



AFRICAN
SCHOOL OF
REGULATION

Policy dialogue on

SUSTAINABLE AND SCALABLE MINIGRID BUSINESS MODELS

Summary of Conclusions ²

Makerere University in Kampala, Uganda,
on September 10th, 11th and 12th, 2024. ¹

Prepared by
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¹ A Policy Dialogue on “Sustainable and scalable minigrid business models” was organised by the African School of Regulation (ASR), in collaboration with the Mini-Grid Partnership (MGP) and its secretariat hosted by Sustainable Energy for ALL (SEforALL), and the German Agency for International Cooperation (GIZ). The event was hosted by Makerere University in Kampala, Uganda, on September 10th, 11th and 12th, 2024. The event gathered about 30 experienced participants – from ministries, regulatory agencies, development financial institutions, international development organisations, foundations, think tanks, private investors, consultants and academia – who debated under the Chatham House rule.

² This summary of the conclusions of the event has been prepared by Ignacio Pérez-Arriaga, Senior Advisor to the African School of Regulation and co-organiser of this policy dialogue. A draft of this document has been distributed to the participants in this event and their comments have been considered in the present final version of the document. All effort has been made to represent the consensus reached on the topic of the conference and the opinions expressed by the participants, but the final responsibility for the content of this summary is that of its author. The links to download the position papers distributed prior to the conference can be found in the concept note for the policy dialogue and can be found on the website of the African School of Regulation <https://africanschoolregulation.org>.

Executive Summary

This brief report examines the regulatory, business and financial models that must be employed to achieve universal electricity access, with a focus on how to achieve sustainable and scalable minigrid business models in sub-Saharan Africa. The report summarises the outcome of a meeting of a diverse group of experts at Makerere University in Kampala, Uganda, in September 10, 11 and 12, 2024.³

The large gap in Sub-Saharan Africa (SSA) between the target of Sustainable Development Goal 7.1.1 (SDG7.1.1, full electrification by 2030) and the reality is well known and speaks for itself.⁴ Minigrids will have to help close about a third of this gap. Substantial public and private investment will be needed, and the latter will only be possible if business models for all the minigrids needed can be defined that are financially viable and can maintain this state in the long term, i.e. business models that are sustainable and scalable.

These are the recommendations of the expert group convened to discuss this topic:

- a. The main overall recommendation was to adopt an "integrated approach" to electrification. The regulation, business models and financing of mini-grids need to be integrated into the national electrification strategy, and therefore in the definition of the planning, regulation, business models and financing of all the electrification modes.
- b. Cost effectiveness requires the development of an integrated least cost geospatial electrification plan that specifies the electrification mode corresponding to each demand in the entire country.
 - The plan must provide the complete specification of the bill of materials, investment and O&M costs, and the distribution in time of the necessary works from the present time until some prescribed target date to achieve universal electricity access.

³ Ibid. Page 1.

⁴ Current projections indicate that about 660 million people will still lack access to electricity in 2030, 560 million of them in SSA. See the joint report of the SDG7 custodian agencies "Tracking SDG7. The energy progress report 2024".
<https://www.iea.org/reports/tracking-sdg7-the-energy-progress-report-2024>.

- The plan must minimise the total implementation cost, while respecting any political, social, or environmental priorities or constraints established by the policymakers. The plan must consider all electrification options, including grid extension, minigrids and stand-alone systems. The plan must reflect how the investment and O&M costs of each electrification mode depend on the adopted business model for each one and the associated sources of financing, when determining the least cost solution. The plan must be able to adapt to changing demands, component costs, energy prices and any other uncertain inputs.
 - The electrification plan must also take into account the case, unfortunately common in SSA, of those grid-connected customers with a very unreliable supply. In this case, the plan must include what is necessary to improve the service until it reaches a satisfactory level.
- c. For some SSA countries, it may seem premature and overly ambitious to design an electrification plan with a target date compatible with SDG7.1 (the year 2030). In this case, a reasonable approach may be to settle for a limited electrification target – e.g. 50% if the current level is 20% – but always taking into account the integration of the three electrification modes, the sustainability and scalability of the regulatory and business models, and the integrated financial approach.
- d. The sustainability of the electrification plan. A non-sustainable model does not meet the requirements of SDG7.1, because access to electricity may disappear after a few years. A sustainable business model must be able to continue to serve a given community indefinitely. Any electrification business model must be sustainable: i) from the perspective of the companies providing the service and ii) from the perspective of the government, which must consider all electrification modes together.
- The sustainability of any electrification mode must be based on cost-of-service remuneration (or the outcome of a competitive bidding process), to be recovered from the regulated tariffs plus a subsidy. Electricity suppliers must be paid the cost of providing the service for each electrification mode (including, of course, a reasonable return on invested capital) as a necessary condition for raising the large volume of capital required for a national electrification plan.
 - A sustainable business model for minigrids needs a "utility-like" long-term commitment by the companies providing the service and by the regulator to ensure continuity of supply, so that minigrid customers know they will never be left behind. This must be also the case for the grid extension business model and for stand-alone systems.

