

Grids Of The Future

Why Africa's utilities are the linchpin of the continent's growth: and the solutions and financing models that can realize their potential

August 2026

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About this report

In May 2026, BCG and the Global Energy Alliance for People and Planet co-convoked a Utility CEO Forum on the sidelines of Enlit Africa, a multi-day gathering that brought together utility chief executives and technical leaders from across the African continent to discuss the challenges and opportunities facing Africa's transmission and distribution grids.

The conversation was candid, grounded in lived operational experience, and striking in one respect above all: the gap between the scale of the problem and the availability of practical, affordable solutions has narrowed considerably. The tools exist. The sequencing is understood. What remains is the will to begin.

A central message to emerge from the Forum is that digitization and AI are not futuristic add-ons but the most practical and affordable route available to utilities today. Aspects of this have been validated through Global Energy

Alliance's Grids of the Future programme deployments across Africa and Asia, including the digitization of roughly two million assets for Jaipur Vidyut Vitran Nigam Limited in India. Getting the grid right starts with making it visible: building an accurate digital record of assets and customers, layering in an AI-ready data infrastructure, and only then deploying the intelligence that turns data into operational and financial decisions. This short report distils the key insights from the Forum through that lens, including a five-stage technical modernization roadmap, financing models that go beyond grants and sovereign guarantees, and four priorities for collective action over the next twelve months.

It is aimed at utility leaders, financiers, and policymakers with a stake in Africa's energy transition, and at anyone who has wondered whether the continent's grid challenges are solvable. As Enlit Africa 2026 made clear, the answer is yes.

The grid is the economy

No economy has industrialized without reliable, affordable and accessible power. The grid is the circulatory system of growth: where investment in generation becomes productive use, from which factories, hospitals, schools and digital infrastructure draw their driving force, and where the economics of the entire energy value chain are settled. For Africa, home to the world's youngest, fastest-growing population, and with an ambition to power approximately 600 million of people while industrializing and integrating its markets, getting the grid right goes beyond the power sector, extending to national development.

The utility sits at the center of that system. When utilities are solvent and capable, generation attracts finance, renewables scale, tariffs stay affordable and cost-reflective, and industry can rely on the power it needs to compete. When they are not, the whole chain stalls: distribution companies cannot pay for bulk supply and deliver reliable supply to customers, transmission is inflexible and constrained, generators cannot pay for fuel, energy intensive users defect and put more pressure on strained utilities, and tariff pressure grows. It becomes a self-reinforcing downward spiral that no volume of new generation can fix on its own. Strengthening the utility, especially the transmission and distribution grids, is therefore the most effective step available to any entity invested in

African growth, including the financial institutions on whose capital the transition depends.

The pressures utilities face, including commercial and technical losses, tariffs that do not reflect costs, and a widening infrastructure financing gap, are well known. What the Utility CEO Forum at Enlit Africa 2026 made clear is even more important: the solutions now exist, they are affordable, and they can be sequenced so that each step earns the right to the next.

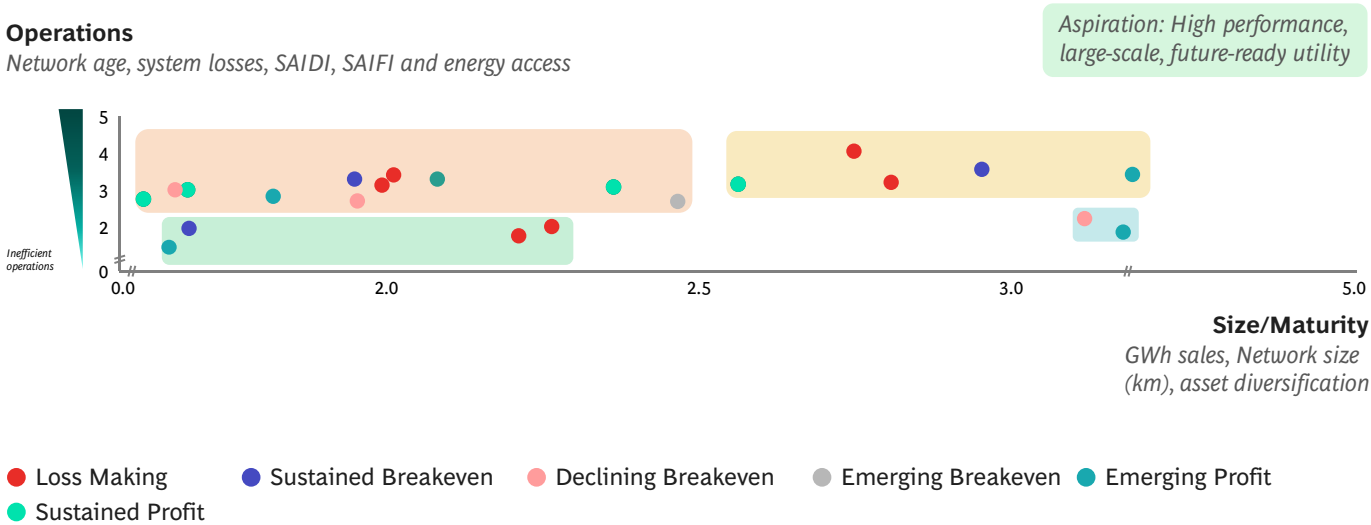
One destination, different starting points

