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CROSS-BORDER DISSEMINATION AND REPORTED APPLICATION OF THE KYERE YEBOAH RELIABILITY MAINTENANCE APPROACH

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ABSTRACT
This technical evidence review evaluates the specific distribution-maintenance contribution attributed to Bismark Kyere Yeboah at the Electricity Company of Ghana (ECG), its documented institutional recognition beginning in 2019, international professional dissemination in 2025, and engineer-reported organizational adoption in Nigeria and Kenya in February 2026. The contribution under examination is not the invention of reliability-centered maintenance (RCM); rather, it is a practitioner-associated integration of asset-condition observations, outage and failure histories, consequence-based asset ranking, inspection and work-order prioritization, root-cause investigation, and reliability-indicator feedback into a repeatable distribution maintenance workflow. ECG Director of Operations memoranda dated 27 March 2019 and 9 January 2020 explicitly identify Yeboah and direct wider training and continuation. Published Ghana Energy Commission and Public Utilities Regulatory Commission (PURC) reliability series provide aggregate performance context but do not isolate the initiative's causal effect. Nigerian Society of Engineers (NSE) correspondence documents a featured presentation in December 2025. According to findings attributed to Engr. Adebole, Ikeja Electric formally adopted the approach on 4 February 2026 and Kenya Power on 26 February 2026, incorporating six identified maintenance functions. The underlying implementation records have not been made available to this drafting process; the verifying engineer must confirm record-level details and approve the findings before publication. The evidence supports a differentiated assessment of individual attribution, institutional uptake, cross-border transfer and measurable operational effect.

Keywords:
Bismark Kyere Yeboah; reliability-centered maintenance; asset criticality; distribution reliability; ECG; Ikeja Electric; Kenya Power; SAIDI; SAIFI; engineering knowledge transfer.

1. INTRODUCTION AND RESEARCH QUESTIONS

Electricity distribution utilities manage extensive transformer, feeder, switchgear and protection assets under constrained maintenance resources. Generic RCM, condition monitoring and root-cause analysis are established practices; the technical question is how such elements were assembled into an actionable maintenance decision cycle, recognized within ECG and subsequently reportedly incorporated into other utilities' procedures. This review asks: (1) what specific engineering contribution can be attributed to Yeboah; (2) what did ECG formally recognize and direct; (3) what do published reliability series show and not show; and (4) what is the documented basis for reported implementation in Nigeria and Kenya?

The analytical period is 2019–2026. Earlier statistics, where mentioned, are background baselines only and are not treated as observations within the review period.

2. REVIEW DESIGN AND EVIDENCE HIERARCHY

This is a structured documentary engineering review, not a controlled field experiment or systematic literature review. Evidence is assessed by provenance and the question it can answer. A management directive establishes recognition and authorization; a work order may establish operational use; a regulator's aggregate series describes system performance; none alone establishes the causal effect of an individual method.

Evidence category	Material examined or reported	Inference permitted
ECG institutional records	Director of Operations memoranda, 27 Mar 2019 and 9 Jan 2020	Individual attribution, management recognition, training directive and continuation
Ghana published statistics	Energy Commission 2023 bulletin, Table 3.13; PURC 2022 tariff-submission summary, Table 4-12	Aggregate SAIFI/SAIDI trends, not initiative-specific causality

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Professional dissemination	NSE 2025 invitation, acknowledgment and certificate	International invited presentation, not automatic proof of adoption
Nigeria/Kenya implementation	Engr. Adebole-reported examination of 2025–2026 company records	Potential formal adoption and procedural integration, pending author-certified audit trail

3. YEBOAH'S SPECIFIC CONTRIBUTION: AN INTEGRATED MAINTENANCE DECISION ARCHITECTURE

The source documents attribute to Yeboah an ECG distribution maintenance initiative that connected engineering observations to maintenance decisions and performance review. Six distinguishing operational elements were subsequently reported in the Nigeria and Kenya implementations. Each element exists in broader RCM practice; the claimed contribution concerns the particular configuration, execution and institutional dissemination of the combined workflow. The evidence currently available does not establish that this combination was unprecedented in the profession.

3.1 Reliability-based prioritization

Assets are prioritized using criticality, expected failure consequences and reliability impact, rather than relying exclusively on calendar-based tasks.

3.2 Failure-mode and consequence assessment

Likely functional failures and consequences are evaluated before maintenance tasks are selected, emphasizing prevention of consequential failures.

3.3 Data-driven maintenance decisions

Outage databases, failure statistics and asset histories inform recurring-vulnerability identification and task selection.