- From the viewpoint of the government, financing electrification must be contemplated in an integrated way: i) jointly considering the three electrification modes, and ii) accounting for the contributions of Development Partners (DPs), donors and private investors – each one according to its specific characteristics – as well as the income from tariffs (including cross-subsidization schemes) and governmental subsidies. The integrated approach to financing and a long-term perspective greatly facilitate the overall viability of an electrification financial plan.
- e. The scalability of the electrification plan. SDG 7.1 requires universal electricity access, i.e., no one left behind. The business model of a minigrid is scalable if it can attract the investment that is needed to install and operate all the minigrids that must be deployed in a territory by a given date, according to an electrification plan that leads to universal access. The same principle must apply to grid extension and standalone systems. Once an electrification plan has been adopted, for each electrification mode there must be one or more “utility-like entities” that are responsible for providing permanent supply for a specified long-term period.
- f. Concession contracts are suitable instruments to achieve sustainability of supply as well as scalability. Concessions typically imply commitments of 20+ years, and their conditions should allow for viable business models. They can be applied to portfolios of minigrids, but also to the supplier of solar home systems in a territory, or to an incumbent distribution company. There are satisfactory experiences for each of these formats. The main document describes diverse formats of implementation of minigrids to be considered.
9. The end goal of electricity access is to improve human welfare and promote economic development. Therefore, explicit incentives and/or requirements in the service contracts to promote efficient appliances, bottom-up participation, the use of electricity in activities with economic value, and collaboration with other sectors (agriculture, sanitation, transport, education, health, communications) must be explored to unlock the full transformative potential of electrification.

h. Who does what?

- A designated governmental entity will need to ensure that continuous political commitment to universal access is realized through an integrated techno-economic plan, sound regulations, and a viable financial structure. This high-level supervisory role must correspond to the ministries of energy and finance and/or any agency linked to them, via some ad hoc specialised committee. Among other tasks, this committee will supervise the development of the electrification plan and will be responsible for its implementation.
- The electricity regulatory authority and/or some governmental agency will be responsible for organising the tenders for concessions, determining the regulated remuneration of each electrification mode and establishing the regulated tariffs for each one.
- A specialized financial intermediary, “FinanceCo”, which will be a government-affiliated entity with external participation in its governance, will act as a central hub for channelling financing to distribution companies and off-grid developers. It would be very convenient, time and effort wise, if FinanceCo could be established by upgrading or adding responsibilities to an existing institution with similar duties. FinanceCo will coordinate all financing sources, including government subsidies and equity contributions, grants and concessional loans from Development Partners (DPs), loans and equity provided by private banks and investment funds, and the revenues from regulated tariffs paid by the customers. The involvement of these players in the governance structure of FinanceCo will ensure oversight and proper control of finances.

- i. The implementation of these recommendations must be customized to each country’s power sector structure, institutions, energy policy and regulation, and macroeconomic, and technical conditions, also accounting for political economy considerations.

Sub-Saharan Africa (SSA) had 1152 million people in 2022, and it is estimated that by 2050 SSA will have 2094 million people, that is, 942 million more than in 2022.

Today, about 600 million people in SSA have no access to electricity at all. At the present electrification rate, it is projected that SSA will still have 560 million unelectrified people by 2030. Today, less than a fifth of African countries have targets to reach universal electricity access by 2030. An additional 45% of the continent has set access to electricity targets, yet these are less ambitious than the goals under SDG7.⁵

The IEA in its Net Zero Emissions by 2050 scenario shows a pathway to achieve universal electricity access by 2030 where the remaining electrification to be done in SSA – mostly in rural areas – with the mix of least-cost technologies consists of 44% grid extension and connection of consumers close to the existing grid (densification) and of off-grid solutions such as mini-grids and stand-alone systems, representing 31% and 25% respectively. Almost 90% of new connections are based on renewables in the scenario.⁶

According to recent reports, there are approximately 3,000 mini-grids currently operating in SSA. These mini-grids are primarily funded through grants and non-commercial capital, with the private sector investment still nascent. To achieve universal electricity access by 2030, it is projected that up to 160,000 mini-grids would be needed to provide electricity to an estimated 380 million people in SSA. To meet these goals, the sector will require about \$91 billion – only in investment – by 2030.⁷

Completing the off-grid electrification picture, GOGLA estimates that just the investment cost of providing the tier 1 level of electrification with solar home systems would cost USD 20 billion and USD 50 billion for tier 2 level. As of 2024, approximately 45 million people in SSA have access to electricity through solar home systems.