Throughout the room, where utilities of very different sizes, geographies and maturities were present, the aspiration was identical: a high-performing, future-ready utility, financially solvent and trusted by its customers. What differed was the starting point. A simple framework makes that concrete, locating each utility on dimensions of operational efficiency and system complexity, with an overlay of financial health. Four archetypes emerge, each implying a different first move.



African utilities generally fall into one of four archetypes

Segmentation of African utilities by operational efficiency and size/maturity



A Emerging Smaller Operators Smaller systems still building basic operational discipline, with limited reliability, coverage, and financial stability. Losses ~20-40%; SAIDI 50-250 hrs; Network ~15-35k km	Focus - Stabilize collections and cash flow by improving billing and payment discipline - Establish basic operational control and visibility (outages, losses, collections) - Build core systems and processes to run reliable day-to-day operations
B Growing Mid-Scale Operators Smaller to mid-sized systems improving performance, but still facing losses, inefficiencies, and constraints to scale operations. Losses: 10-25%; SAIDI up to 80 hrs; Network ~1-100k km (variable)	Focus - Reduce technical and commercial losses by targeting high-loss feeders and improving metering and enforcement - Improve field productivity and streamline procurement to reduce costs and delays - Prioritize quick wins that generate cash to fund the next steps
C Scaled but Operationally Constrained Larger systems with significant scale, but performance is held back by outages, losses, and weak operational execution. Losses ~18-23%; SAIDI 40-55 hrs; Network ~90-170k km	Focus - Identify the biggest sources of losses and inefficiencies (feeders, outages, assets) - Focus on a few high-impact interventions (outage reduction, fault response, key assets) - Scale what works across the network
D Scaled and Advanced Operators Large systems with strong capabilities and performance, facing growing complexity and the need to sustain performance while integrating new technologies. Losses ~5-15%; SAIDI <35 hrs; Network ~100-400k km	Focus - Optimize system performance and reliability using data and predictive tools - Modernize the grid and digital capabilities (data platforms, analytics, automation) - Enable integration of decentralized energy (e.g., solar, batteries) and manage growing demand

1. Classified as having profit margin of -5%<x<5% ; 2. Indicative ranges based on benchmarking across African utilities; actual classification reflects multiple dimensions.
Note: Utilities were evaluated across all dimensions relevant to the x- and y-axes, with the final score calculated as the weighted average of all sub-buckets
Source: Utility Annual Financial Statements; World Bank; UPBEAT; BCG analysis

The value of the framework is the discipline it imposes: the right first move is the one that delivers visible operational and financial value, builds credibility with boards, funders and communities, thereby justifying the next investment. All four archetypes follow the Grid of the Future digitization journey.

The foundation of the “Grid of the Future”: digitize first, then add intelligence

Narrowing the focus down to electricity distribution, the most persistent pain points facing utility grids: patchy visibility of assets and customers, slow loss detection, long connection cycles, and fragmented systems, are essentially data and process gaps. They yield to a sequence that incremental fixes cannot match: digitization first (turning physical assets and processes into accurate geo-spatial digital records), then a consolidated, AI-ready data layer, then the intelligence that turns data into decisions, and only then the AI applications on top. Order matters: without a geospatially referenced asset register, AI cannot tell which feeders are bleeding value.

The Distribution Company Modernization Journey: a five-stage roadmap to the Grid of the Future

Translating this sequencing principle into practice, Global Energy Alliance’s Grids of the Future programme structures utility modernization into five progressive stages, drawing on implementation experience from Jaipur and other emerging-market utility engagements. Each stage delivers measurable value and earns the right to fund the next, making the journey self-reinforcing rather than dependent on a single large capital commitment.

1 Foundational: Network Digitization. Building the digital foundation through Asset Digital Twin Creation, Asset Registry and Taxonomy Management, Network Topology Modeling, Feeder Load Profiling, and Power Flow Analysis. Without this layer, no AI application can function reliably.

