

COMMON MARKET FOR EASTERN AND SOUTHERN AFRICA

REGULATORY FRAMEWORK ON OFF-GRID ELECTRIFICATION

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1 Objectives of the off-grid Electrification Regulatory Framework

The main objective of the COMESA Off-Grid Electrification Framework is to provide COMESA Member States with harmonized guidelines that would facilitate off-grid electrification regulation harmonization in the COMESA region in efforts to ensure that private sector investors are more-or-less faced with similar off-grid electrification regulatory frameworks in the COMESA region.

The specific objective of the off-grid electrification framework is to provide an outline of contents expected in an off-grid regulatory framework, financing models and off-grid electrification technologies, which countries can then adopt and/or customize, therefore, harmonizing the off-grid regulatory framework in the spirit of regional integration.

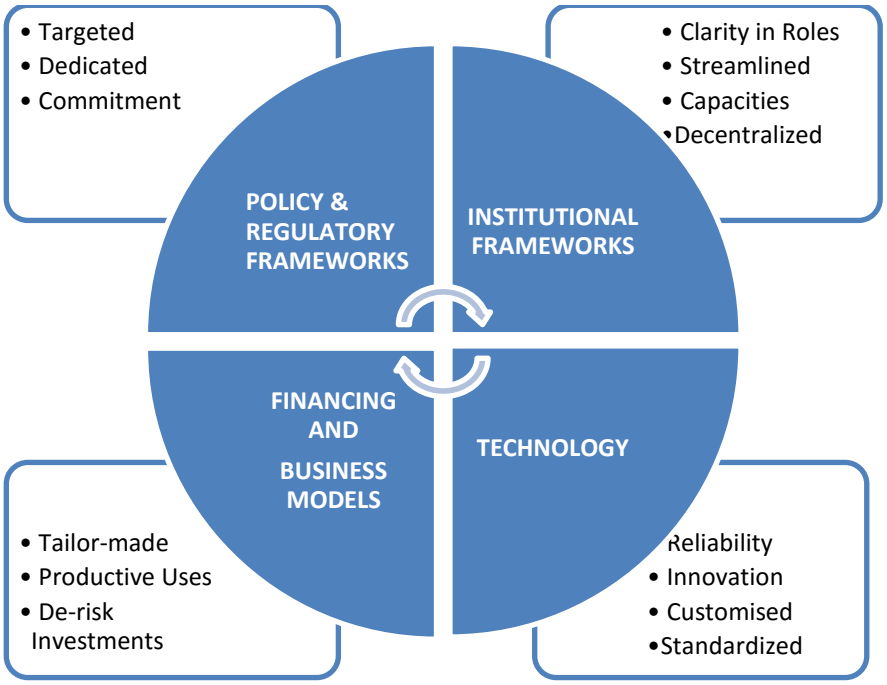
Achieving universal access to modern energy services is a vital pre-requisite to advancing socio-economic development. The options available to policy makers seeking to accelerate electrification have developed significantly in recent years. Decreasing costs and improving reliability have led off-grid renewable energy technologies to become the most cost-effective option for electrification in most rural areas. In recognition of the critical role renewable energy will play in achieving the goal of universal energy access it must be integrated into national rural electrification strategies.

2 Enabling Environment for off-Grid Rural Electrification Deployment

An enabling environment needs to be put in place to accelerate rural electrification. OREC[1] highlighted that this enabling environment mainly consists of four basic building blocks: policy and regulatory frameworks, institutional framework, financing and business models and technology – see Figure 1.

[1] International Off-Grid Renewable Energy Conference held in Ghana in November 2012.

Figure 1 : Building Blocks of an Enabling Environment For Off-Grid deployment



3 Policy and Regulatory Framework

There is no 'one size fits all' approach for enabling off-grid RE policies and regulatory frameworks. However, there is tremendous potential for cross-regional exchange of best practices and lessons learnt from different rural electrification initiatives. There are four elements that are important for supporting off-grid RE deployment: political commitment, a clear rural electrification strategy including long, medium and short-term targets, dedicated and stable policies, and community involvement and participation.

3.1 Political commitment

Political commitment is essential at all stages of rural electrification efforts. Introducing off-grid renewable energy into the mainstream national rural electrification strategy with dedicated policies is important for the sector's development. Without strong political commitments and the implementation of sustainable supporting frameworks, the electrification rate will never catch up with the population growth and the un-electrified population in the poorest regions of the world will keep increasing.

The off-grid RE should be embedded within the national policy framework. Unless this is done, the market cannot be developed to support private sector investment and utilise the entire potential of off-grid electrification.

Continued political support and commitment is important while during the development and implementation of the rural electrification strategy. Many successful rural electrification programmes have only succeeded after years of learning and course correction.

