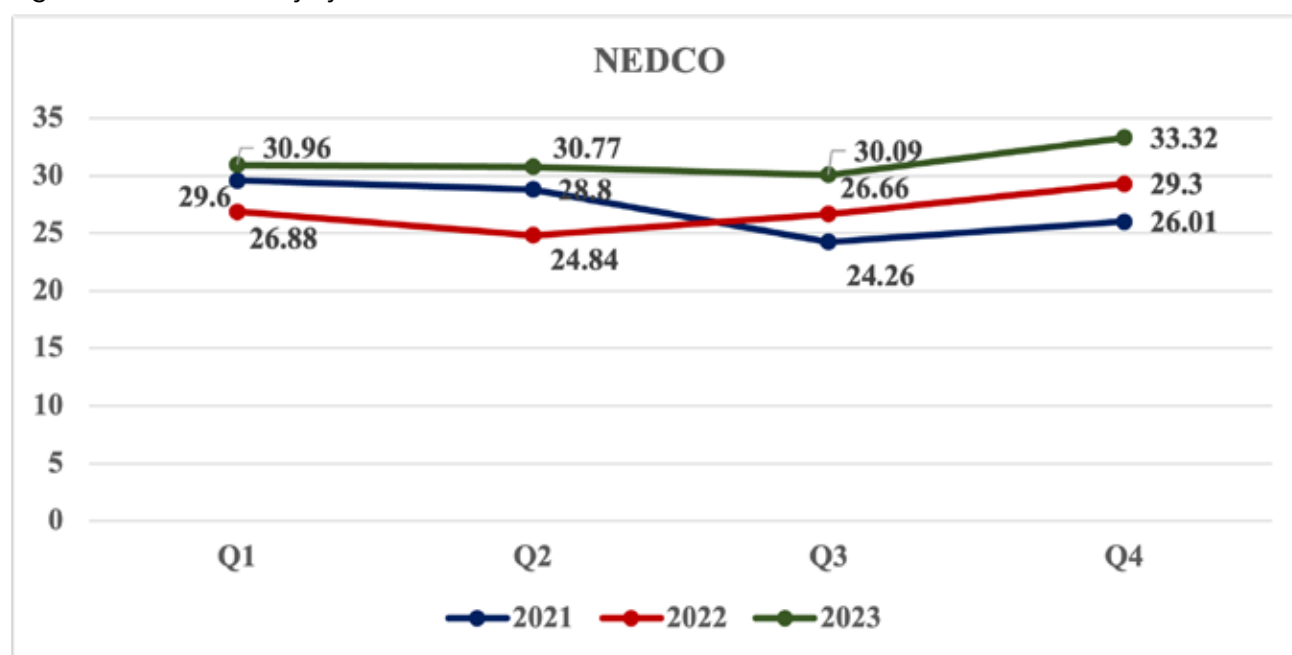


In general, ECG's annual system losses for the period (2021, to 2023), can be said to have improved albeit still high. Aside recording a higher system loss of 37.36% in the first quarter of 2022, subsequent values recorded have been below the average system loss for 2021 (31.9%). The system losses for the first three quarters of 2023 further declined significantly below that of the 2022 values while that of the Q4 of 2023 increased to 27.3%. Despite this improvement, the average system losses still failed to meet the benchmark that was set by the Commission for the period; [22.6% for 2021 and 2022, and 21.4% for

5.2 Northern Electricity Distribution Company

Similar to the case ECG, it was observed that, except for the year 2022, NEDCo, also experienced higher system losses in the first and fourth quarters of each year. It was also noted in 2022 that, subsequent to the decline in system losses for the second quarter, there was an increase in the third quarter to the fourth quarter.

Figure 1: ECG's Quarterly System Losses (2022-2023)

