AFRICA RENEWABLE ENERGY SCALE UP

THE CHALLENGES OF ACHIEVING UNIVERSAL ELECTRIFICATION

OVERVIEW AND RECOMMENDATIONS

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Published: October 2019
As part of the Sahel Alliance conference on "Access to Energy in the G5 Sahel Countries", with financial support from the European Union.

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AFD AGENCE FRANÇAISE DE DÉVELOPPEMENT

CONFÉRENCE ALLIANCE SAHEL ACCÈS À L'ÉNERGIE DANS LES PAYS DU G5 SAHEL Paris, 9 et 10 octobre 2019

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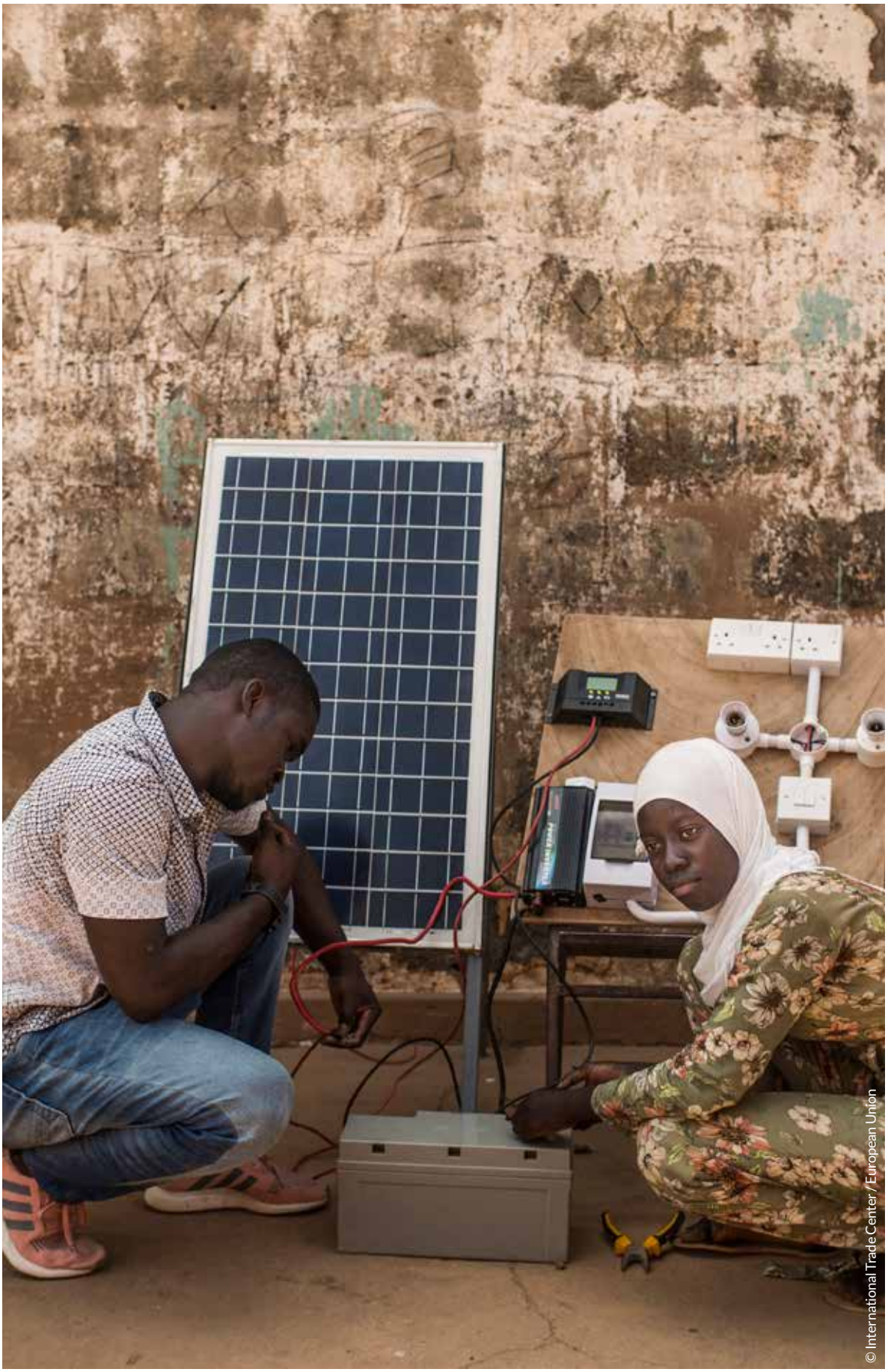