2 Efficiency: Operational Integration & Grid Observability. Consumer-Transformer (CT) Mapping, AMI Head-End Integration and Meter Data Standardization (MDMS), Outage Visibility, AT&C Loss Segregation, and Network Congestion Analytics give the utility real-time visibility across its entire network. This transforms reactive crisis management into evidence-driven operations.

3 Modernization: AI-Enabled Predictive Analytics. Reliability Indices (SAIFI, SAIDI, CAIDI), Demand Analytics, Non-Intrusive Appliance Load Monitoring (NIALM), Asset Health Indexation (AHI) and Remaining Useful Life (RUL) Estimation, New Connection Workflow automation, and Demand Response. The utility moves from describing what happened to anticipating what will happen.

4 Advanced: DER Optimization. Bidirectional Power Flow Monitoring, Renewable Energy Forecasting, Short-Term Load Forecasting (STLF) and Long-Term Demand Planning, Distributed Renewable Energy (DRE) Hosting Capacity Analysis, and Battery Energy Storage System (BESS) Siting and Sizing Optimization. This stage makes growing renewable penetration grid-safe and dispatchable.

5 Leadership: Transactive Grid. Power Purchase Agreement (PPA) Optimization and Merit Order Dispatch, Real-Time Demand Flexibility Management, Virtual Power Plant (VPP) Orchestration, and blockchain-enabled Peer-to-Peer (P2P) Energy Markets enable the utility to become an active market orchestrator. At this stage, it is bankable, trusted, and fully future-ready.

No single stage is optional. A utility attempting Stage 3 predictive analytics without the Stage 1 asset register, or Stage 4 DER optimization without the Stage 2 metering data layer, will find the technology misfires. The framework’s discipline is precisely its value: it prevents the procurement of point solutions that cannot connect to anything, and it gives funders a clear, evidence-linked basis for releasing the next tranche of capital.

Crucially, this is viable now, even in highly constrained contexts. The Global Energy Alliance’s Grids of the Future deployment in Jaipur, India, financed and operationalized in partnership with Jaipur Vidyut Vitran Nigam Limited, digitized roughly two million assets in months rather than years. This was achieved at an order of magnitude lower cost than traditional methods. The deployment also reduced the processing time for connection applications from 90-days to less than a week. Learnings from this deployment are now being applied across Global Energy Alliance’s Champion Utility engagements in Africa and other regions. While there is no silver bullet, right-sized, locally grounded solutions deliver fast, economical results. Tools must reflect local realities; approaches trained on contexts that do not resemble African streets will misfire. As with any transformation, this journey needs to be accompanied by a change management process. The opportunity lies in bringing existing investments together with new ones into a coherent, sequenced stack, rather than buying the next standalone point solution.

Digitizing the grid also unlocks a larger prize - a renewable-heavier generation mix is the structural route to lower-cost, resilient, and more affordable power. But to finance generation, losses in the grid, especially non-technical losses, must be reduced, because the same leakage that compresses

today's cashflow raises the risk premium that lenders attach to tomorrow's generation. And many of the hardest problems are as much socio-cultural as technical: vandalism, theft and non-payment can be addressed not only by smart or prepaid meters and analytics, but by community engagement, education, visible accountability, and giving communities genuine agency over their supply.

Financing the future: beyond grants and sovereign guarantees

For financially-strained utilities, there is a welcome message that the financing conversation must broaden. Two parts of the problem call for different funding structures.

For operational interventions, such as applying digitization and AI to the distribution network, ticket sizes are modest and paybacks are quick. They open the door to models beyond grants: OEM and vendor service contracts paid on usage; outcome-, milestone- and performance-based arrangements in which a successful pilot unlocks funding to scale; and PPP structures. Reducing non-technical losses pays for itself and carries the simplest business case of all.

For infrastructure, above all transmission, the gap is more acute and the structures are harder. Generation PPPs have essentially been solved, leaving transmission as the frontier, with cross-border interconnectors harder still. The challenge is twofold: finding creative financing models beyond grants and sovereign guarantees, and reforming governance and regulation to build investment confidence. Working examples already point the way: Mozambique, where transmission and generation were financed together; South Africa, where privately-funded transmission is being tendered and supported by an innovative Credit Guarantee Vehicle (CGV) to remove requirements for government guarantees, which pool and reallocate risk. A key step is opening the regulated transmission model to new players, like independent transmission developers and regional intermediaries, alongside the incumbent, rather than requiring every asset to sit on the utility's balance sheet. Telecommunications, which faced analogous challenges decades ago, solved them through new technologies and business models, and provides a useful precedent.