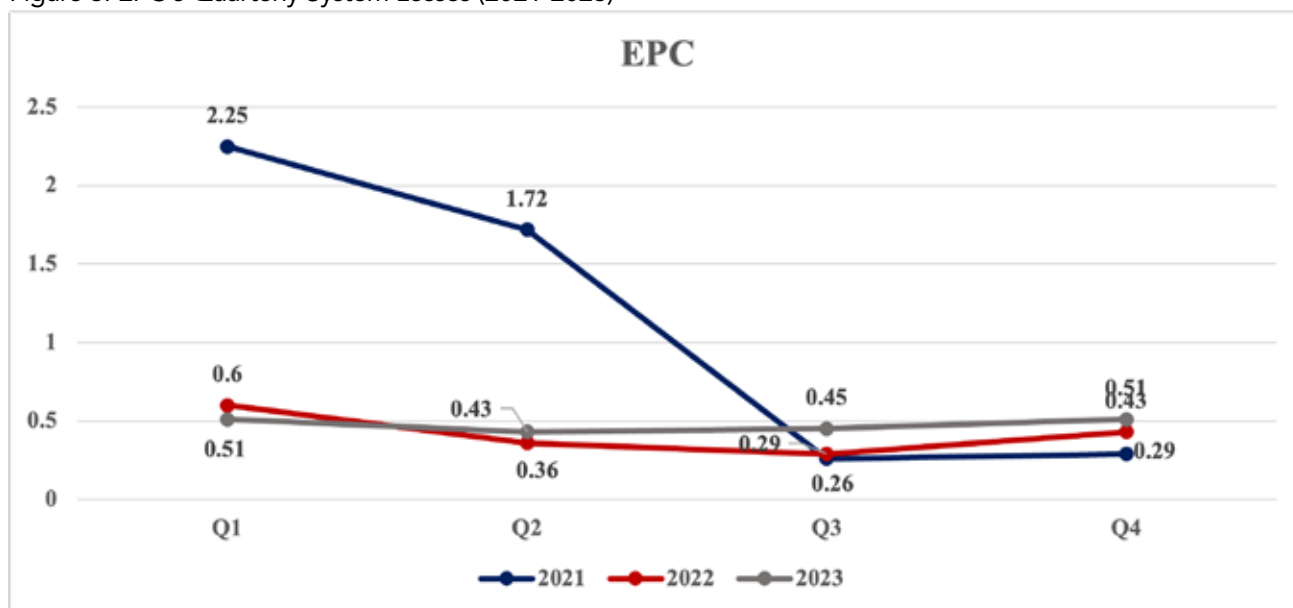


It was generally, observed that, NEDCo's losses for the period were above the regulatory benchmarks. Over the period under review (2021 – 2023), NEDCo's best performing year was 2022, with an average energy loss of 26.92%, compared with 27.17 % 2021 and 31.28% in 2023. This suggests that, NEDCo's 2022 system losses improved by 0.92% over the 2021 recorded values of 27.17%. The reduction in losses could be attributed to improvements in power generation from the Bui hydro plant and GRIDCo's energization of the Kumasi – Kintampo stretch of the 330kV line. NEDCo's performance has since deteriorated, averaging 31.28% per quarter for the year 2023 after the downward adjustment of the loss benchmark during the 2022-2025 major tariff review.

5.3 Enclave Power Company

The Commission's energy loss benchmark for EPC is 3.0%, comprising 1.4% technical losses and 1.6% commercial losses. This benchmark was set taking into consideration, the small nature of the distribution company, serving a small class of consumers, within the free trade zone areas. Similar to ECG and NEDCo, the first and last quarters EPC also experienced higher system losses in the first and fourth quarters of the years under review (2021 – 2023), experienced higher system losses compared with the second and third quarters. These losses were, however, lower than the Commission's benchmark.

Figure 3: EPC's Quarterly System Losses (2021-2023)



It is observed from Fig. 3 that, EPC's losses have always met the Commission's benchmark of 3% since 2021, and has since improved significantly falling far below the Commission's benchmark. The company's quest at reducing low voltages and technical losses led to its investment in distribution feeders within its network and this has since yielded some significant results. During the 2022 major tariff review, the Commission admonished the company to further reduce its losses as it was considering reducing the loss benchmark from 3% to 2%. As shown in figure 3.0, EPC has since been performing below the benchmark for the period.

6.0 Implications of System Losses

As part of efforts to manage losses throughout the 2022–2025 Tariff Control Period, the Commission, in its major tariff review (September, 2022), adopted yearly loss reduction targets for electricity distribution companies. The Commission's loss reduction targets for these regulated utilities are contingent upon short-term capital investments which have been approved for the period.

Prior to September 2022, the benchmark for ECG's and NEDCo's losses was set at 22.6%. However, the Commission in its 2022-2025 major tariff review reduced the benchmark from 22.6% to 21.4%. This regulated benchmark of 21.4% was used to account for the cost of power losses in the distribution network. The overall distribution losses for ECG which the Commission approved, based on the 21.4% loss levels, amounted to 3,676 GWh; estimated at GHS 2,463.39 million. Similarly, the approved overall distribution losses for NEDCO based on the 21.4%, amounted to 486 GWh; estimated at GHS 327.22 million.