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OVERVIEW

This document[1] reviews the state of play of national off-grid electrification strategies, focusing on two main approaches: mini-grids and solar home systems. It makes recommendations with the vision of achieving universal access to electricity by 2030. This is in line with Sustainable Development Goal (SDG) 7, which is to ensure access to affordable, reliable, sustainable, and modern energy for all.

[1] This document is an executive summary of a capitalization study on solutions for access to off-grid electricity, conducted in 2019 by the Burgeap/Nodalis/ENEA/GRET consortium. The objective of the study was to analyze success factors and obstacles in programs for implementing electricity-access solutions in 7 countries (Burkina Faso, Cambodia, Kenya, Madagascar, Mauritania, Morocco, and Senegal). This included analysis of institutional and regulatory strategies, pricing policies, technical and economic components and environmental, societal and governance issues. It consisted of a literature review (studies, project evaluations, technical and regulatory documents) and interviews with key stakeholders.

TECHNOLOGICAL CHANGES AND THE EMERGENCE OF NEW PRIVATE BUSINESS MODELS ARE DISRUPTING ELECTRIFICATION STRATEGIES, INCLUDING THE "SOLE PUBLIC OPERATOR" AND RURAL ELECTRIFICATION AGENCY MODEL

In many developing countries, national grid extension strategies carried out by a single operator have proved costly and ineffective in significantly increasing rural electrification rates within a reasonable timeframe. Entrusted to rural electrification agencies since the late 1990s, management of electrification in rural areas has had limited results. This is particularly due to a limited presence in rural areas and lack of operational skills. Notably, the lack of operational knowhow explains the poor results in providing a reliable service. Although these agencies are useful during the investment and planning phase, they often have limited operational competencies.

In recent years, technological changes and new market practices have led to the emergence of new electrification solutions. Examples of technological changes include the reduction in cost of photovoltaic solar energy, batteries and highly energy efficient appliances and the introduction of mobile money. Examples of new market practices include paying a flat rate for a service rather than for consumption in kWh and lease financing arrangements with mobile payment.

These have led to new solutions such as the pay-as-you-go (PAYG) solar model, which integrates a solar home system and remote payments management. These changes have also led to new regulatory and institutional frameworks, as well as market entry from new private actors, including pay-as-you-go start-ups, utilities and investors. These new solutions can partially compensate for shortcomings in electrification efforts. However, with 800 million people still lacking access to electricity, the question of how to ensure the maximum number of households and businesses have a continuous, equitable and universal electricity service remains.

SUCCESS OF ELECTRIFICATION MODELS IS DETERMINED BY INSTITUTIONAL AND REGULATORY FRAMEWORKS

Successful electrification strategies require public authorities to competently manage and gradually implement policies.

In Morocco and Cambodia, electrification policies have been carried out successfully. Neither of these countries had a rural electrification agency, suggesting the presence of such agencies is not necessarily a decisive success factor for achieving widespread electrification.

However, the institutional framework must be comprehensive and coherent with a clear distribution of roles, skills, and resources across all actors. It must strike a balance between flexibility to adapt to changing contexts and stability to guarantee commitment from the private sector, including technical and financial partners, over the long term. Lastly, the effectiveness of the regulatory framework is also a key success factor.

RECOMMENDATION 1

ORGANIZE AN ELECTRIFICATION STRATEGY AROUND A "LEAD ENTITY", ALONGSIDE STRONG INDEPENDENT REGULATION

Entrust the electrification program to a Lead Entity with recognized authority, multiple skills, and a presence at all territorial levels

The Lead Entity must combine technical skills with the ability to manage subscribers, procurement, and other key commercial aspects. They must be able to manage large-scale programs, particularly in relation to co-financing, often on a concessional basis. In addition to deep knowledge of electricity demand, they must fully master the solutions for access to electricity in rural areas. Lastly, they must have a certain authority in relation to other institutions in the sector and have a decentralized local presence for the control and monitoring of electrification actions. **An electricity company with national coverage** has the widest range of skills to carry out or accompany the implementation of a universal electrification public policy. Another possible solution is a **public entity dedicated to rural electrification[2].**

Such a Lead Entity can work with private operators. Working with private operators can: 1) improve flexibility in interventions 2) allow for quick action in reaction to changes in demand 3) foster the development of technological innovations 4) mobilize additional investment 5) share the risks of intervention within a contractual framework. Many countries use a **public service delegation** system where the responsibilities and expected performances are defined within a detailed contractual framework. The terms and conditions of public and private co-financing can be adjusted according to the target market segments' capacity to pay.

