



Presentation of the GEAR Initiative

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Context

Despite being home to almost one-fifth of the world's population, Africa accounts for only about 3% of global electricity demand. Yet, Africa stands at the threshold of an unprecedented period of growth in electricity demand, with many countries suffering from blackouts hindering social and economic growth. At a sustained growth rate of 6.5% per annum, it has the highest growth rate in the world, according to the International Energy Agency (IEA). Improving grid efficiency and resilience in order to contribute to increased access to electricity is the priority of many governments, especially in non-OECD countries.

Demand, which currently stands at around 200 TWh p.a., would more than quadruple by 2040 under an energy demand growth scenario based on existing policies and driven by expected increases in income and industrialization; a more ambitious 2040 scenario that prioritises universal access to electricity shows a seven-fold increase to 1,500 TWh p.a. The electricity demand projections are being progressively converted into investment plans and contracts for electricity infrastructure worth at least 42 billion US\$ per year through 2040¹.

With political aspirations to get more people connected (Sustainable Development Goal 7 calls for universal energy access by 2030), priority is given to the lowest initial cost. One way to increase the amount of electricity delivered to the final end-users is to reduce losses in transmission and distribution (T&D). It is with this in mind that the Grid Efficiency and Resilience (GEAR) Initiative is established.

Rationale

The African Union has acknowledged that Africa's grid, especially in Sub-Saharan Africa, has higher technical and commercial losses than many other economies. The African Union's Action Plan for Harmonized Regulatory Framework for the Electricity Market in Africa (2016)

¹ Source: The PIDA Energy Vision, The Programme for Infrastructure Development in Africa: Transforming Africa through Modern Infrastructure. Available at www.afdb.org.



identifies that “most African countries record very high total transmission and distribution system losses. While the total system losses in developed countries range between 7% - 10%, they are about 15% to 29% in most sub-Saharan African countries”². In the Republic of Congo, T&D losses are estimated at 44.5%³.

Strategy documents by the African Union Commission, power pools and utilities (as quoted throughout this study) recognize that **loss reduction is essential to improve the viability of utilities and stretch energy access to the maximum number of people**. The challenges to achieving that are significant and reducing losses will require a mix of interventions that are captured in the Grid Efficiency and Resilience (GEAR) Initiative. The range of technical measures to reduce losses are well established with low-loss distribution transformers as one of the most widely applicable, relatively easy to rectify and highly effective in the long term. Crucially, low losses must be built into the upcoming surge of installation numbers so that better performance is locked in for the service life of those transformers, products which have service lives of over 30 years.

The objective of the GEAR Initiative is to **improve the efficiency and resilience of grids to contribute to greater access to safe and reliable electricity**, by mobilizing existing structures, organizations, and programs in regional efforts throughout the continent.

Mission Statement

GEAR’s mission is to maximize the amount of electricity delivered to fuel developing countries’ economic and human development without increasing electricity production and GHG emissions

Alignment with UN SDGs

It can be argued that SDG7 is the golden thread that connects all 17 of the UN Sustainable Development Goals. GEAR’s top-level goal is to make progress against the stated objective of SDG7 to “ensure access to affordable, reliable, sustainable and modern energy for all.” A more efficient and stable electricity grid in Africa will make a positive impact on as many as ten of the 17 UN SDGs:

Here are some examples of impact on the SDGs. This is not an exhaustive analysis, but rather a high-level overview to show how an effort focused primarily on SDG7 provides many socio-economic benefits.

- A stable grid can provide more hours of access to electricity. This means students are able to study when the sun goes down, leading to higher education rates (SDG4).
- This, in turn, creates a young population more prepared to enter the workforce, which alleviates poverty (SDG1), improves economic growth (SDG8) and supports a sustainable transition towards an increasing rural population (SDG11).
- Energy poverty strongly affects the individual’s living and social conditions and undermines educational and business opportunities, and disproportionately affects

² Source: https://au.int/sites/default/files/documents/40437-doc-ActionPlan_HarmonisedRegulatoryFrameworkElectricityMarket.pdf

³ Source: <https://web.stanford.edu/group/efmh/jacobson/Articles/I/TransmisDistrib.pdf>



women and girls. Access to a stable grid supports gender equality (SDG5) and empowers women and girls to become self-reliant.