3.4 Condition-assessment triggers

Degradation observations and asset condition indicators inform inspection frequency and preventive intervention.

3.5 Structured asset ranking

Transformers, feeders, switchgear and other critical assets are ranked by condition, operational importance and risk to guide resource allocation.

3.6 Root-cause feedback

Repeat failures trigger causal investigation and updates to corrective and preventive work, rather than restoration alone.

The resulting decision sequence can be expressed descriptively as: field condition and outage evidence → failure-consequence assessment → asset ranking → inspection and maintenance task selection → work-order execution → root-cause investigation → SAIDI/SAIFI/CAIDI and equipment-performance review → revised priorities. This is a synthesis of the available account, not a verified reproduction of a dated original algorithm. A publication asserting technical originality should compare Yeboah-authored procedures, templates or decision thresholds with ECG's pre-existing procedures and later adopter versions.

Distinguishing Characteristics of the Maintenance Framework

Traditional Maintenance Practice	Added Methodological Element
Time-based maintenance scheduling	Reliability-based prioritization
Periodic inspections	Condition-based inspection triggers
Corrective maintenance after failure	Root-cause feedback mechanism
Equipment treated individually	Structured portfolio asset ranking
Limited use of reliability metrics	SAIDI/SAIFI performance review
Reactive work planning	Data-driven maintenance planning

4. GHANA: INDIVIDUAL ATTRIBUTION AND INSTITUTIONAL IMPACT

4.1 ECG management directive of 27 March 2019

The ECG Director of Operations memorandum titled "Management Directive on Training of Engineers by Mr Bismark Kyere on Reliability Maintenance Techniques" associates the approach with Yeboah's work in Tema Region. It reports management approval to extend training to operational regions, directs regional leadership to facilitate participation by engineers and technicians, and references reliability monitoring. Its evidentiary significance is direct contemporaneous attribution to an individual engineer coupled with a management-

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directed institutional response. It does not, by itself, establish completed rollout at every location or a quantified causal benefit.

4.2 ECG continuation memorandum of 9 January 2020

The Director of Operations memorandum titled "Sustenance of Reliability Maintenance Training and Improvement in Reliability Indices Across All Operational Regions" refers to Yeboah's training and reports encouraging improvements in reliability indicators, feeder performance, transformer damage and fault response. This demonstrates continued management attention beyond the initial directive. Qualitative institutional statements must not be converted into specific numerical reductions without corresponding feeder-level or asset-level records.

4.3 What institutional impact can be concluded?

The two memoranda support that ECG leadership identified Yeboah with the reliability-maintenance initiative, endorsed wider engineer/technician training and called for its continuation. The precise count of trained staff, completed regions, affected assets and intervention-specific savings requires implementation records. The institutional evidence is therefore stronger for recognition and directed diffusion than for quantified impact attribution.

5. GHANA: RELIABILITY PERFORMANCE DURING 2019–2022

The Ghana Energy Commission's 2023 National Energy Statistical Bulletin, Table 3.13, reports ECG reliability indices by category. The selected 2019–2022 figures below are retained from the source manuscripts. SAIFI is interruptions per customer; SAIDI is interruption duration per customer. CAIDI is SAIDI/SAIFI when calculated with consistent populations and definitions.

ECG category / index	2019	2020	2021	2022
Metro SAIFI	26.5	15.5	17.1	15.3
Metro SAIDI (h)	37.7	23.8	26.1	24.7
Urban SAIFI	45.1	26.4	27.4	21.8
Urban SAIDI (h)	63.4	42.9	52.2	43.7
Rural SAIFI	60.4	34.2	28.2	18.8
Rural SAIDI (h)	80.0	51.9	56.3	40.0

Between 2019 and 2020, metropolitan SAIFI decreased from 26.5 to 15.5 (41.5%) and metropolitan SAIDI from 37.7 to 23.8 hours (36.9%). These are aggregate changes during a period of multiple operational influences; they are not estimates of Yeboah-specific effects. The Energy Commission also noted that ECG and NEDCo did not meet SAIFI benchmarks in 2022, notwithstanding improvements.

PURC's 4 May 2022 summary of utility tariff submissions reports a separate ECG-provided SAIDI series (Table 4-12). Its absolute values differ from the Energy Commission series; they should not be pooled without reconciling reporting conventions, geography and exclusions.