[2] Different solutions can be considered and adapted to each country for this public entity. This may result in:
a. Transforming a rural electrification agency by developing its activity and means
b. Creating a dedicated entity within the national electricity company
c. Creating a new entity to replace old ones

In profitable areas of intervention, the program should be streamlined via unilateral administrative acts. These could be licenses or authorizations that set out requirements for the operator to maximize the positive impact for the public.

Implement independent, tailored and flexible regulation

The regulator is the key link in the institutional framework to ensure both economic sustainability and compliance with standards and regulations. The regulator's role must be strengthened by clearly defining its mission, making it politically and financially independent, and providing it with adequate technical and human resources. Part of the responsibility for monitoring developers and operators may also be given to the Lead Entity.

The system must also find the right level of regulation, balancing control and flexibility. Control must be tighter if the operator is carrying out a public service mission, but more flexible if operator's activity is purely private. The system should also be adapted to each business model and the corresponding expectations. Expectations include information to validate the technical characteristics of a project, monitoring of the operator's technical and financial capacity if it is receiving national public funds, monitoring compliance with minimum standards of quality and compatibility, social and environmental impact, urban planning and insurance. Lastly, to simplify price regulation, the latter must only be applied if public funds are being used.

Private developers should be selected through an **adapted tender process**. When a public utility is to be entrusted to a private operator, it is necessary to ensure that the operator is chosen on the basis of commitments to optimize technical and financial performance and reduce the risk of failure. In a market approach, private operators mainly develop their business on their own initiative in a context that is **necessarily more flexible**. A tender process is therefore not always needed, provided there is sufficient monitoring and control downstream. Lastly, to foster innovation and allow applicants leeway in their technological choices, the competitive process must remain flexible. Different methods should be chosen in accordance with the case in hand, such as calls for projects or calls for tender in one or two stages. A single operator can be chosen to act throughout the territory, or several operators within defined areas.

If the electrification program relies on private operators receiving public funds via public service outsourcing, a **procurement mechanism managed by the Lead Entity in support of the competent delegating authority is necessary**. The Lead Entity may act as delegating authority.

CURRENT PRICE REGULATION ARRANGEMENTS AND REDISTRIBUTION MECHANISMS DO NOT ALLOW PROJECTS TO ACHIEVE THE AIM OF A UNIVERSAL AND SUSTAINABLE PUBLIC UTILITY

In addition to the question of profitability, electricity pricing policy must allow for sustainability and universality requirements. Pricing policy can be subject to political decision-making and complex and sometimes contradictory concerns between profitability and universality or cost variability and equity. Given this, pricing policy requires redistribution mechanisms to offset gaps between markets or inequalities among users. These **subsidy and price equalization** mechanisms are essential to achieve universal access to electricity within a suitable timeframe.

Different pricing mechanisms are used according to different technical choices:

- PAYG solar home systems are mainly implemented in a context of unregulated pricing. The companies adopt a selective pricing strategy, in which the rates are affordable for a customer segment with high purchasing power. To increase sales, the strategy is accompanied by a decreasing relative pricing strategy, in which the price does not increase in proportion to the volume consumed.
- Mini-grids and the national grid are implemented in a context of mainly regulated pricing but are subject to strong political pressure. With equalization, a pricing strategy consisting of different prices per customer category can help generalize access to electricity (domestic and business use), for example by using a cost-reflective approach. Additional subsidies may therefore be necessary to offset high unit costs due to low demand and/or geographical isolation.