3.2 Clear Rural Electrification Strategy

A clear rural electrification strategy identifies the areas to be reached by grid extension within a reasonable time frame and the areas suitable for off-grid installations. This reduces uncertainty and provides clarity to both off-grid project developers and rural communities. The interplay between stand-alone and mini-grid installations in rural areas is another important element that needs to be considered within the national electrification strategy. Stand-alone systems can often stimulate demand for electricity, thereby improving the economic case for mini-grids. Similarly, mini-grids can be further integrated into regional mini-grids or the main grid, where technically feasible.

To be effective, the rural electrification strategy must cover the following:

i. Ensure that rural electrification is part of the national policy.
ii. An agency that focussed on rural electrification should be established. It can be located within government or part of the electricity regulator or a stand-alone agency.
iii. The national rural electrification strategy should set targets, which have to be pragmatic and adjusted to socio-economic conditions. The period must be specified and include a progress review mechanism.
iv. The technology to be used much be specified and periodically reviewed.
v. Rural electrification must be public led, with adequate incentives for private sector and cooperatives participation.
vi. Its overriding objective should be to provide universal access to modern energy services to the rural population.
vii. Learning-by-doing approach must be adopted, accompanied by periodic reviews. This requires policies, including support schemes, to be dynamic in order to effectively support the growing market.

3.3 Stable Policies and Regulatory Frameworks

Regulators play a critical role in creating an enabling environment which encourages private sector involvement, especially in the mini-grid sector. Given the importance of tariffs in sustainable mini-grid business models, regulators can adopt a tariff structure which takes into consideration both the socio-economic conditions of consumers and the commercial feasibility of projects.

Adequate regulatory frameworks can also encourage innovation in technology design, finance and business models. This allows non-traditional players to participate. For instance,

making use of the off-grid telecommunications infrastructure to provide electricity services through non-traditional business models requires a suitable regulatory framework. This incentivises the participation of telecommunication infrastructure operators in a market beyond their core business.

Other Policies, Laws and Regulations that impact on rural electrification should be aligned so as to facilitate the expansion of rural electrification.

3.3.1 Policy Instruments and Financial resources

Governments have used a broad range of policy instruments to support off-grid RE development. These include public financing (*e.g*. soft loans), fiscal incentives (*e.g*. exemptions from import duty/VAT) and the elimination of market distortions such as fossil fuel subsidies. While most policy instruments for stand-alone and mini-grid projects have a great deal in common, the needs they address may vary. In the case of stand-alone systems, it is critical to unlock the purchasing power of rural households (consumers) and support small and medium enterprises (SMEs) in supplying clean-energy products/services into the market. On the other hand, mini-grid development is better supported through reduced transaction costs for developers, appropriate tariff guidelines, access to affordable finance at various stages of project development and so on.

3.3.2 Identification of Barriers to off-grid developments and Removal of Barriers

The following are often the major barriers for rapid development of off-grid RE:

i. Off-grid RE not mainstreamed in the energy policy;
ii. Public perception that grid electricity is the only acceptable form of electricity;
iii. Lack of a cogent regulatory framework to mainstream off-grid RE;
iv. Lack of mainstreaming rural electrification in rural development strategy;
v. Disbursement of subsidies with little regard to whether they are reaching the target populations, incentivising RE or improving energy access;
vi. Standards for RE devices that are either non-existent or are not suited to spur innovation;
vii. Absence of an efficient mechanism to make finance available at various levels, for both the end user and entrepreneur;
viii. Energy access not sufficiently integrated with larger developmental goals.
ix. Heavy-handed regulation.

3.3.3 Adopt light handed and simplified regulation

A regulatory rule will typically specify information that must be supplied or procedures that just be followed. Complying with a regulatory rule costs time and money. This is true regardless of whether the regulated enterprise is privately, publicly or community owned.

For off-grid operators, one should be especially conscious of the costs of regulation because most off-grid enterprises operate on the "razor's edge" of commercial viability. They have high costs because they often serve small isolated households and low revenues because these households usually can afford to buy only small quantities of electricity (typically around 50 kWh per month). Unnecessary regulation can easily destroy their commercial viability. In designing a light handed regulatory system to support electrification, two questions need to be asked:

i. Is the information really needed?
ii. Can the number of review and approval steps be reduced or devolved?

3.4 Community Involvement and Participation

Communities must be consulted and involved in planning, implementation and operation of off-grid schemes as these schemes are dependent on their acceptance and participation for successful implementation. Community involvement can be extended to providing labour and other resources during construction and operations.

3.5 Linkage to Rural Development

Electrification in rural areas may have significant direct effects on economic development, through:

i. Social and public uses - Electricity can be used for lighting and vocational teaching in schools, sterilization and refrigeration in health clinics, public water systems, and street lighting.
ii. Employment - Employment benefits from productive uses of electricity in agriculture and industry could be significant; these benefits are related to the expansions in output and the existence of a market for the output.
iii. Environmental improvements - the major energy related environmental problem in developing countries is deforestation and erosion caused by fuelwood gathering for cooking and heating - the largest use of energy for the poor.
iv. Foreign exchange savings - the substitution of kerosene and diesel oil by electricity for lighting and motive power could be a net benefit in foreign exchange savings--if the central supply is not based on oil imports as well.
v. Impacts on migration and fertility - electricity is often thought to have an impact on reducing rural migration to cities through its effects on levels of living, employment, and incomes.

vi. Encouraging innovation and modernity - electricity is a potent instrument for inducing modernism...it strengthens the forces of change in stagnant attitudes and responses to opportunity of the rural folk[2].