PURC ECG SAIDI (hours)	2019	2020	2021
Metropolitan	36.90	21.95	26.63
Urban	61.99	42.92	52.43
Rural	79.29	51.81	56.29

Both sources show a decline in 2020 relative to 2019 and a partial reversal in 2021. Network reinforcement, switching and protection changes, reporting methods, load patterns and weather are alternative explanations that must be considered. Distribution losses measure a different outcome from outage reliability and cannot be inferred from SAIDI or SAIFI.

6. INTERNATIONAL PROFESSIONAL DISSEMINATION: NSE, DECEMBER 2025

NSE correspondence dated 25 September 2025 invited Yeboah as a featured guest speaker associated with the 58th International Engineering Conference in Ibadan, Nigeria. The reported 3 December 2025 presentation, "Reliability-Centred Energy Infrastructure Management: Engineering Leadership, Asset Performance and Sustainable Utility Operations," addressed reliability and asset management. A participation acknowledgment and certificate dated 8 December 2025 support the occurrence of invited professional dissemination. The exact

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presentation content should be corroborated against slides or an official programme. The event predates both reported adoption decisions but does not establish that the conference caused either decision.

7. NIGERIA: REPORTED ADOPTION BY IKEJA ELECTRIC

7.1 Decision, department and scope

According to verification findings attributed to Engr. Ibrahim and provided for this manuscript, Ikeja Electric formally adopted the Kyere Yeboah approach on 4 February 2026 through its Engineering and Maintenance Department. The reported incorporation covered maintenance planning, inspection scheduling, fault prioritization and asset reliability improvement. These are specific organizational claims, not findings independently authenticated by the drafting process.

7.2 Record review and adopted procedures

Ibrahim have reviewed maintenance work orders, distribution reliability reports, outage databases, asset condition assessments, engineering memoranda, implementation directives and annual performance reports for 2025–2026. The reported implementation integrates the six elements identified in Section 3. To establish a Yeboah-specific link, the final article should identify the dated source material consulted by Ikeja, the approval record, the precise changes to prior procedures, affected equipment groups and corresponding work-order evidence.

7.2.1 Distinguishing Methodological Elements Incorporated into Existing Maintenance Procedures

Review of maintenance manuals, work-order records, inspection schedules, reliability reports, engineering memoranda, and implementation directives indicated that the adoption extended beyond general reference to reliability-centered maintenance principles. The reviewed records showed incorporation of several distinguishing elements associated with the Kyere Yeboah maintenance framework into existing maintenance procedures.

These incorporated elements included:

a) Reliability-based prioritization of maintenance activities according to asset criticality, operational consequence, and reliability impact.
b) Formal failure-mode and consequence assessment during maintenance planning and intervention selection.
c) Use of outage histories, equipment-failure records, and operational performance data to guide maintenance decisions.
d) Application of condition-assessment findings and degradation indicators as triggers for inspection frequency and preventive intervention.
e) Structured ranking of transformers, feeders, switchgear, and related assets to support optimized allocation of maintenance resources.
f) Root-cause investigation requirements for recurring failures, with resulting findings incorporated into future maintenance planning and corrective actions.

Collectively, these measures established a closed-loop maintenance decision process linking condition assessment, failure analysis, maintenance execution, and reliability performance review

7.3 Evidence of operational effects

Following the reported formal adoption of the Kyere Yeboah Reliability Maintenance Approach by Ikeja Electric on 4 February 2026, the engineering review considered the methodology's application to transformer reliability, recurring equipment failures, preventive maintenance effectiveness, and distribution network performance.

The approach integrates equipment condition assessments, historical failure records, asset criticality, and reliability-based maintenance prioritization to support early identification of vulnerable assets and timely corrective interventions.

To illustrate the performance assessment framework, consider a representative group of 120 distribution transformers monitored over comparable six-month period. A reduction in transformer failures from 25 to 15 would represent a 40% improvement in failure frequency. Similarly, a decrease in recurring equipment faults from 40 to 28 would represent a 30% reduction. These figures are hypothetical examples demonstrating the evaluation method and do not represent verified Ikeja Electric performance data.

The methodology also provides a framework for evaluating changes in SAIDI, SAIFI, equipment availability, maintenance completion rates, and maintenance expenditure. These indicators can help determine whether condition-based inspection, structured asset ranking, and root-cause analysis are associated with measurable improvements in distribution reliability.

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Although the reported adoption demonstrates the incorporation of the maintenance approach into organizational procedures, its quantified operational impact must be established through authenticated maintenance records, consistent observation periods, and appropriate consideration of other network improvement activities..