In the case of a public service, redistribution mechanisms must include a subsidy system for CAPEX and sometimes OPEX. Financial contribution to CAPEX is often essential if the private sector is involved. This is especially so for facilities with a long payback period, such as those based on photovoltaic power production. However, such subsidies alone are not enough to guarantee project viability if the regulated price remains low when operating, maintenance and renewal costs are high, or if consumption is below forecasts. OPEX subsidies are also often necessary for both technical and social reasons. Technical reasons can be linked to higher production costs with decentralized solutions and social reasons can be linked to equity between urban and rural users. In such cases, subsidizing OPEX can allow the same rate to be guaranteed in these areas. Harmonizing prices between rural grids and national grids is (often quite rightly) seen by many countries as a means of advancing universal electrification. Nevertheless, it is difficult to base the financing of a standardized price solely on equalization between users of the same operator. Price harmonization requires the implementation of more sophisticated tools and procedures. This may be a national equalization fund to make financial transfers between segments that are electrified using technologies with significantly different operating costs.

Providing access to electricity among poor populations requires financial support from public authorities. It also requires existing financial tools to be adapted to the realities of the sector, including subsidies, guarantee funds, and credit lines. Development partners are reluctant to grant subsidies or subsidized loans directly to private companies, especially as the sector is considered risky. These systems should seek a complementary fit between public and private funding to facilitate a large-scale roll-out of electricity services.

SUCCESSFUL TECHNICAL AND FINANCIAL SET-UP OF AN ELECTRIFICATION PROJECT DEPENDS ON FINDING THE RIGHT FIT BETWEEN TECHNICAL-ECONOMIC AND FINANCIAL FACTORS

Several factors must be considered:

- **The technical-economic trade-off** between extending the interconnected grid and setting up mini-grids (grid quality and storage costs) or solar home systems:
  - Investment costs in relation to population densities in the areas to be electrified:
    - *In clustered but isolated communities, installing mini-grids is less expensive than extending the national grid. However, the uncertain and variable nature of local consumption is still perceived as a major risk factor by many investors;*
    - *Stand-alone solar home systems are inherently better adapted to more spread-out communities, as there are no costs associated with the electricity distribution infrastructure ;*

- The electrical power required to meet local needs: the capacity of a grid is more attractive than that of solar home systems for supplying devices requiring high power at certain times;

- **Financing needs for technology**: to support its growth, the solar home system sector needs working capital and seed capital funds for local distributors. This must be in local currency and include the possibility of requesting funding guarantee tools. On the other hand, mini-grids need longer-term financing (15-20 years), especially for debt, and for larger amounts (from several hundred thousand euros to several million).

RECOMMENDATION 2

ALIGN PRICES AND SUBSIDY MECHANISMS WITH THE SUSTAINABILITY AND UNIVERSALITY OBJECTIVES FOR THE ELECTRICITY UTILITY

Build universal public policy pricing strategies

Depending on different national contexts, decisions regarding the deployment of the electricity utility require choices to be made between three contradictory objectives: 1) affordability for users, 2) extent of the geographical coverage of the service, and 3) budget sustainability for the authorities. Economic growth and social development can also be stimulated by a suitable strategy to support services that encourage power consumption.

In terms of financing and pricing, access to a (public) electricity service that is universal (in addition to quality, continuity, and equity aspects) requires actors to:

- Take account of the trend towards **alignment of pricing** rates in urban areas and the need for lower access costs to accelerate domestic subscriptions;
- Put in place **measures to encourage economic growth** alongside support for financing equipment to develop those uses which represent the largest portion of electricity consumption and, therefore, operator income. Measures can include sliding-scale pricing to support the growth of economic services that are very sensitive to electricity prices;
- Maintain **public or sectoral budget financing** when the public authorities impose universal rates. This may include compensatory subsidies to cover the depreciation or operating expenses of the operators, which are higher in rural areas; permanent subsidy funds or access to price equalization to promote the sustainable financing of the sector's development. The weight of this over-financing remains low, however, within the overall financing budget of the national electricity sector. The development of new digital tools may facilitate the implementation of these subsidy mechanisms.

In human, institutional, and technical terms, access to electricity requires:

- Qualified operators to develop and adapt the service to demand;
- Transparent technical and financial management tools for local development, including the monitoring/evaluation of rural electrification;
- Regulatory powers to guide and channel action in the light of the public policy objectives set out, and to assess the sector's financing needs.