3.6 Regulatory Incentives

Given the limited resources to fund rural electrification it is essential that subsidies are spent efficiently to support poor rural areas in accessing modern energy services but also to increase the commercial potential of rural projects and therefore to leverage private investments. The most common subsidy schemes are:

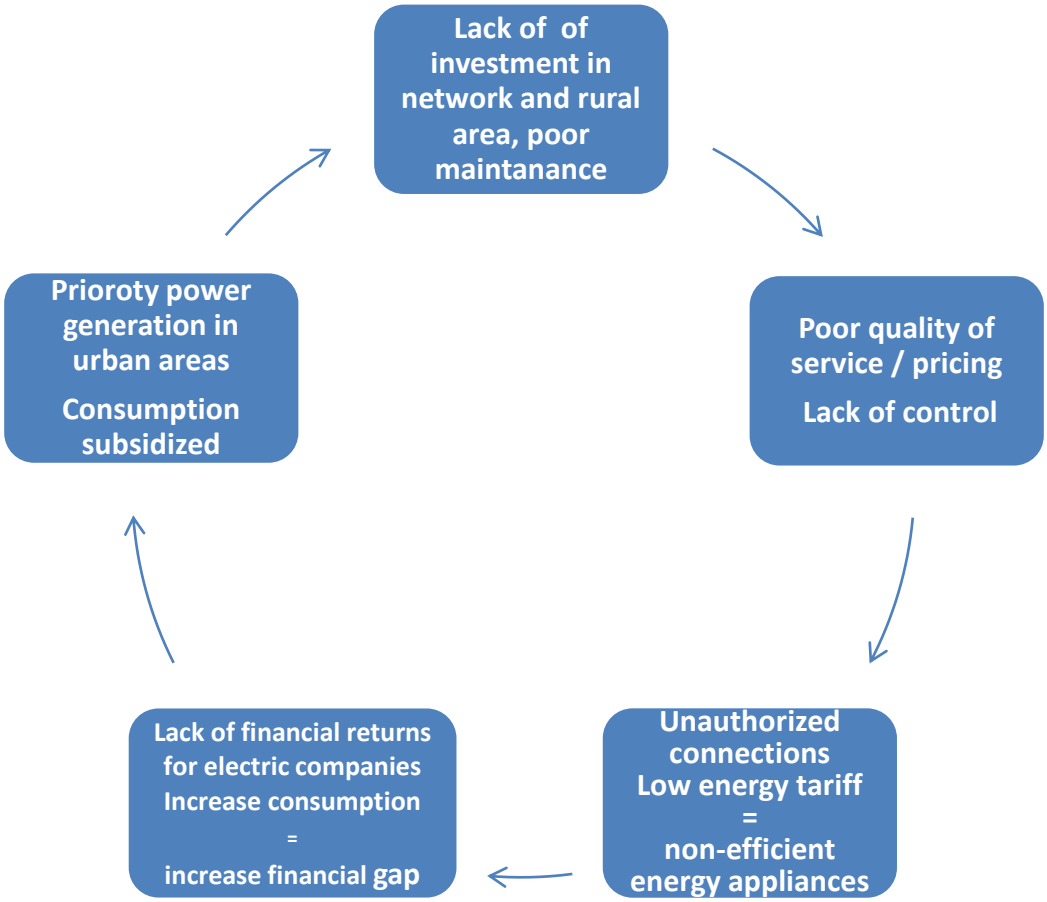
i. One-off subsidies or capital subsidies target the overall initial investment or at least part of it.
ii. Operational subsidies, cover the operation of the system, but not the production. They are needed where there is a gap between affordability and cost recovery and consequently, operators are left in a perpetual dependence upon public money without incentive to produce more or more efficiently.
iii. Output-Based Aid consists of a subsidy planned directly in exchange for a service to encourage its occurrence. These subsidies can be established either with a connection-based or production-based approach. The latter subsidy is intended to decline over time as the service provider improves efficiency and as end-user revenues increase.
iv. Pro-poor rates (subsidizing energy use for the poorest consumers) and cross-subsidies / price discrimination (where richer consumers help subsidize poorer consumers, and rural electricity use is subsidized by urban consumers) can also be successful.

[2] Prospects for Modernising Rural Artisan Trades and Decentralized Small Industries (Yousufguda, Hyderabad, 50045, SIETI, 1978).