⁵ Ibid. Page 2.

⁶ Ibid.

⁷ World Bank. (2023). "Solar Mini Grids Could Sustainably Power 380 million People in Africa by 2030 – if Action is Taken Now."

<https://www.worldbank.org/en/news/press-release/2023/02/26/solar-mini-grids-could-sustainably-power-380-million-people-in-afe-africa-by-2030-if-action-is-taken-now>

This means that solar home systems now provide electricity access to 4% of SSA households. Mini-grids provide access to 2% of people in SSA, while main grids provide access to more than 40%. Around 18% of the population without access in SSA now benefits from a solar lantern or multi-light system.⁸

Recent initiatives, like the partnership of the World Bank with the African Development Bank that aims to provide electricity to 300 million people in SSA,⁹ which is called Mission 300, aim to overcome the present gap in ambition. The two institutions are currently in the process of developing frameworks and strategies to facilitate achievement of this target.

It is therefore necessary an in-depth revision of the fundamentals behind the planning, regulation, business models and financial approaches to electrification for universal electricity access in general and minigrids in particular. This is the purpose of this report.

⁸ <https://www.iea.org/commentaries/access-to-electricity-improves-slightly-in-2023-but-still-far-from-the-pace-needed-to-meet-sdg7>

⁹ <https://www.worldbank.org/en/news/press-release/2024/04/17/new-partnership-aims-to-connect-300-million-to-electricity-by-2030>

Although the debate in the Policy Dialogue focused on mini-grids, it was inevitable to extend many of the conclusions to all modes of rural electrification. Searching for an efficient plan to electrify a territory one must consider a combination of the three electrification modes – grid extension, minigrids and standalone systems. Some level of coordination will be necessary to regulate the interactions among the business models of the developers of the diverse electrification solutions. And financing the entire electrification process of a country to achieve SDG7.1 must be contemplated from the government in an integrated way, since it would not make sense to finance the development of all the minigrids included in a national electrification plan while ignoring those demands that must be met by grid extension or by standalone systems. Therefore, the primary recommendation emerging from the Policy Dialogue was to adopt an “integrated approach” to all the electrification modes, in planning, business model design and financing.

The recommendations developed during the Policy Dialogue fit into the broad but demanding scope of what has been called the Integrated Framework for Electrification (IFE).¹⁰ The IFE is a comprehensive approach to structure electrification processes at country scale, which allows ample implementation flexibility while respecting fundamental principles emerging from the SDG 7.1 objectives.

The IFE integrates the regulation, business models and financing of mini-grids into the overall planning, definition of regulation, business models and financing of all the electrification modes.

¹⁰The IFE concept was developed by the research team at MIT of the Global Commission to End Energy Poverty, see <https://www.endenergypoverty.org>, an initiative of the Rockefeller Foundation. The original name was the Integrated Distribution Framework, but this led to the acronym IDF, which was not considered adequate. The IFE also allows to contemplate independent areas with grid extension fed by mid-sized generation, for instance mini-hydro power plants. The term IFE has a distinguished place in African history. The Ife Empire was the first Yoruba empire. It was founded in what is now southwestern Nigeria and eastern Benin. The Ife Empire lasted from 1200 to 1420. The empire became well-known for its sophisticated art pieces. It rose to power through trade with Sahelian and forest states. Its capital city, Ilé-Ife, was one of the largest urban centres in 14th century West Africa.

The IFE stands on four guiding principles that are easy to accept because they are simple and commonsense. These principles have profound implications on how the electrification process must be conducted and on their implementation with regulatory and business models, as well as on they must be financed.

3.1 Cost Effectiveness

To ensure least-cost electrification it is necessary an integrated approach that combines on- and off-grid solutions – grid extension, mini-grids and standalone systems.

The per unit cost of electrification (\$/kWh) is typically more expensive than the average cost of grid extension (because the main grid always includes urban areas with a high density of demand, plus the largest industrial and commercial loads, where the per unit cost of electrification is much lower than in rural areas). However, for communities situated far from the main grid and also for many small communities not too distant from the existing grid, minigrids can offer the lowest cost alternative to grid extension. The same can be said of standalone systems when the demand is low and scattered.¹¹

Implications of this principle

It is necessary a national electrification strategy based on the integration of grid extension, mini-grids, and standalone systems to ensure a least-cost electrification plan that is compatible with available funding and socio-political priorities.

The plan is meant to be implemented, with flexibility to adapt to changing conditions, and to guide the smooth transition between electrification modes, because the main grid will reach most of the minigrids eventually, and also the minigrids and ultimately the main grid will connect most of the current low and disperse demand.