These solutions are complementary, as investment-grade governance that attracts private capital is itself a product of operational and financial progress. Where replacement capital is scarce, extending the life of existing assets is a powerful lever. Drone-based inspections with AI imagery analysis, predictive maintenance and continuous asset-health monitoring deliver value early, reduce unplanned outages and ease the very capital pressure that motivates the financing conversation. Regional planning and financing, too often missed by taking solely national views, deserve the same fresh attention as bilateral approaches reach their limits.

Already in motion

At the Enlit Utility CEO Forum, utility leaders shared initiatives that they were already undertaking, including digitally-powered solutions:

- 1. AI-powered tariff modelling** for external shocks such as oil-price moves, coordinated with the finance ministry on subsidy timing, alongside a financing partnership for strategic stockpiling.
- 2. Live loss-prevention pilots**, pinpointing the gap between what is delivered and what is consumed by specific customers.
- 3. Smart-meter rollouts at scale**, with parallel ministry-led network assessments to verify reported losses.
- 4. Criminalization of energy theft**, with the focus now shifting to enforcement.
- 5. Prioritizing power imports** through Power Pool Agreements for industrial / paying customers, while keeping domestic generation aligned to residential consumption.
- 6. Regional financing exploration**, including intermediary structures such as Africa GreenCo in the SAPP context.

Moving Forward

Four actions warrant collective attention over the next twelve months:

- 1. Tackle commercial losses vigorously**, treating community engagement and customer education as strategic priorities, not afterthoughts. Stage 2 tools, including AT&C Loss Segregation and Network Congestion Analytics, provide the granular evidence base that makes this actionable rather than aspirational.
- 2. Pursue AI in asset management**, including inspection, predictive maintenance, and health monitoring, to extend asset life without enterprise system overhauls. This maps directly to Stage 3 Asset Health Indexation (AHI) and Remaining Useful Life (RUL) Estimation, which identify deteriorating equipment before it fails and prioritize capital allocation based on evidence rather than political pressure.
- 3. Sustain structured cross-utility peer learning**, sharing both successes and lessons from approaches that did not work.
- 4. Deepen exploration of regional financing possibilities**, including intermediary structures, hybrid-currency arrangements, and regional planning frameworks.

The Grid of the Future

Envision the power grid that will emerge when this path is followed. It knows its network in real time: every transformer, feeder, and meter is a live data point, so losses are evident as they occur and faults are addressed before most customers notice them. Capital is allocated based on evidence rather than political pressure. Connecting a new customer takes days instead of months, and a growing share of supply is clean, locally generated, and affordable, supported by a grid that is flexible enough to accommodate it. Batteries and distributed renewable energy resources are optimized automatically, storing surplus solar generation during the day and dispatching it during the evening peak, while Virtual Power Plants aggregate distributed assets into reliable, dispatchable capacity. At its most advanced, the grid enables peer-to-peer energy markets in which communities and businesses trade locally generated power directly, turning consumers into active participants in the energy economy.

Above all, such a grid is bankable: its transparency and discipline deliver precisely what private and concessional capital require. Financing becomes investment in a creditworthy enterprise, rather than grants of last resort. The power grid is trusted and guarded by the communities it serves, who evolve from adversaries to active stewards. It is no longer the bottleneck in the economy but its enabler, powering the factories, hospitals, schools and data centers on which Africa's growth depends.

None of this requires a single breakthrough or a grand bargain. It is reached one disciplined step at a time, each step delivering visible value, building credibility, and earning the right to the next.

That is the opportunity in front of every utility's power grid and every financier with a stake in the continent. The grid is where Africa's growth ambitions will be won or lost. The encouraging conclusion from Enlit Africa 2026 is that the path is now navigable: affordable, sequenced and bankable, for those willing to take the first step.



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Acknowledgments

The authors thank the utility CEOs, executives, and technical leaders who participated in the Utility CEO Forum at Enlit Africa 2026 for their candid insights, on-the-ground experience, and willingness to share both successes and setbacks. The issues and solutions captured in this report are based on their perspectives and group discussions. We are equally grateful to Enlit Africa for hosting the Forum and for convening the continent's utility leaders in such a substantive and productive way, and to our co-convening partners for their partnership in making it possible.

We thank our colleagues across BCG's Energy practice and the Global Energy Alliance for their contributions to the analysis,

their review of earlier drafts, and their ongoing commitment to advancing energy access across the continent. Special thanks are due to the teams working directly with African utilities through Global Energy Alliance's Grids of the Future programme, whose implementation experience grounds every recommendation in this paper.

We also acknowledge the broader ecosystem of development finance institutions, regulators, technology partners, and community organisations whose collaboration makes the Grid of the Future not just a vision, but an achievable destination: one disciplined step at a time.



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