4 Institutional Framework

The large-scale deployment of renewable energy for rural electrification and its proper regulation requires the adoption of a clear institutional framework defining the role of each actor. An appropriate institutional framework is crucial when designing and implementing a national rural electrification strategy. While some countries have created new bodies with a mandate to support rural electrification activities, others have placed responsibility for rural electrification within existing ministerial frameworks.

Figure 2 : Vicious Circle Resulting from Lack of Regulation



5 Capacity Building and Local Participation

It is vital to ensure institutions have the necessary capacity to effectively design and implement the rural electrification strategy. The capacity needs range from technical skills across the rural electrification value chain, including within public and financial institutions, to the availability of stable budgetary allocations for institutions charged with implementing the rural electrification strategy. In this context, a capacity needs assessment is necessary to identity the needs and the gaps.

The exchange of information within COMESA Member States to convey the best practices and lessons learned from other successful rural energy programmes is crucial in capacity building. The Involvement of local enterprises drawing on local capacities and development of local skills are crucial in successful RE programmes

6 Financing and Business Models

Accelerated rural electrification by scaling up off-grid RE deployment can only take place through adoption of sustainable business models. There are two factors that contribute to the sustainability of business models, namely *access to affordable finance* and *electricity supply for productive uses*. Access to long-term, affordable finance allows developers to deliver products and services at lower costs. It is important for all stages of project development, including scale-up. At the same time, access to consumer finance means end users can afford the energy services and products offered. Hence, off-grid finance mainly consists of two components: a) downstream (end users) who require consumer finance and b) upstream (enterprises) that require start-up capital, working capital, project finance, etc.

Financing and business models should be developed for both Stand-Alone and Mini-Grid systems as these have different financing requirements depending on the different approaches to mini-grid implementation. Financing costs include project transaction costs, finance for mini-grid projects, and tariff considerations, which should be addressed to make such projects viable and provide affordable electricity to customers. Tariff considerations should focus on consumer ability to pay and regulator tariff guidelines. Consumer willingness or ability to pay signals the maximum price the operator can realistically charge. Any gap between this price and a commercially viable tariff will need to be bridged through adequate policy or financing instruments.

6.1 The utility-based model

The principal advantage of this approach is that the primary responsibility lies with an experienced party with the financial resources and technical capabilities to implement and manage the project. Due to their public or quasi-public position, utilities also directly benefit

from a privileged legal position and have better access to financing mechanisms that they can sometimes apply themselves (i.e. cross subsidies).

The success of utility-based programs usually rely more on the innovative business approaches adopted by the utilities, rather than on the traditional public-oriented programs.

6.2 Private sector-based model

Private sector-led mini-grids are another possibility, often when government support raises an interest, but sometimes also spontaneously. In this case, it is naturally around the private sector that will be structured the business plan, unless the ownership of the systems is transferred after implementation to another actor. In general, a well done rural electrification program must follow an economic logic and be able to attract private companies. In fact, more and more private sector service providers enter into rural energy market through subsidy schemes or regional concessions.

In developing countries many private sector companies involved in the generation of electricity from mini-grids have a local interest in providing electric power services and therefore an added motivation for their own involvement. Compared to public utilities, private firms may be better able to navigate political interference. Given the situation of most rural areas in developing countries, the private sector cannot generally be expected to build up a system and/or serve rural populations without some form of public financial support. Experiences in many developing countries show that it can be quite difficult to find enough interested and qualified companies to bid for rural electrification concessions. Therefore, the interest in these types of longterm projects usually comes from smaller local private companies, which tend to have limited technical skills and financial resources.

The domestic capital market is either not large enough or experienced in offering loans to private sector infrastructure projects. There is a potential for PPP[3]s in rural electricification, particulary because the State is expected to play a role, which involves some form of financing / subsidy.

The regulatory framework must provide modalities of what should happen when the national grid expands to the mini-grid area. This may include requiring the grid operator to purchase the mini-grid at commercial rates or continue to off-take electricity at original price for the mini-grid.

[3] COMESA has adopted PPP guidelines which are found in their website (www.comesa.int)

6.3 Community-based model

Community-based mini-grid management mostly occurs if a mini-grid in isolated areas does not attract private-sector or utility interest. In this case, the community becomes the owner and operator of the system and provides maintenance, tariff collection, and management services.

In fact, in many countries, the community model is the only option in remote areas. Compared to the alternatives, the owners and managers in a cooperative or community-based organization are also the consumers and therefore they have a strong interest in the quality of the service and a real presence in managing it. Community-based organizations increase community self-sufficiency and self-governance and often are more efficient than utilities, which tend to be bureaucratic. Finally, they generate operation, maintenance and management jobs in the community and offer the possibility to apply tailor made tariffs.

6.4 Hybrid business model

Hybrid models try to combine different approaches to benefit from the advantages of each of the models and to minimize shortcomings. They can therefore be quite diverse, tending to adopt the different types of O&M contracts earlier and combining different ownership structures (i.e., one actor owns the grid, the other the generation capacity).