¹¹ The optimal (i.e. least cost) percentages of each electrification mode in a national electrification plan are not prescribed at the outset. They are the outcome of a mathematical optimisation process, where the inputs are the demand to be met for each customer and the locations of these customers, the layout of the existing grid, the price of energy from the main grid, and a catalogue of components with their technical characteristics and costs, among other input data. The optimisation process must respect policy, regulatory, social, environmental, and budgetary constraints. See for instance <https://universalaccess.mit.edu/#/rem>

3.2 Sustainability

A non-sustainable model does not meet the requirements of SDG7.1, since electricity access may disappear after a few years. A sustainable business model must remain operational supplying a given community for an indefinite time.

Each electrification business model must be sustainable: i) from the perspective of the supplying company, and ii) from the government's perspective, which must jointly consider all electrification modes.

Implications of this principle

Sustainability of each electrification mode must be based on cost-of-service remuneration (or the outcome of a competitive tender), based on regulated tariffs plus a subsidy. Electricity suppliers, by any electrification mode, must receive the cost of providing the service (obviously including in this cost an adequate return on the invested capital) as a necessary condition to raise the large volume of capital that a national electrification plan needs.

Since most communities in rural SSA cannot afford an access that would allow a dignified minimum household consumption level and could sustain human and economic development via community and productive uses of electricity, a subsidy is necessary to fill the gap. In grid extension a permanent cross-subsidisation system is disguised by the application of the same tariff to all grid-connected customers (as it happens in every country in the world), so that urban customers subsidise rural customers whose supply costs are much higher. The customers supplied by minigrids that provide a similar service to the main grid (sometimes better) should be also subject to the same tariff as the grid-connected customers, following the same reasoning.

Sustainability requires permanence of supply and therefore the subsidy to minigrid developers must be permanent, in the same way the urban customers cross-subsidise rural customers worldwide on a permanent basis. Therefore, the business model of minigrids must ensure a "utility-like" long-term commitment by the supplier, and by the regulator guaranteeing the continuity of supply, so that the minigrid customers know that they will never be left behind. – as it is the case with the business model of grid extension.

The same principle must apply to the model of supply via standalone systems. With independence that any household or other type of demand is free to purchase a standalone system from any vendor, every rural household in the areas that, according to the electrification plan, must be supplied with standalone systems, must be able to pay a regulated monthly (or any other periodic) fee to a "utility-like" entity and to be supplied by a solar home system that is owned, maintained and replaced, when necessary, by that entity. The entity must receive a subsidy to fill the gap between the total cost of supply and the revenues from the regulated fees.

From the viewpoint of the government, financing electrification must be contemplated in an integrated way: i) jointly considering the three electrification modes, and ii) accounting for the contributions of Development Partners (DPs), donors and private investors – each one according to its specific characteristics well as the income from tariffs (including cross-subsidization schemes) and governmental subsidies.

This integrated approach and the long-term perspective can greatly facilitate the overall viability of an electrification financial plan, as it will be commented later.

3.3 Scalability

SDG 7.1 requires universal electricity access. No one left behind. The business model of a minigrid is scalable if it can attract the investment that is needed to develop and operate all the minigrids that must be deployed in a territory by a given date, according to an electrification plan that leads to universal access. The same principle must apply to grid extension and standalone systems.

Implications of this principle

Once an electrification plan has been adopted, for each electrification mode there must be one or more utility-like entities responsible for providing permanent supply for a specified long-term period.

This requires the existence of at least one default provider (available to supply if no one else does, for instance always bidding in any tender for a portfolio of minigrids) and a last resort provider (committed to take over if anyone fails, for instance a minigrid developer going bankrupt or just exiting).

An electrification plan must also consider the case, unfortunately frequent in SSA, of those grid-connected customers with a very unreliable supply. Then the plan must include whatever is necessary to improve the service until a satisfactory level is achieved.

3.4 Development Focus

The end goal of electricity access is to improve human welfare and promote economic development.

Implications of this principle

Explicit incentives and/or requirements in the service contracts to promote efficient appliances, bottom-up participation, the use of electricity in production activities that make development possible, and collaboration with other sectors (agriculture, sanitation, transport, education, health, communications) must be explored to unlock the full transformative potential of electrification.

This is in addition to a reliable, affordable, sustainable and universal electricity supply.

The implementation of these principles while implementing an electrification plan must follow a logical process:

- STEP #1. What must be done and how much does it cost?
- STEP #2. Who will do it and how?
- STEP #3. How will it be financed?

And, to comply with the fourth principle, how to manage so that electricity access can achieve its development goals?