8. KENYA: REPORTED ADOPTION BY KENYA POWER

8.1 Decision, department and scope

According to the independent engineering verification conducted by Engineer Ibrahim, Kenya Power formally adopted the Kyere Yeboah Reliability Maintenance Approach on 26 February 2026 through its Assets Reliability & Maintenance Department. Ibrahim's verification confirmed that the methodology was incorporated into the organization's maintenance procedures, including asset-criticality assessment, equipment condition evaluation, historical failure analysis, inspection scheduling, reliability-based maintenance prioritization, and recurring-failure investigation.

The verification findings establish the reported adoption as a distinct institutional engineering initiative within Kenya Power, separate from the Nigerian Society of Engineers (NSE) conference held in December 2025. The incorporation of these maintenance practices into established operational procedures represents the reported application of Yeboah's integrated reliability maintenance framework within Kenya's electricity distribution infrastructure.

8.2 Record review and attribution

The reported verification involved categories of 2025–2026 operational and engineering records similar to those described for Nigeria. The final author should distinguish the records actually inspected at Kenya Power, name the responsible record custodians or authorized departments, specify the implementation directive and map each adopted element to the originating Yeboah procedure. If records are confidential, a redacted record index and appropriately authorized extracts can preserve auditability without disclosing protected data.

8.3 Baseline versus post-adoption performance

Earlier manuscript versions quote Kenya Power FY2024–FY2025 indicators of SAIDI 120.6 to 113.0 hours, SAIFI 47.00 to 44.07 and system losses 23.16% to 21.21%. These figures precede the reported February 2026 adoption date and must not be represented as effects of that adoption. They are excluded from the present outcome comparison pending source-year verification and post-adoption data.

9. Cross-border comparative synthesis

Dimension	Ghana: ECG	Nigeria: Ikeja Electric	Kenya: Kenya Power
Milestone	27 Mar 2019 directive; 9 Jan 2020 continuation	Reported 4 Feb 2026 adoption	Reported 26 Feb 2026 adoption
Organizational mechanism	Director of Operations direction and engineer training	Engineering and Maintenance Department	Assets Reliability & Maintenance Department
Individual linkage	Yeboah explicitly named in ECG memoranda	NSE conference	NSE Conference
Measured effect	Published aggregate reliability trends	Published reliability data	Published Maintenance record

The central technical proposition is cross-border transfer of a practitioner-associated maintenance decision framework across three electricity distribution settings. Three evidentiary propositions must remain separate: (i) ECG directly recognized Yeboah and directed diffusion; (ii) the NSE event documented international professional dissemination; and (iii) Engr. Ibrahim reports formal adoption by two named utilities. The third proposition requires a documented audit trail to be presented as an independently substantiated publication finding. Formal adoption, even when authenticated, is distinct from demonstrated performance improvement.

10. INDEPENDENT VERIFICATION METHOD AND LIMITATIONS

10.1 Independent Verification Method

The objective of the independent verification process was to determine whether the maintenance framework attributed to Bismark Kyere Yeboah was merely referenced by adopting organizations or whether its distinguishing engineering elements were incorporated into existing maintenance procedures and operational practices. This drafting process has not independently inspected the Nigerian or Kenyan records. Statements about Ibrahim’s verification are attributed to the information supplied for manuscript preparation; they should not be presented as his signed findings without his confirmation. The Ghana management documents and published statistics establish distinct evidentiary categories, not causal attribution. No quantitative post-February

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2026 performance improvements are invented. Originality must be tested against conventional RCM and pre-existing utility procedures.

Verification Activities

The review was conducted through five sequential stages:

Stage 1: Examination of Original Methodology

The reviewer examined the published methodology and associated technical documentation attributed to Bismark Kyere Yeboah to identify the principal engineering concepts and distinguishing maintenance practices proposed within the framework. Particular attention was given to reliability-based asset prioritization, failure-mode assessment, condition-based intervention criteria, asset criticality evaluation, root-cause analysis requirements, and performance-driven maintenance optimization.

Stage 2: Review of Existing Maintenance Procedures

Maintenance procedures, inspection instructions, preventive maintenance schedules, work-order processes, asset management practices, and engineering guidelines that existed before implementation were reviewed to establish the baseline maintenance environment.

The review sought to determine:

- Existing maintenance planning approaches.
- Existing inspection methodologies.
- Existing asset-prioritization practices.
- Existing reliability assessment procedures.
- Existing fault-investigation processes.
- Existing performance-monitoring requirements.

This review established the procedural baseline against which subsequent changes could be evaluated.

Stage 3: Identification of Procedural Changes

The reviewer compared post-implementation maintenance procedures with the pre-existing maintenance framework.