The quality of the service must be monitored for off-grid rural electrification solutions, especially concerning the **operational components**. A decentralized service requires dedicated organization and implementation procedures as well as effective digital monitoring and control tools.

Implement flexible, long-term funding mechanisms

The aim is to break away from the traditional conception of rural electrification development. Formerly designed around the construction of physical infrastructure, it must now focus on the construction of operating models for a public-interest service. Financial and subsidy mechanisms must respect two principles. Firstly, besides financing infrastructure and products, they must encourage the implementation of **long-term plans for the operation of assets** to encourage the development of a relationship between the operator and its customers. Secondly, their application methods must remain open enough to leave room for innovation and stay flexible to keep up with the operational changes among actors.

The provision of a sustainable, high-quality service requires **stable subsidy arrangements**, when operating costs are not covered by subscriber income alone. Innovative off-grid technical solutions can be more efficient and less costly than grid extension when they are led by utility companies building a **long-term relationship** with their consumers (PAYG model, financing of user and productive equipment).

Combine public and private funding effectively

In a context where technical solutions are evolving and it remains difficult to forecast demand, it is important for mini-grid operators to retain the freedom to adjust their service offering. Support funding must allow for this type of adjustment. To promote universal access to electricity, a virtuous subsidy system for the private sector must be more structured and managed by the Lead Entity.

Make financing more competitive: public schemes to reduce project risk and mobilize commercial financing

Several gaps remain in financing off-grid electrification. Donors and private investors can support access to finance by:

- Facilitating access to long-term loans for mini-grids with a large photovoltaic solar component;
- Financing studies or support during the development phase for projects led by private actors;
- Reducing transaction costs (standardizing due diligence and subsidizing processes, grouping similar projects into a single portfolio to be funded, setting up partnerships between complementary actors);
- Ensuring continuity in the financing mechanisms for actors during their development phase (seed capital, series A funding, commercial debt and working capital financing). Donors can invest in third party structures (seed funds, debt facility) to accompany the development of the financed structures;
- Backing loans and equity with guarantees to limit risks, particularly for commercial debt inflows for medium-sized projects ($10-15 million);
- Exploring innovative financing mechanisms, such as securitization and combining subsidies and traditional loans (particularly in the case of public service outsourcing).

Introduce virtuous subsidy and incentive mechanisms

Subsidy mechanisms should:

- Adhere to a transparent process, avoiding market distortions;
- Be sustainable and available over time;
- Enable actors to innovate and encourage their involvement in building long-term relationships with their customers

Their management will also be facilitated using digital tools.

These recommendations can be applied according to different time scales:

- In the short term, donors can provide equity financing, seed grants, support for innovation and technical assistance to regulators and planning ministries to favor the creation of public-private partnerships.
- In the longer term, through sovereign financing, donors can support the definition of long-term rural electrification programs, including off-grid solutions.

ENVIRONMENTAL, SOCIAL AND GOVERNANCE (ESG) ISSUES ARE NOT TAKEN SUFFICIENTLY INTO ACCOUNT BY STAKEHOLDERS IN THE SECTOR

ESG issues concerns both 1) the environmental externalities, economic and social impacts of a sector 2) the role of local authorities and users in the governance schemes of decentralized projects. These issues are often neglected by actors in the sector because they diverge from the primary objective of electrification, are multi-disciplinary in nature and complex to address.

- Electrification solutions requiring storage are not carbon-neutral and can have a large carbon footprint if they are rolled-out on a very large scale. Today, the negative environmental externalities of off-grid solutions are not considered to any extent by public authorities. In particular, those externalities related to electrical and electronic waste, such as lead or lithium batteries, are not considered. Formal public and private waste collection and recycling initiatives are rare and consist of making the supply of new equipment conditional on the return of used equipment.
- In many cases, electrification projects do not spontaneously lead to the development of economic activities and public services. The introduction of additional accompanying measures is still very rare. Support for in-house training for businesses and public services and access to credit for purchasing electrical equipment are just two of the measures that must be reinforced.

Due to policies that are still limited in matters of decentralization and the weight of centralized power grid models, local authorities continue to be excluded from the governance of electrification. Greater involvement is essential to ensure a link between customers, operators, and institutions and to facilitate the success of the projects.