This three-step implementation process is not linear, because there are feedback loops between the three steps. For instance, if the electrification plan is too ambitious – i.e., the target date to achieve universal access is too close or the minimum demand to be supplied is too high – the financial plan will not be viable, i.e., the amount of capital that would need to be raised would not be realistic and feasible – and the electrification plan will have to be redone with a later target date. Or, depending on the choice of business models in step 2 – e.g., privately versus publicly owned companies, or full concessions versus just O&M concessions – the cost of capital in the financial plan would be different; and If the resulting cost of capital for each electrification mode differs significantly from what was assumed when designing the electrification plan, Step 1 would need to be updated and the entire process adjusted.

4.1 STEP #1. What must be done and how much does it cost?

This step consists of developing an integrated least cost geospatial plan that defines the electrification mode corresponding to each demand in the entire country, how to achieve it with complete specification of the bill of materials, investment and O&M costs, and the distribution in time of the necessary works from the present time until the target date to achieve universal electricity access.

The plan must minimise the total cost while respecting any political, social, or environmental priorities or constraints established by the policymakers. The plan must consider all electrification options, including grid extension, minigrids and stand-alone systems. The plan must reflect how the investment and O&M costs of each electrification mode depend on the adopted business model for each one and the associated sources of financing, when determining the least cost solution. The plan must be able to adapt to changing demands, component costs, energy prices and any other uncertain inputs.

Specific regulation must be developed to facilitate the smooth transition between electrification modes: i) what happens when the main grid arrives to a site where a minigrid already exists; ii) idem when the main grid or a minigrid arrive at a territory where a regulated concession for standalone systems exists; and even iii) what happens when a minigrid is deployed at a site where the main grid is already supplying electricity, although with poor reliability, quality of supply or quality of customer attention. Detailed regulation for item (i) has been developed in several countries and is being applied in some of them.

It must be acknowledged that, for some SSA countries, it may look premature and overly ambitious to design an electrification plan with a target date compatible with SDG7.1 (the year 2030) or even 2035, because of sovereign debt-related borrowing limits, and/or lack of human capital to accomplish the task on time, among other constraints. Planning for a very distant future may be unrealistic, given the uncertainty involved. In this case, a reasonable approach may be to settle for a limited electrification target – for instance 50%, if the present level is 20% – but respecting the integration of the three electrification modes (even if practical considerations may advise to start focusing on one or two modes, delaying the implementation of others), the sustainability and scalability of the regulatory and business models and the integrated financial approach. The fact that the target is a transitory partial electrification is no excuse for abandoning the principles of IFE.

4.2 STEP #2. Who will do what must be done and how?

The geospatial least-cost electrification plan

Some ministerial department or a separate governmental entity specialised in electrification planning must develop the integrated geospatial least-cost electrification plan, considering the three electrification modes and assigning which one corresponds to each customer. The plan must be subject to the approval of the regulatory authority or the energy ministry, depending on the specific allocation of responsibilities in each country.

Regulatory and business models

Sustainable and scalable business models for each electrification mode must be defined. These models must be compatible with the existing regulation; otherwise, modifications must be proposed. The implementation of the IFE must be customized to each country's power sector structure, institutions, energy policy and regulation, and macroeconomic, and technical conditions, also accounting for political economy considerations.

There are diverse options of regulatory and business models to choose from, but not all of them will be compliant with the IFE principles that emerge from SDG7.1. For instance, leaving off-grid solutions solely to the market is not a scalable model and universal access will never be achieved. Initial CAPEX subsidies will result in the quick deployment of minigrids until the funds are gone, but the sustainability of these minigrids a few years later is in jeopardy, as well as the incentive in promoting productive uses of electricity. Programs that facilitate the purchase of subsidised solar home systems run into the same sustainability problem; once the devices stop working their owners return to the initial condition of lack of access; and community and productive uses of electricity have no place in this model.

Sustainability of the business models requires cost of service remuneration, determined by regulation or as the result of a tender, based on the revenues from regulated tariffs plus a subsidy. And sustainability requires that if a supplier fails for whatever reason, regulation must ensure that another company – called a "last resort provider" – will take over so that the service is not interrupted.

Similarly, scalability of business models so that "no one is left behind" requires a "default supplier", i.e. regulation and business models that ensure there is always at least one company willing to supply electricity to consumers, regardless of their location or affordability.

The role of concessions

Concession contracts are suitable instruments to achieve sustainability of supply as well as scalability. Concessions typically imply commitments of 20+ years, and their conditions should allow for viable business models. They can be applied to portfolios of minigrids,¹² but also to the supplier of solar home systems in a territory, or to an incumbent distribution company or a combination of these technologies. There are satisfactory experiences for each of these electrification modes and for combinations of them.