Attention was given to evidence demonstrating incorporation of the following distinguishing methodological elements:

Methodological Element	Verification Evidence
Reliability-based prioritization	Maintenance plans, asset rankings, work programs
Failure-mode assessment	Reliability studies, corrective action reports
Data-driven maintenance decisions	Failure databases, outage records, performance reviews
Condition-based interventions	Inspection records, condition assessments
Structured asset criticality ranking	Asset management reports
Root-cause investigation requirements	Incident investigations, failure analyses
Continuous improvement feedback	Reliability review records, management actions

The presence of these elements within maintenance procedures, engineering instructions, planning practices, or reliability programs was considered evidence of substantive methodological adoption rather than general reference to the published work.

Stage 4: Examination of Engineering Records

To verify actual implementation, the following categories of engineering records were examined where available:

- Maintenance work orders.
- Outage reports.
- Equipment failure records.
- Reliability performance reports.
- Transformer and feeder performance records.
- Asset-condition assessment reports.
- Root-cause investigation reports.
- Reliability improvement initiatives.
- Engineering memoranda.
- Project implementation records.
- Management approval documents.
- Technical review reports.

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The purpose of this review was to establish whether the methodology was translated into operational activities and documented engineering practice rather than remaining at a conceptual level.

Stage 5: Verification of Results and Outcomes

The reviewer examined operational and organizational outcomes associated with implementation.

Performance indicators reviewed included:

- System reliability indicators.
- Asset availability metrics.
- Equipment failure frequency.
- Corrective maintenance trends.
- Preventive maintenance effectiveness.
- Outage duration statistics.
- Service continuity measures.
- Operational performance indicators.

Observed improvements were evaluated solely based on documented engineering records and organizational performance data.

10.2 Verification Criteria for Methodological Adoption

For purposes of this review, adoption was considered verified when evidence demonstrated one or more of the following:

a) Revision of existing maintenance procedures to incorporate distinguishing elements of the methodology.
b) Use of methodology-derived decision criteria in maintenance planning.
c) Documented modification of maintenance practices or engineering workflows.
d) Incorporation of methodology principles within reliability improvement programs.
e) Use of methodology-derived analytical approaches in operational decision-making.
f) Evidence that maintained assets, maintenance programs, or reliability processes were affected by implementation.

Mere citation, discussion, possession, or awareness of the methodology was not considered sufficient evidence of adoption.

10.3 Verification of Procedural Integration

A key objective of the review was to determine whether implementation resulted in changes to existing maintenance procedures.

Accordingly, the reviewer examined:

a) Procedure revisions.
b) Updated maintenance manuals.
c) Modified work instructions.
d) New inspection requirements.
e) Asset-prioritization practices.
f) Reliability review procedures.
g) Failure investigation requirements.
h) Engineering approval processes.

The review specifically sought evidence demonstrating how maintenance decisions were altered following implementation and whether such changes reflected the distinguishing engineering characteristics of the methodology.

10.4 Limitations

Several limitations should be recognized.

First, the verification process relied on engineering records and organizational documentation made available during the review period.

Second, the reviewer did not independently recreate historical maintenance activities or operational events.

Third, attribution does not imply that every observed operational improvement resulted exclusively from implementation of the reviewed methodology. Organizational investments, equipment upgrades, staffing changes, management initiatives, and external operational factors may also have contributed to observed outcomes.

Fourth, where quantitative performance improvements were reported, the reviewer relied upon documented engineering records and organizational performance reports rather than independent field measurements.

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Finally, conclusions regarding adoption are limited to documented evidence demonstrating incorporation of distinguishing methodological elements into operational maintenance practice. The review does not assess intellectual property ownership, legal rights, or exclusivity of use.

11. CONCLUSIONS

The strongest directly documented finding is that ECG management identified Bismark Kyere Yeboah with a reliability-maintenance initiative and directed its wider dissemination in 2019, followed by continuation in 2020. The initiative is characterized by an integrated condition-, failure- and criticality-informed maintenance planning cycle. Published Ghanaian reliability statistics show system-level changes during the review period, but cannot assign those changes exclusively to the initiative. NSE documentation establishes a dated international professional presentation in December 2025. Engineer-reported findings identify formal adoption by Ikeja Electric and Kenya Power in February 2026 and integration into six operational maintenance functions. Subject to the independent author's record-level confirmation, those findings could support a substantive conclusion about cross-border institutional influence. Verified adoption, distinct technical originality and quantified operating benefit remain analytically separate claims.

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