- A lack of stable energy leads to the use of fuelwood for cooking. When done in contained indoor environments this leads to high instances of respiratory illnesses, in particular with infants and young children. Healthcare facilities and the systems contained within also benefit from a stable grid (SDG3, Good Health & Well Being).
- Reliable refrigerators for food storage powered by a stable grid helps to ensure a sustainable food supply (SDG2, Zero Hunger).
- Lower transmission and distribution losses are critical to overall efforts to increase energy efficiency, which is necessary if climate change ambition (SDG13) is to be realized.
- SDG17 (Partnerships for the Goals) is critical.

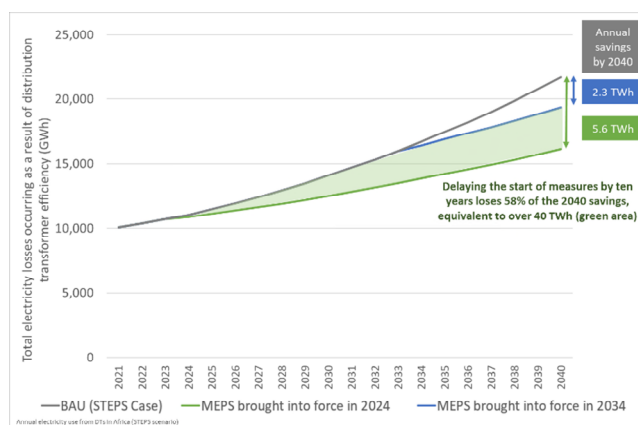


GEAR seeks to partner with existing initiatives whose remit is to make an impact on the UN SDGs in Africa. Like-minded organizations working together can accomplish much more than individual companies going at it alone, and we bring more than 20 years of experience and expertise in building partnerships in support of SDG7 and the myriad of SDGs that benefit from advancement of SDG7.

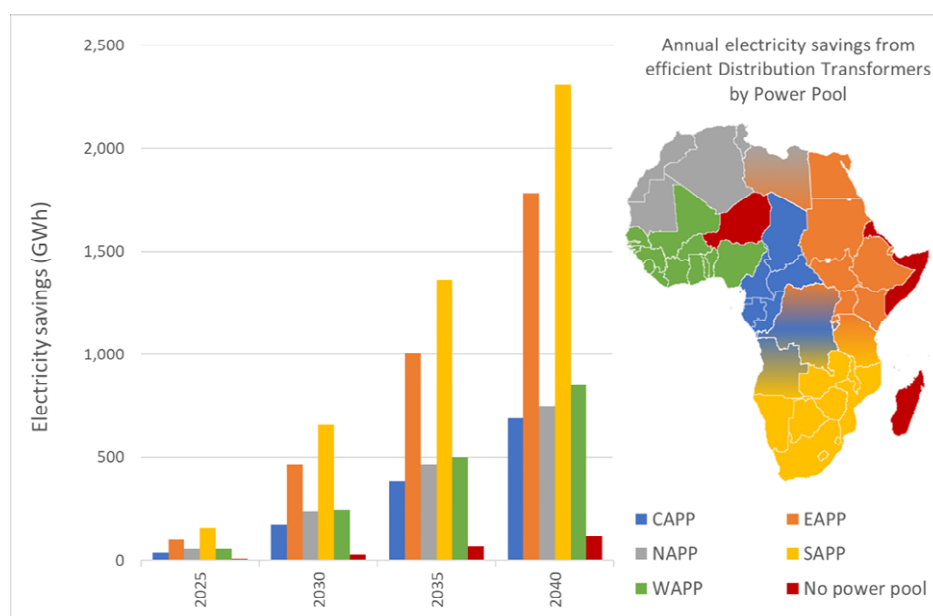
Low-loss distribution transformers: a crucial element in electricity access

There are multiple benefits when distribution systems reduce technical losses through the deployment of low-loss distribution transformers. Electricity and CO₂ emission savings through avoided losses are effectively additional kWh that can be delivered to customers.

Given the imperative nature of electricity access for all, low-loss DTs can play an important role in terms of reducing the need for additional capacity and increasing the amount of electricity delivered to the final end-user by up to 5.6 TWh by 2040, should countries adopt MEPS (minimum energy performance standards) by 2024 per the U4E Country Savings Assessments.