¹² The International Finance Corporation (IFC) Scaling Mini-Grid Program, "Concession Agreement User Manual" (2022).

https://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/infrastructure/priorities/power/scaling+mini-grid

Concessions admit different formats. Under “full concessions” during the concession period the concessionaire is responsible for all investments – both new developments and the replacement of obsolete existing assets – plus the operation and maintenance of all the assets. Under “management concessions” (“affermage” in francophone countries) all major investments are financed by a third party, while the concessionaire is in charge of the EPC and O&M, plus some minor investments that must be done quickly and that is not worth the trouble to be requested from the financing organisation. At the end of the concessions the property of all assets returns to the government, who must compensate the investor for the residual value of the assets that it purchased. In principle, tenders – despite their organisation complexity – are preferable over direct bilateral negotiations in determining concessionaires, because of transparency concerns and the expectation that competition would bring the costs down.

Extension and improvement of the main grid. Concession contracts are advisable to improve and extend the national grid when the incumbent utility or utilities are unable to provide reliable service to its existing customers and/or to extend the grid where this is specified in the electrification plan. Concessions can make possible to turn a poorly performant distribution company (or the distribution segment of a vertically integrated utility) into a good performant and financially viable company, able to attract private capital and operational expertise. Concessions generally require that some existing liabilities of the original distribution company must remain with the incumbent public utility. Successful (and less successful) experiences exist in some African countries, India and elsewhere. These concessions can be full or just for management. In the latter case, the revenues from the regulated tariff, after remunerating the concessionaire for their O&M activities according to the concession contract, may leave a surplus for the investors, depending on the value of the tariff and of the regulated O&M costs.

Concessions for off-grid solutions. These concessions – for a portfolio of minigrids or for a territory in the case of standalone systems – allow to address the scalability problem, as concessions can be tendered even for the most difficult areas and the entity assigned as “default provider” must always bid, under some prescribed ceiling. This default provider could be the incumbent distribution company (or one of them, if there are more than one) – in the rare case in SSA when there is a financially viable and well-performant utility – or the on-grid concessionaire as one of its obligations specified in the concession contract, or another entity willing to accept the technical and economic conditions of a tender to perform this role.

The concession contracts must specify how the remuneration for the developer will evolve with time, considering the cost of additional investments to meet demand growth, replacement of worn out components and changes in the O&M costs. It is recommended that the tariffs for minigrid customers and for grid-connected customers be the same. The computation of the subsidies to the minigrid developers must be specified in the concession contract. These calculations will be carried out by the regulatory authority.

Permits for new minigrid concessions will not be allowed outside the regulated tenders. Existing minigrids will be allowed to continue their contracts until they expire and/or offered a transitory period to converge to the new regulated regime.

It is recommended that a similar approach be followed for standalone systems. The solar home systems would be owned and maintained by the concessionaire, and the customers would pay an affordable monthly (or any other periodic) fee, which will be supplemented by a subsidy provided to the concessionaire to cover the complete cost of providing the service. Medium and large sized standalone systems for commercial and industrial customers would have a special treatment.

The “affermage” or “management concessions” alternative can be seen as an unbundling of the responsibility of investing in the infrastructure of electrification – whether on-grid or off-grid – and operating and managing this infrastructure, including customer engagement, billing and revenue collection. In case that private developers are not expected to respond to the tenders for full concessions, or the cost of capital might become too high, this unbundling may facilitate attracting blended financing with a different kind of more patient and lower cost private investors. This will be explained in more detail later – see “the flows of money” in section 4.3.

Who does what?

As indicated previously, the techno-economic electrification plan will be developed by a specialised governmental entity, or by some external consultant under the supervision of this entity.

A high-level governmental entity will be necessary to ensure that continuous political commitment to universal access is realized through the implementation of the integrated techno-economic plan, with sound regulations and business models, and a viable financial structure. This high-level supervisory role must correspond to the ministries of energy and finance, and/or any agency linked to them, via some ad hoc specialised committee.

The electricity regulatory authority and/or some governmental agency will be responsible for organising the tenders for concessions, determining the regulated remuneration of each electrification mode and establishing the regulated tariffs for each one.

A specialized financial intermediary, “FinanceCo”, which will be a government-affiliated entity with external participation in its governance, as detailed later, will act as a central hub for channelling financing to distribution companies and off-grid developers. The involvement of all these players in the governance structure of FinanceCo, alongside the government’s ministries of energy and finance will ensure oversight and proper control of finances. It would be very convenient, time and effort wise, if FinanceCo could be established by upgrading or adding responsibilities to an existing institution with similar duties.

The role of FinanceCo will be detailed in the next section dedicated to step #3.

4.3 STEP #3. How will the electrification plan be financed?

An electrification plan is not complete until a viable integrated financial plan has been developed for the entities implementing each electrification mode and for the Government.