For example, a utility or a private company implements and owns a renewable energy mini-grid power system, a community-based organization manages it on a daily basis and a private company provides the technical back-up and management advice. The collaboration enjoys the technical expertise and experience of the utility with the possibility to realize economies of scale in the realization of big infrastructure works (grids), the local involvement of the community-based organization, and the financial investment, technical expertise and efficiency of a private company.

Two major tariff design challenges for mini-grid operators are:

i. *High connection costs* can significantly restrict the uptake of mini-grids. since household inability to afford connection fees affect the market penetration of the service;
ii. *High operational costs* are often incurred by mini-grid operators during metering and fee collection activities. This means lower revenues for developers and/or higher tariffs for consumers. To address these issues, information technology tools should be integrated into business models for remote fee collection and for metering, monitoring and regulating consumption. Smart meters, prepaid systems and mobile commerce are new efficient tools which can influence tariff design and collection methods. Load limiters may also be used to curbs electricity usage. These load

limiters are basically switches that will trip on overload and cut-off power supply automatically. Load limiters are inbuilt in the latest pre-paid electricity meters.

Governments should create an environment that minimises investment risks and attracts private sector participation into the RE mini-grid sector through the use of funds from different sources (*e.g.* domestic and multilateral organisations) to invest in public infrastructure (*e.g.* local distribution grids and non-generating assets, in general) or for various incentive mechanisms (*e.g.* publicly backed guarantees, long-term affordable financing, grant/ debt facilities for end users to cover connection costs, etc.). Both the private sector and public utilities can benefit from such an environment, and it can effectively facilitate large-scale mini-grid deployment while shifting away from a project-by-project approach.

Some COMESA Member States have establish a Rural Electrification Fund (e.g., Malawi, Zimbabwe). The role Fund's primary role is to ensure there is finance for rural electrification and promoting private sector participating as well as soliciting grant finance in a structured manner. Appropriate policies is required to ensure that mini-grids once established, their area of operation does not in future years compete with the national grid. The national grid should be forced to compensate the mini-grid owners as soon as the national grid extends to the mini-grid supply area.

7 Technical Requirements

7.1 Selection of Technologies and Application thereof

RE technologies will be at the core of electricity access efforts as they use locally available energy resources and can be deployed close to the load centres in various sizes and configurations. They have a wide range of possible applications and represent the most suitable option for off-grid installations in most areas. The technologies selected must meet the particular demands and requirements of the off-grid RE development, be it to supply domestic customers or water pumping or some other purpose.

Possible RE generating sources including solar, wind, small hydro and bioenergy.

7.2 Technical Challenges

TECHNOLOGY	TECHNICAL CHALLENGES AND ISSUES
Solar Energy Systems	i. For rural areas it is important that the system and individual components are robust, tamper-proof and user-friendly. Thin and fragile cable connections are known causes of system failures. ii. System abuse, as users experiment with heavy loads can limit the

TECHNOLOGY	TECHNICAL CHALLENGES AND ISSUES
	lifetime of components, requiring more frequent replacements. iii. Compromise on quality of less expensive components like charge controllers (2 – 4 % of system lifetime costs) may negatively impact the overall cost of the system over its lifetime. This is because they play a crucial role in the effective operation of relatively expensive components like batteries (as much as 50% of system lifetime costs). iv. The choice between direct current and alternating current solar home systems should take into account the distances through which power has to be distributed since efficiency of direct current systems declines significantly more with increasing distance.
Small and Medium Wind Turbine	i. Lack of wind resource data for rural areas prevents preliminary assessments of suitable sites for small and medium-sized wind power plants. ii. There is a general lack of awareness of the technology and its potential role in an integrated rural electrification network that benefits from synergies between different technologies. iii. Product certification of wind turbines using international standards has been highlighted to be important to ensure that installations in rural areas operate optimally.
Biomass Gasifier	i. Developing sustainable biomass supply chains in the long term is critical to project success. ii. During the initial stages of project operation, the electricity demand may be limited, leading to lower plant load factors. iii. Need for a comprehensive model for regular installation operation & maintenance. In some cases, a cluster approach could be adopted to cater for multiple installations through a single operation & maintenance infrastructure.

7.3 Standards

The use of international standards is important for rural electrification. The IEC Standards[4] are recommended by the Alliance of Rural Electrification.

7.3 Rural Mini-grid Design

Mini-grids design is important to service diverse loads and need to integrate have proved to be an attractive option for rural electrification. They provide a major opportunity for communities since they can service diverse loads, including for productive applications. Whether hybrid or entirely based on RE, mini-grids can integrate several sources (wind, biomass/biogas, hydro, solar, diesel, etc.). They can be designed in a way that is compatible with the main grid distribution infrastructure.

7.4 Quality control and After-Sales Care

Stringent quality control and after-sales service **is** one of the critical success factors is a strong quality control mechanism complemented by an efficient after-sales service supply

[4] http://www.ruralelec.org/fileadmin/DATA/Documents/06_Publications/ARE_TECHNOLOGICAL_PUBLICATION.pdf

chain. Strict quality control facilitates the uptake of the technology among rural communities and helps dispel any negative perceptions of its reliability.