Low-loss distribution transformers represent one element – albeit an important one – in an approach towards increasing available electricity. GEAR sees an opportunity to align with partners that bring expertise and technical capacity in other facets of grid efficiency.



Electricity savings achieved in each African Power Pool by introducing MEPS for DTs in 2024 (note: chart includes duplication of savings as some countries are members of more than one Power Pool, denoted by mixed colour shading; those in red are not members of a Power Pool).⁴

Stakeholders' consultations

Interviews were conducted with 17 key stakeholders to help identify the threats and challenges that must be addressed, and to identify opportunities for partnerships. Discussions were held with four utilities, three development banks, four regional energy efficiency programme hubs, a multinational transformer manufacturer and a power pool. A questionnaire was also circulated to a larger number of stakeholders.

⁴ For more information on the approach and savings, see the U4E Country Savings Assessments: <https://united4efficiency.org/countries/country-assessments/>

Policy makers and regulators

Market transformation can only be achieved within an enabling policy and regulatory environment. It is therefore crucial that countries adopt mandatory minimum efficiency performance standards (MEPS) for distribution transformers. Consultations also revealed that the IEC 60076 series must be adopted as a testing standard to appropriately measure the performance of DTs.

Provide technical assistance to policy makers and regulators to develop national market transformation policies based on MEPS and IEC 60076-1.

Decision-makers

DTs are purchased by utilities and non-utility players. In both cases, decisions are based on economic analyses which often favour the initial purchase costs, as opposed to the life cycle cost of the equipment. As DTs usually last for over 30 years, the Total Cost of Ownership approach should be adopted.

Build capacity of decision-makers on the TCO: utilities and non-utility players, governments (for public procurement)

Local manufacturers

Present in most developing countries, local manufacturers often do not have the technical capacity to design and manufacture low-loss DTs. A market transformation cannot happen at the expense of the local manufacturing industry, which capacity must be built.

Build capacity of local manufactures on design of low-loss DTs; facilitate access to finance for local manufacturers

International finance community

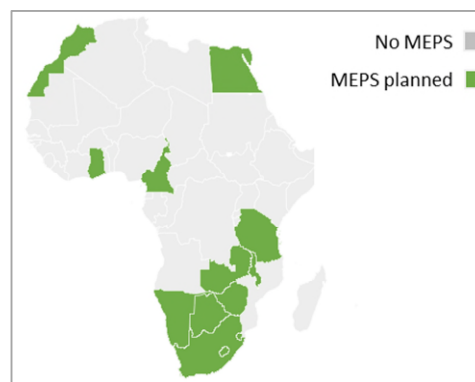
Many electricity grid expansion investments in Africa are funded via the international finance and donor community. Technical loss reduction must be embedded in loan or grant conditions. It makes no sense for the international donor community, in its assistance to developing countries, to finance projects which do not meet sustainability criteria.

Work closely with banks and donors to mandate the procurement of low loss DTs and other technical loss reduction measures

In addition, there are several financing mechanisms that can be utilized to make the financing of low-loss DTs affordable to non-utility players as well as public utilities.

Opportunities for synergies

With little attention paid to the efficiency of distribution transformers (DTs), only few countries have initiated the process to adopt MEPS. However, **continental and regional-level initiatives are underway**, including a combination of bottom-up, technically driven engineering good practice in utilities and industry, while top-down regulatory approaches to grid development have ensured development of the market for low-loss distribution transformers in several parts of Africa.



These programs and initiatives offer important foundations for the development of technical assistance programs in support of grid efficiency in Africa:

- **Overarching regional political framework:** the African Union has committed to the adoption of the U4E Model Regulations Guidelines⁵ and Procurement Specifications⁶, including for DTs; the African Union Commission (AUC) and the African Energy Commission (AEC) are developing a continental strategy for technical losses reduction.
- **Technical assistance tools and programs:** a number of organizations are active in providing technical assistance and capacity building: U4E, UNEP Chemicals and Health program, West African Power Pool and GIZ, the Association of Power Utilities in Africa (APUA), as well industry players like Hitachi-ABB.
- **Readiness support projects** funded by the Green Climate Fund in eight countries in the SADC region are developing MEPS and supporting policy measures to promote low-loss DTs.
- **Case studies to inspire:** several countries have successfully adopted MEPS for DTs, and several utilities, including in Africa, have mandated the procurement of low-loss DTs.