- The financial plan must secure funding for expanding capacity, managing, operating, and maintaining the distribution utility (or the distribution segment of a vertically integrated utility) and the electrification plan.
- The implementation of the IFE must be customized to each country’s power sector structure, institutions, regulation, macroeconomic, and technical conditions, as well as to political economy considerations. The role of each organisation must be defined accordingly.

FinanceCo will be the meeting place of the funding organisations, will be in charge of keeping the entity within standard financial indicators, and will transfer the money to each one of the concessionaires.

- FinanceCo will coordinate all financing sources, including government subsidies and equity contributions, grants and concessional loans from Development Partners (DPs), loans and equity provided by private banks and investment funds, and the revenues from regulated tariffs paid by the customers.
- FinanceCo’s unique position will allow it to access concessional funding and grants from DPs, which can be supplemented by private investors. This blend of financing sources will help achieve optimal funding conditions for electrification.

The government of the country bears the ultimate responsibility regarding the success of the plan. By intervening in the value of the tariffs to the end consumers¹³ it determines the volume of subsidies that will be needed.

Participation of the government with equity in FinanceCo would give confidence to other investors, aligning their interest and unlocking grant participation from DPs.

¹³ This is a legitimate political decision, even if it is not advisable in general the interference of politics in tariff setting. The remuneration of the companies that supply electricity must be strictly cost reflective, but the end customer tariffs can be subject to political intervention. If they are set below costs, subsidies to the supplier companies will be needed.

The existence of a thorough and viable financial plan and the commitment of the government to it can provide confidence that the national power sector will be able to reach a sustainable financial situation at the end of the plan; this should reduce the pressure on the level of guarantees.¹⁴

Integrated financing involves different asset classes. This might create difficulties with some private funds because of their restrictions in mandates. The participation of the local commercial banks is in principle highly desirable, but since their financing will be more expensive than DP financing, their role may be minimal in a first stage. Thereafter, their role will be crucial in dealing with new investments due to maintenance or population growth. It must be explored if other existing structures like “electrification funds” could serve as FinanceCo.

The flows of money

Figure 1 describes the flows of money among the different organisations involved in the implementation of the electrification plan. The figure shows different implementation options that are possible under the IFE, as explained in the previous section. Each concessionaire – for each one of the electrification modes – could be the owner of the assets and/or the operator, financed by its own sources and receiving the revenues from the regulated tariffs plus a subsidy via FinanceCo, capitalized by the government and the DPs. This is one extreme possibility, with fully private concessionaires.