Some facilities maybe designed to issue targeted subsidies for promoting quality and after sales service. For examples, a special fund dedicated to rural electrification is used to finance the private sector to provide after sales service to the facility. This could be a concession based on identified areas per private sector service provider.

8 Concessions - Regulatory and Contracting Issues[5]

Member States need to decide on the appropriate legal and contractual basis on which off-grid developments will take place, and put appropriate arrangements in place. In recent years there has been growing interest in the use of regulated *'energy-service concessions'* and other public-private regulatory mechanisms as a way to provide affordable and universal electricity services to rural populations not connected to central electric power grids. Rural energy-service concessions may employ a mixture of energy sources to serve customers, including diesel generators, mini-hydro, photovoltaic, wind, and biomass. Installations may be household-scale systems (i.e., photovoltaic "solar home systems") or village-scale "mini-grids" using a hybrid mixture of solar, wind, hydro, diesel, and battery storage.

Some of the key regulatory and contracting issues associated with concessions are described below:

Market aggregation of rural services - delivery of services to rural populations is expensive. Marketing, sales, and service involve many activities like information dissemination, installation, fee collection, maintenance and warrantee service, reclamations, after-sales customer services, and non-payment interventions. One way to reduce the high transaction costs may be to bundle energy services with other existing services (e.g. water, communications, financial services, or consumer electronics sales and service).

Terms of concessions and mechanisms for terminating concessions – the design of incentives and risk allocation in a concession contract will affect first the intensity of competition and then the sustainability of the original contract[6]. Regulatory frameworks need to assure that the phasing out of the concession will not be hindered by the responsible local regulatory or other interested parties whose function or business would be eliminated or curtailed with the end of the concession.

Attracting capable bidders - there may be a substantial challenge in getting enough qualified bidders to respond to a tender. Potential domestic and international bidders may be

[5] Refer to the COMESA PPP Guideline available of the COMESA website (www.comesa.int/).
[6] Klein, Michael (1998c) Designing Auctions for Concessions—Guessing the Right Value to Bid and the Winners Curse.World Bank Public Policy Note 160. Washington, DC: World Bank.

hesitant to participate in bidding because of lack of tested experience with the regulatory framework and process and lack of reliable information on costs and profits. Regulators need to carefully consider who are the potential bidders and what are their concerns. Subsidies may be attractive to bidders, but the regulatory framework may be a more decisive factor. Regulators should consider active ways to interest potential bidders (e.g., seminars on rural electrification issues for international utilities, and on concession business plans for local companies), and ways to promote joint ventures or bidding partnerships between local and international firms.

Bidding process design, competition, negotiation, and rebidding - formal competitive bidding takes time, is costly, and may discourage innovation. Negotiated contracts may be much quicker but more costly and be less politically acceptable. Many other decisions about how to structure a competitive bidding process can greatly affect the outcome. For long-term concession contracts, renegotiation can diminish the importance of initial competitive bidding and affect costs. If concession contracts are subject to periodic rebidding, then service adjustments (costs, prices, etc.) can be made competitively and continued competition may decrease the need for price regulation.

Relevance of rural service experience - in some circumstances, such as has happened in Argentina, existing concessions in urban areas may be granted the opportunity or required to serve the rural off-grid market. If this happens, there arises the question of whether the urban concession is willing or able to service the rural market and whether it is familiar with the technologies and service infrastructure needed. One solution would be to encourage the concession to partner with other firms, foreign or domestic, that have experience in serving rural markets or with the technologies concerned. A better solution may be to fully separate the two markets.

User participation - participation of technology users is crucial for project success. This social challenge of rural electrification may be easier to handle by concession. One typical example is the challenge how to regulate the demand of individual households in a mini-grid (community use of a limited resource). User participation is complicated by the distribution of user demand; typically, many users have low demand, while a few have much higher demand for energy services.

Equipment selection: purchase versus leasing - if concessions can choose the technologies to offer users, will they offer least-cost types of technology? Alternatively, technologies are specified by the project management unit and leased to the concessions; this allows economies of scale and standardization in purchasing, and relieves the concessions of needing skills for competitive procurement, but also takes away the concession's ability to vary technology according to user needs and to achieve least-cost applications.

Regulatory Agency Capability And Performance - regulation of concessions is quite different from traditional regulatory practices for state-owned electric utilities. In countries with traditionally state-owned, state-managed utilities, regulatory oversight may not have existed at all. Even where utilities have been privatized and new regulatory mechanisms established, new regulatory skills will be needed for rural energy concessions. Among the biggest challenges in regulatory design are achieving political independence and introducing rules to ensure accountability[7].