The Rationale for greater ambition

While minimum energy performance standards (MEPS) – not only for distribution transformers, but for all electricity-using products – are critical, they ensure energy-efficient markets for *future purchases*. To achieve total market transformations, the *installed base* must also be addressed, especially for equipment that have an operational lifetime of over 30 years like distribution transformers.

With this in mind, policy interventions focused purely on MEPS will leave out an enormous energy saving potential that could be grasped only with programs targeting the installed

⁵ Source: <https://united4efficiency.org/resources/model-regulation-guidelines-for-energy-performance-requirements-for-distribution-transformers/>

⁶ Source: <https://united4efficiency.org/resources/model-procurement-guidelines-for-liquid-immersed-distribution-transformer-technical-specification/>

base. How can we overcome this challenge? A critical component of GEAR is the development of early replacement programs for distribution transformers.

If electricity grids in Africa are to be made sustainable and resilient, priority must be given to the 196.6 MVA of installed distribution transformers in Africa. GEAR will include capacity building and technical assistance as part of its overall effort to accelerate grid efficiency efforts in Africa. Financing of early replacement programs is a significant challenge; yet, a value proposition based on Total Ownership Cost will show attractive payback periods and a strong return on investment. Based on successful experiences in large-scale replacement programs on industrial equipment (i.e., electric motors) financial institutions and philanthropic organizations working in Africa will be mobilized.

The Grid Efficiency and Resilience program elements

In the context of universal access to electricity, and therefore with respect to grid extension programs in Africa, several measures are needed to make electricity delivery more stable and efficient. Such measures are a mix of mandatory and accompanying policy instruments, as revealed by needs analyses and confirmed by relevant stakeholders. The program elements described hereafter have been designed to address the needs expressed by the key stakeholders and build on existing political and organizational structures that can be instrumental.

The program elements follow the U4E Integrated Policy Approach for distribution transformers, which has been developed and utilized by a range of experts from governments, utilities, manufacturers, NGO and international organizations. The program elements adapt the U4E Integrated Policy Approach to meet the current needs and circumstances of African countries.

1. Create an enabling policy and regulatory framework

1.1 Adoption of the IEC 60076 series as testing standard

All stakeholders including utilities and manufacturers agree that IEC 60076-1 is the most appropriate standard to be used to measure the performance of DTs (using load and no-load losses testing as opposed to 50% load). Adoption of IEC 60076-1 standard should be done across countries in a harmonized manner to avoid non-tariff barriers to trade. Harmonization also provides economies-of-scale. A regional or continental approach for the adoption of the U4E Model Regulations Guidelines for DTs should be preferred, and such could be initiated under the auspices of the African Union, building on institutions such as the African Energy Commission, with support from the Association of Power Utilities of Africa (APUA).

1.2 Adoption of mandatory MEPS

Minimum energy performance standards (MEPS) are a critical element of the market transformation program. They mandate the minimum level of performance of DTs. A schedule for increase of the MEPS levels must also be adopted to accompany the market transformation to allow sufficient time for end-users and local manufacturers to cope with the impact of the regulations. Since all countries in Africa are not at the same stage of economic development, MEPS levels could vary from country to country. However,



capacity-building efforts to support policy makers should be done in a regional format, and build on existing regional centers such as SACREEE⁷, ECREEE⁸, EACREEE⁹.

1.3 Strengthen technical loss reduction objectives in grid codes

Grid codes are critical elements of the strategy to improve the efficiency of African grids, since they prescribe the level of efficiency and other technical criteria. The program will therefore work with African electricity regulators to: 1) Develop technical loss assessment and improvement targets as statutory requirements in grid codes and distribution contracts, imposing a default use of ‘total cost of ownership’ approaches wherever appropriate in line with IEC TS 60076-20 or its derivatives; and 2) Identify and replicate good practice wording of codes.