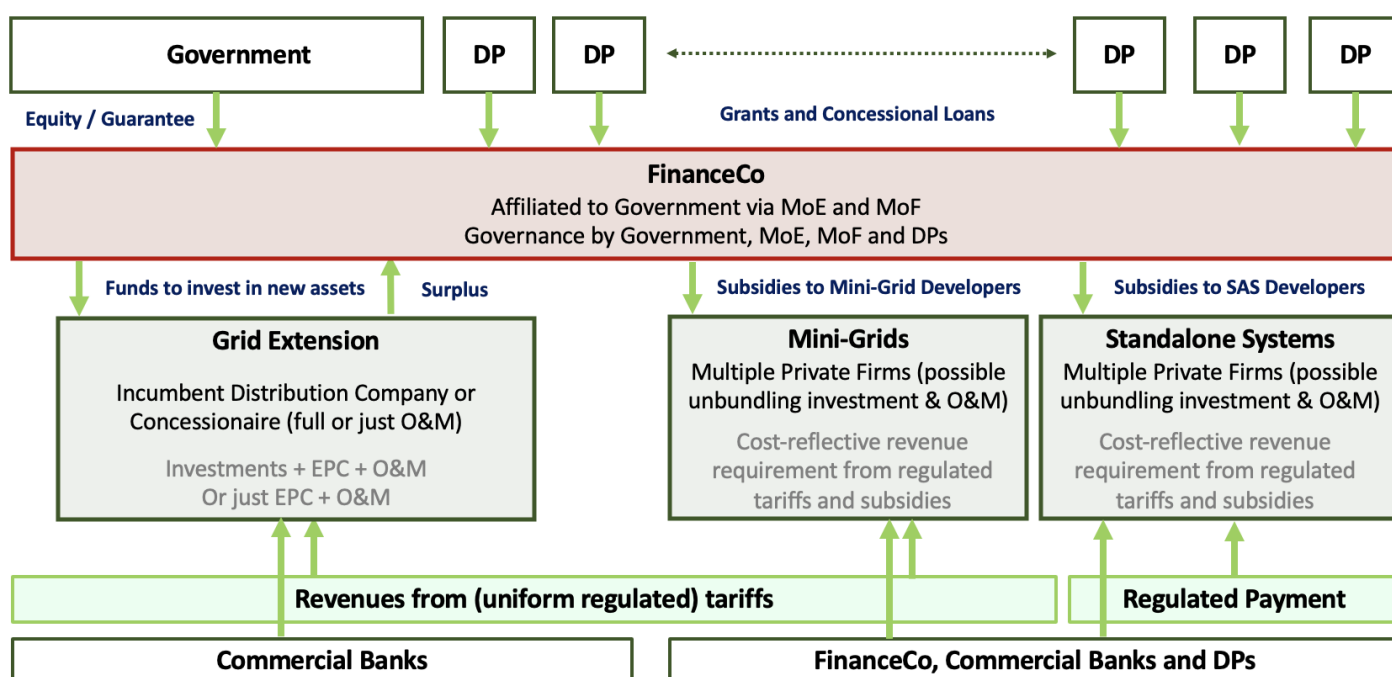


Figure 1. FinanceCo's role in an integrated financing approach.

¹⁴ A particular feature of the electricity sector is that it is regulated with a high degree of quantitative precision (i.e. the cost of service and the retail tariffs are carefully calculated and implemented, typically on an annual basis). There are uncertainties, such as fuel prices or future demand, but regulators can adjust tariffs or expansion plans to accommodate changes in their original estimates and keep their plans financially viable. Therefore, if an electrification plan is initially shown to be financially viable, and if the means to monitor and adjust its implementation are well established, it is very likely that no additional external support will be needed and that the plan will end in a sustainable state.

At the other extreme, all the necessary infrastructure to implement the electrification plan would be financed via FinanceCo and the concessionaire would be only responsible for the operation, maintenance and some minor investments, plus the EPC for the new large investments financed by FinanceCo. This unbundling of infrastructure and operation can be exploited by the regulatory authority to give priority in the allocation of the collected revenues to the payment to FinanceCo, leaving the demand risk and other risks to the operators. If this is the case, FinanceCo could resort not only to concessional financing (always scarce) but also to other large sources of low-risk and patient private capital. However, integrated financing may not suit investment funds due to mandate restrictions, so they should be approached differently, contributing by asset class rather than as DPs or donors. Local banks, though more expensive than DPs financing, may play a smaller role initially but will become key for future investments in maintenance and growth.

This second approach presents several attractive features:

- i) it reduces the cost of capital, since the investment in infrastructure can now be considered as lower risk;
- ii) it removes from the operator the concern about having to search for financing, focusing now its activity only on the operation of the assets;
- iii) it can incentivise meticulous billing and revenue collection, as well as activities to promote demand growth, if adequate performance based instruments are established by the regulator. It remains to be seen if sufficient private companies might be attracted to the business model of just being operators. The regulated cost of service must include derisking features to adapt the remuneration of O&M activities to the uncertain inputs of demand and costs, as well as appropriate incentive schemes must be put in place to reward good performance in reliability, quality of service, losses, billing and revenue collection. A default provider and a last resort provider are also needed, as described previously.

The solution to be adopted in each case is likely to be a middle ground between these two extreme approaches, adapted to the particular conditions of each country. It is expected that the regulatory, business and financing models proposed in this document can facilitate the financing of electrification modes, both on-grid and off-grid, that are currently very difficult or simply impossible¹⁵

¹⁵ The report “Stocktaking in the energy sector in Uganda. Electricity Distribution” (2022) shows in full detail a proposal to apply the IFE approach in Uganda, with focus on the steps 2 and 3 of the process, see <https://africanschoolregulation.org/wp-content/uploads/2023/01/GT012-Uganda-Report-Electricity-Distribution-Final-Report-FINAL-XX072022-IPA-CLEAN.pdf>

The IFE approach is currently being implemented in a large area in the north of Madagascar with about half a million population. The processes of electrification of Morocco in the late 1990s and early 2000s and in semi-isolated rural areas in Argentina (in the region of Jujuy) are other examples that have been inspired by the same principles.

4.4 The focus on development

Limited experience exists on how to introduce incentives or requirements to promote economic development in concession contracts, but it can certainly be done. Some considerations follow:

- It can be required that the operator, perhaps via a subsidiary firm, will make available and facilitate the purchase of efficient household appliances, and machinery for productive uses appropriate to each context.
- It can be required a minimum level of engagement with the communities, for instance via the mandatory organisation of an electrification committee in every electrified village, with a parity number of women, and with specific responsibilities to empower the community in the electrification process.
- It is strongly recommended to link the power sector with other sectors – agriculture, health and sanitation, education, communication or transport – to exploit the economic unlocking power of electricity.
- The participation of local banks in financing the electrification plan can also help in this regard, in addition to mitigating the currency risk.

A shortcoming to be overcome is the regulatory dilemma of encouraging the on- or off-grid regulated distributors to engage in commercial activities that entail financial risks. This is forbidden by the regulators of many jurisdictions worldwide.