9 Regulatory Oversight

The off-grid system should be designed to meet technical and operational requirements applicable in the industry, including those relating to health and safety. Regulators should issue the appropriate licences and subject the mini-grid operators to reporting, monitoring, compliance and enforcement provisions applicable in the sector. As discussed in section 3.3.3, light handed regulation is preferred for rural electrification. This, in addition to the discussion in section 3.3.3 may include:It must be size specific (exempt small undertaking (e.g., < 50 kW and progressive increased regulation for larger systems, depending on size),

- Use of conditional licencing,
- Empowerment of the community in participating in some of the regulatory functions,
- Self regulation,
- Enable owners to apply for licensing exemption,
- Permit performance contract licensing as a form of regulation.

[7]Estache, Antonio (1997) Designing Regulatory Institutions for Infrastructure—Lessons from Argentina. World Bank Public Policy Note 114. Washington, DC: World Bank.

APPENDIX A - Matrix of Electricity Supply Models

Table 1 : Matrix of Electricity Supply Models

FORMS OF OWNERSHIP		GRID EXTENSION	VILLAGE MINI-GRID CONNECTED	VILLAGE MINI-GRID ISOLATED	SINGLE USER SYSTEM
GRID…….OFF GRD					
	Private (for profit)	Small decentralization	Small grid reseller	Hydro mini-grid selling to local customers and to the main grid (China, Nicaragua), Formerly Isolated mini-grid now connected (Cambodia).	Diesel or hydro mini-grid.	PV solar systems for private homes. Solar Water Heaters. PV Solar / Wind water pumping Pico hydro systems.
		Large decentralization	Privatized concessioner extends grid (Argentina, Chile, Guatemala, Uganda)	Technology neutral concession (Senegal).	Off-grid concession (Argentina)	Off-grid PV Solar for schools and clinics (Burundi).
	Non-Governmental	cooperative	Co-operative finance grid extension (Bangladesh, Costa Rica, USA)		Multi service cooperative with diesel or hydro micro grid (Bangladesh, Bolivia, Sri Lanka)	Agriculture co-operative using diesel generator.
		Other community organizations	Small community gateways (Bolivia)		Community micro-grids	Diesel generator. PV Solar / Wind / Pico Hydro to power a school / clinic / community centre. PV Battery charging station.
	Public (State Owned)	Small Decentralization	Small State owned utility extends grid (Brazil, Colombia)		Municipal diesel or hydro mini-grids.	Solar Heating Systems.
		Large decentralization	State utility extends grid and sells at retail (Botswana, Mozambique, Thailand, Tunisia)		Residual state owned isolated diesel mini-grids with fuel subsidies.	Solar Heating Systems.

APPENDIX B - Examples of Rural Electrification Frameworks in COMESA

Table 2 : Examples of Rural Electrification Frameworks in COMESA

COUNTRY	RURAL ELECTRIFICATION FRAMEWORK
Burundi	The focus of the energy policy is on rehabilitation of existing (hydropower)plants and distribution grids as well as the development of new hydroelectric sites. Furthermore a rural electrification program is planned mainly by grid extension and by providing information on alternative energy sources affordable for low-income households. For solar systems, priority is given to the electrification of social infrastructure structure (schools, hospitals, health centres, pumping stations, local administration offices) in remote, off-grid areas. For Wind energy the strategy is the electrification of social infrastructure in off-grid and remote areas.
Comoros	The Ministry of Planning, Water and Energy is responsible, amongst other tasks, for the regulation of the energy sectors of the country. MAMWE (Gestion de l'Eau et de l'Electricité aux Comores), the national utility company for Grand Comore and Moheli, and Electricitéd'Anjouan (EDA), are responsible for regulation of the electricity sector, as well as their market activities. About 46% of the population have access to electricity. The network covers 97% of the country, however, there is a shortage of generation.
DRC	The Ministry of Energy and Water regulates the electricity industry. The Ministry for Rural Development is responsible for rural electrification. Institutions in Rural Electrification are scattered and have poorly defined roles. The European Union Energy Initiative Partnership Dialogue Facility (EUEI-PDF) in 2008 and 2009 supported the Ministry of Energy in creating an Energy Sector Policy Letter, focusing on separating the functions of the state and encouraging private-sector participation in the energy sector, as well as pragmatic service expansion and regional integration of energy networks The Rural Electrification Strategy was developed [as part of the EUEI-PDT project], targeting increased private-sector involvement in rural electrification, as well as promoting appropriate use of renewable energy sources, and establishing both centralised and decentralised rural electrification schemes, at affordable prices. The electricity national access rate is 9 % and 1 % for rural areas.
Djibouti	The Ministry of Energy and Natural Resources has the responsibility for regulating the electricity and oil sectors in Djibouti. The government is in the process of engaging in a comprehensive solar energy development plan, with various targets for dissemination of the technology, including: (i) equipping 70 rural boreholes and 100 other wells with solar pumps, (ii) equipping all rural health centres and 100 rural schools with solar arrays, (iii) the electrification of 5,000 households with solar PV by 2017, increasing rural electrification to 30%.. The urban electricity access rate is 40% and the rural electrification is less than 1%.
Egypt	The Electric Utilities and Consumer Protection Regulatory Agency (EEUCPRA, www.egyptera.com) was established by Presidential Decree No. 339/2000 under the supervision of the Minister of Electricity and Renewable Energy. Egyptian electrification rates in 2008 were approximately 99.4% according to the International Energy Agency (IEA); this rate is among the highest of the continent with