2. Stimulate demand for low-loss DTs

Since low-loss DTs are more expensive than less-efficient transformers, it is critical to build the capacity of decision-makers regarding their economic advantages. Using the Total Cost of Ownership (TCO) approach, capacity-building programs using U4E’s TCO tool for DTs should be implemented for the following targets¹⁰:

2.1 Utility and non-utility players: education campaign and distribution of the TCO tool for design engineers and finance departments to provide evidence for them to change their procurement policies.

2.2 Finance ministry: for public utilities, procurement is handled by the ministries of finance. Since electricity is subsidized, electricity losses burden governments’ budgets with avoidable, unnecessary spending. An estimate of the financial impact of low-loss DTs on public finance should be conducted to demonstrate the necessity of changing public procurement criteria in favour of low-loss DTs. The program’s intervention will follow the guidelines of U4E on sustainable public procurement¹¹.

2.3 Improve refurbishment practices: refurbishment of old DTs is a common practice to delay the new purchase. Experience proves that this is not a sound financial policy, since it leads to a degradation of the efficiency of the transformers. The program’s intervention will seek to build the capacity of engineers and technicians on refurbishment best-practices, as well as promote performance-based contracting for refurbishment companies.

3. Support local manufacturing

Interviews with local manufacturers in Africa have confirmed the need for technical training on design and manufacture of low-loss DTs. While such training is necessary, investment in new manufacturing tools and equipment is also needed. The program will organize training course for engineers and technicians, as well as support access to financing.

⁷ SADC Centre for Renewable Energy and Energy Efficiency

⁸ ECOWAS Centre for Renewable Energy and Energy Efficiency

⁹ East Africa Centre for Renewable Energy and Energy Efficiency

¹⁰ Available at: <https://united4efficiency.org/resources/a-guide-to-using-total-cost-of-ownership-when-purchasing-distribution-transformers/>

¹¹ Available at: <https://united4efficiency.org/sustainable-public-procurement/>



The GEAR Initiative operation mode

The GEAR Initiative will be technical assistance for free to projects and programs that may benefit from GEAR's expertise. Based on mutual understandings, GEAR will provide experts and deliver outputs as agreed. GEAR will also develop new programs with strategic stakeholders and search for funding for their implementation.

GEAR is already providing such technical assistance to the governments of the Philippines, of Thailand and Vietnam for the development of MEPS and supporting policy measures to induce a long-term market transformation in favour of low loss distribution transformers.

The GEAR Initiative structure

Founded by ICA, GEAR aims to bring the major influencing agencies and stakeholders together to maximize its impact as well as contribute to a greater coordination of international efforts towards a greater access to safe and reliable electricity. GEAR is therefore overseen by its board. The board advises on strategic directions, make available their resources to support the implementation of projects, and help GEAR develop strategic partnerships and raise funding. Board members also contribute to the visibility of GEAR and enhance its outreach capacity through their wide network. Board members include the International Energy Agency, SEforAll, UNIDO and U4E; the following organizations are being approached to join the board: African Development Bank, South African Power Pool and the African Forum of Utility Regulators.

GEAR's Managing Entity will ensure day-to-day operations and will be financially supported by ICA with a full-time manager as well as other resources such as communications manager and technical experts.

GEAR is then organized according to its program elements. Each program element will be under the responsibility of a team leader, being an international expert in its field, and in charge of developing and coordinating the implementation of projects.

One critical element of GEAR will be "Funding and Partnerships," as it is essential to bring along like-minded and capable organizations through the development of strategic and mutually beneficial partnerships. GEAR will be pro-active in its searching for funding. In a separate effort, ICA is leading the organization of a new energy efficiency financing facility, and GEAR will be one of the workstreams integrated into that initiative.

- Advise on strategic directions
- Provide in-kind contributions as needed
- Help secure funding
- Facilitate implementation of projects
- Make available their communication channels

Board



tbc:



iea



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International Copper Association
Copper Alliance



Managing entity

International Copper Association
Copper Alliance

Strategic partners

Output-based agreements on mutually beneficial activities

Regional hubs



ICIMOD



Policy & regulations

Local supply chain strengthening

End-users education

Smart Grid

Financing

Grid Efficiency And Resilience

Increased amount of electricity delivered to fuel economic and human development in developing countries