In context, the above estimated system losses averages GHS 18.32/kWh; which is the rate required by the distribution companies to pay electricity generators in order to offset the cost of the Commission's benchmarked power lost in distribution. This means that, the distribution companies would be more financially stressed when they fail to bridge the gap between the regulated benchmark and their system losses levels.

7.0 Conclusion

From the above desktop analysis, it can be concluded that, the electricity distribution companies are more vulnerable and record higher system losses in the first and fourth quarters of the year. These periods in Ghana covers the season where the country experiences harmattan dryness and is often associated with bush fires and its attendant burning of electric poles. At the same time, it is believed that, the first and fourth quarters of the year being seasons of heat and long holiday periods also contributes largely to a high demand in electricity consumption.

Literature also suggests that political interferences in the operation of the distribution companies is a major cause of higher system losses. In 2021, the African Centre for Energy Policy (ACEP) reported that, the Self-Help Electrification Programme (SHEP); a community-driven electrification mechanism introduced in 1989, could lead to an exponential rise in system losses. The report noted that political meddling and misuse of SHEP metres, especially when they are not used in approved areas, are major factors in the rise in illegal connections and, thus result in significant losses the power industry is experiencing.

8.0 Recommendations of the Brief

- The following measures are recommended as steps towards minimising distribution system losses.
- The Commission should charge regulated utilities to embark on targeted nationwide campaign on the effects of bush fires on their infrastructure.
- The Commission should engage ECG and NEDCo to understand the real causes for the high system losses in the first and fourth quarter of the year.
- The electric utilities should invest in different weather sensitive devices in order to cater for either hot or cold seasons.
- Electric utility companies should create a database, populated with accurate and up-to-date data on their customers, their billing information, and network assets (such as metres, poles, transformers, etc.). In the case where utilities have already invested in Customer Management System (CMS) and Network Information Systems (NIS), customers may need to be re-registered in their existing CMS and assets geo-tagged and properly coded and added to the NIS.
- Electric utilities need to be able to map losses and their underlying causes, do comprehensive loss analytics, and create and implement focused loss reduction plans.
- The Utilities should proactively capture data on customers connected to the grid via Self Help Electrification Projects (SHEP) meters and issue prompt bills.
- A comprehensive evaluation of the utility as a whole can reveal its organisational strengths and shortcomings in terms of identifying and resolving losses and increasing income. Typically, a utility's loss reduction plan divides its customer base into classes and gives priority to commercial and industrial clients for its activities.

References

- Mahmood, M., Shivam, O., Kumar, P. and Krishnan, G. (2014) Real Time Study on Technical Losses in Distribution System. International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, 3, 131-137.
- Abrokwa, K.K., Dramani, J.B. and Bhattarai, K. (2017) The Effect of Electricity Technical Losses on Ghana's Economy: A Simulation Evaluation. OPEC Energy Review, 41, 286-317. <https://doi.org/10.1111/opec.12111>.
- Osei-Appiah, V.K. and Arthur, J.L., 2022. Managing System Losses to Improve Energy Efficiency within the Electricity Company of Ghana (ECG) Limited. Smart Grid and Renewable Energy, 13(6), pp.121-136.
- Adom, P.K., 2016. Electricity Supply and System losses in Ghana. What is the red line? Have we crossed over?
- Public Utilities Regulatory Commission (2021). Fourth Quarter Public Utilities Regulatory Information System (PURIS). <https://www.purc.com.gh/attachment/455299-20220825070808.pdf>
- Public Utilities Regulatory Commission (2022). Fourth Quarter Public Utilities Regulatory Information System (PURIS). <https://www.purc.com.gh/attachment/760607-20230607090605.pdf>
- Public Utilities Regulatory Commission (2022). Fourth Quarter Public Utilities Regulatory Information System (PURIS).
- ACEP (2021). Investigating the Prevalence of Illegal Meters on the National Grid. <https://acep.africa/wp-content/uploads/2023/03/Investigating-The-Prevalence-Of-Illegal-Meters-On-The-National-Grid-edited.pdf>