RECOMMENDATION 3

BOOST THE CAPACITIES OF RURAL ELECTRIFICATION STAKEHOLDERS IN TERMS OF BOTH UTILITY PERFORMANCE AND SOCIAL AND ENVIRONMENTAL IMPACTS

At the operational level: support all stakeholders in the rural electrification ecosystem

Support should be given to both the Lead Entity (on a technical level, in financial monitoring and programming) and private stakeholders as well as local actors in the deployment of projects (support for private operators in the case of public service delegation). For the latter, the costs associated with these implementation support services must be considered in the business plan. Their financing should be a tool for transparency and fairness in the process of assessing the most qualified operators and lowest bidders in public service outsourcing situations.

This support notably aims to strengthen the “quality” procedures of these contractors for training and supporting installation and operation teams. It also aims to support the development and financing of economic activity and productive uses.

The procedures used by the public authority to select private operators must be pragmatic, with more concentrated selection processes, integration of measures focused on results (such as Result-Based Financing)

rather than means, shorter contract periods for the first projects when they are mainly financed by public funds, and the organization of evaluation and improvement over the long term.

At the sectoral level: accompany reforms

The aim of a potential reform could be to better organize the coordination between different modes of electrification (connection to the national grid, mini-grids, individual solutions) and the different modes of governance (public, private, PPP).

When designing the reform, it will be necessary to ensure that it is based on a well-defined strategy and objectives, that the legal and regulatory framework for electricity is internally consistent, that it complies with the chosen institutional mechanism and that it is not in conflict with other legal and regulatory texts (public order, decentralization, etc.)

During the implementation phase of the reform, the Lead Entity's capacities may need to be strengthened in terms of programming dialogue, project management or local development. This will depend on the Lead Entity's initial competencies and new responsibilities. The regulator and supervising ministry may also require support to effectively play their roles in the new arrangement.

Adapt environmental regulations to the sector and support environmental management systems

The objective here is to:

- Design projects within a general framework of environmental risk assessment and control, analyzing environmental impact on a case-by-case basis. For hybrid mini-grids, this entails minimizing the environmental impact by reducing the "thermal production" component;
- Develop standards that promote the choice of good-quality, repairable equipment built in an environmentally friendly way, such as energy-efficient equipment and power-generation equipment that is modular;
- Support better regulation of waste electrical and electronic equipment (WEEE);
- In terms of waste management: increase prevention campaigns, ensure recycling and reconditioning management, set up mechanisms to improve waste collection and integrate waste into a formal processing network

Implement social development and gender action plans

This includes:

- Initiate action plans for social and gender development: carry out social and gender diagnostics, recruit a gender officer in the technical assistance team.
- Boost local ownership and governance: carry out information, awareness-raising, and consultation actions at all stages of the project; involve local authorities and users in decision-making processes and build their capacities.

This requires the institutions in charge of the sector to become less concentrated with more operators on the ground.

CONCLUDING PRINCIPLES

Achieving the objectives of universal access to electricity requires an electrification strategy based on the following fundamental principles:

- **Public service**: the strategy must aim to establish a public electricity service that is accessible to all and sustainable.
- **A combination of public & private involvement**: the strategy must combine public and private approaches within a precise contractual framework. The public sector is vital for steering the sector and achieving public service objectives. The private sector contributes efficiency, the capacity to innovate and essential financing to the development of the sector.
- **Pricing policy**: any shift towards universal pricing must be accompanied by the implementation of the equalization or subsidy mechanisms it requires.
- **Managed progressive implementation**: this is based on a combination of technical, economic, legal, and financial models in an evolving, often uncertain and risky context. Setting up a sustainable utility therefore requires time and management of the investment phase, the pricing framework, and the operating phase. Implementation must be built up gradually, showing both flexibility and stability.

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AFRICA RENEWABLE ENERGY SCALE UP

A FACILITY TO DEVELOP INNOVATIVE RENEWABLE ENERGY PROJECTS AND ACCELERATE ELECTRIFICATION ON THE AFRICAN CONTINENT.

The AFD Group, with the support of the European Union, has set up the African Renewable Energy Scale-Up facility (ARE Scale Up facility) to stimulate private sector investment in the field of on-grid and off-grid renewable energy in Africa.

Design: JEANJEAN FACTORY

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