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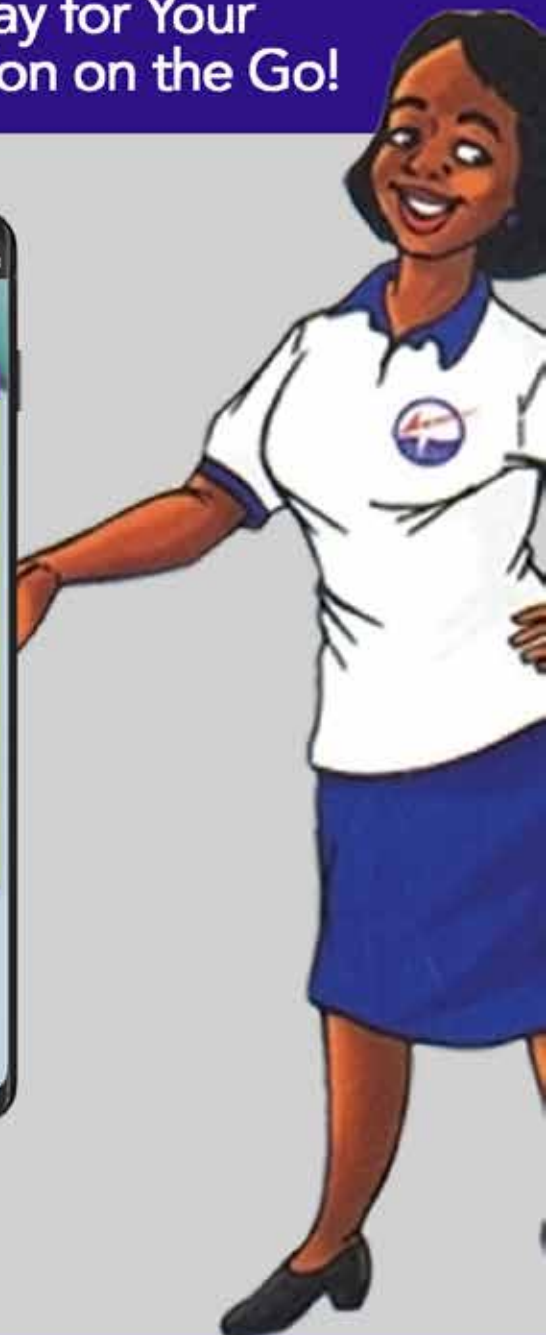
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OUR CONTACTS

HEAD OFFICE

2nd Floor Olympic Committee Building
No. 53, Liberation Road, Ridge
P. O. Box CT 3095 Cantonments, Accra
Digital Address: GA-052-9469
Tel: (233-302) 244181-4
Fax: (233-302) 244188
WhatsApp: (233-558) 082547
Email: info@purc.com.gh
Website: <http://www.purc.com.gh>

Greater Accra Regional Office

Ground Floor, GNAT Heights
Opposite Zenith Bank, Liberation Road
Tel: (233-302) 240046
WhatsApp: (233-540) 126201

KUMASI

1st Floor Cocobod Jubilee House
P. O. Box 1001, U.S.T
Kumasi, Ashanti Region
Tel: (233-322) 037510
Fax: (233-322) 080937
WhatsApp: (233-540) 126202

TAKORADI

2nd Floor, GPHA Credit Union House
Behind Bank of Ghana
P. O. Box AX 1985
Takoradi, Western Region
Tel: (233-312) 024010
Fax: (233-312) 025261
WhatsApp: (233-540) 126203

TAMALE

1st Floor, NCA Building
Opposite Regional Coordinating Council,
P. O. Box TL 1870
Tamale, Northern Region
Tel: +233-372) 026380
Fax: (233-372) 027918
WhatsApp: (233-540) 126204

KOFORIDUA

Galloway, Near Jubilee Park Koforidua
P. O. Box KF 2781
Koforidua, Eastern Region
Tel: (233-342) 020770
Fax: (233-342) 020771
WhatsApp: (233-540) 126205

HO

2nd Floor, GERCO Plaza, Opposite SG-Bank
P. O. Box HP 1373
Ho, Volta Region
Tel: (233-362) 028607
Fax: (233-362) 028608
WhatsApp: (233-540) 126206

SUNYANI

Plot 15/16 South Industrial Estate
Sunyani Magazine
P. O. Box SY 1003
Sunyani, Bono Region
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Tel: (233-382) 024524
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