COUNTRY	RURAL ELECTRIFICATION FRAMEWORK
	total urban access to electricity, and a 99% access rate in rural areas. However, approximately 500,000 people still lack access to electricity.
Ethiopia	The Ethiopian Energy Authority (EEA, http://ethioelectricagency.org), established in June 1997, regulates operations in the electricity supply sector, including licensing and ensuring safety and quality standards. The Agency is now re-established as the Ethipia Energy Authority, with additional mandates. Rural Electrification Executive Secretariat (REES) is entrusted with the responsibility of supporting and promoting off-grid rural electrification projects through cooperatives and private sector operators acting outside the national grid. REES manages the Rural Electrification Fund (REF). Ethiopia has 86 million people, and as of 2011, only 23% of households had electricity (Central Statistical Agency 2012); in rural areas, where the vast majority of the population lives, just under 5% of households were connected to the grid.
Eritrea	The Electricity Regulatory Commission (ERC) established by the Electricity Proclamation No.141/2004, is not yet fully functional, though Ministry of Energy and Mines personnel are occasionally assigned to carry out regulatory tasks. Approximately 32% of the national population have access to electricity, but only 3% in rural areas.
Kenya	The ERC was established as an Energy Sector Regulator under the Energy Act of 2006.The Ministry of Energy is responsible for overseeing the actions of the ERC, without direct involvement. The ERC is responsible for aiding the Ministry in the formulation of national energy policy with statistics and information as necessary. As of 2010, Kenya had an overall national electrification rate of 23%, with rural energy access to the grid about 5% and urban access at 50%. Kenya aims to grow rural electricity access to 20% by 2012 and 40% by 2024. In Kenya there a Rural Electrification Authority (REA) which is in charge of building infrastructure to connect consumers of electricity in the rural areas. It is also responsible for renewable energy projects like solar photovoltaic systems in the rural areas
Libya	There is no regulatory agency in the country. The Energy Council is responsible for all operations in the sector, including such regulatory measures as are necessary for the sector's operation. The Council is chaired by the Prime Minister, and is comprised of the Ministers of Industry and Economic Development, Planning and Finance, and Municipalities together with the Chairmen of the Environmental General Authority, REAOL, GECOL, the NOC, the Atomic Authority, the Solar Energy Research Centre, the Libyan Bank and the National Security Council. Libya has almost 100% access to electricity rate.
Madagascar	The Office de Régulation de l'électricité (ORE, http://www.ore.mg/) is the regulatory body and is independent from the government. ORE'spower are defined by the Electricity Code and the Decree 2003-194. The ORE is responsible for granting permits and concessions to suppliers (from Madagascar and abroad). Whilst reliability and coverage of electricity have increased over the past 7 years, the rate of electrification is low, particularly in rural areas where less than 5 % of the population have access to electricity, the national electrification aces rate is 15 %.
Malawi	Rural Electrification Act, 2003 (No. 21 of 2004) and Malawi Energy Policy, 2003. The Act makes provision for the promotion, funding, management and regulation of rural electrification; and for matters connected therewith and incidental thereto.

COUNTRY	RURAL ELECTRIFICATION FRAMEWORK
	The Act creates a framework for rural electrification in Malawi that can be either through grid extensions or off-grid electrification schemes. It creates the Rural Electrification Management Committee to oversee the implementation of the Act, creates a Rural Electrification Programme and requires prioritisation of sites to be electrified in accordance with agreed criteria, and establishes the Rural Electrification Fund to fund the Programme with rural electrification levies to be collected from sales of energy. The Act also provides for the appointment of Concessionaries to implement rural electrification schemes. Regulatory services and licensing of activities resort under the Malawi Energy Regulatory Authority. The national connection rate is 9%, urban is 37% and rural is 4%.
Mauritius	The MEPU is the central body responsible for formulating and implementing the Government's policy in the field of energy. The Utility Regulatory Authority Act was adopted in 2005 with the Regulatory Authority, as approved under the Act, expected to be established soon. The Regulatory Authority will include regulating third party access to the grid. However, currently the sector is regulated by The Central Electricity Board (CEB), a parastatal body wholly owned by the Government and established in 1952. The main islands of Mauritius and Rodrigues, are fully connected to the Central Electricity Board electricity grid. Mauritius has 100% access to electricity rate.
Rwanda	The Ministry of Infrastructure (www.mininfra.gov.rw/) is responsible for national energy infrastructure, and is the primary government ministry in the energy sector. Rural energy is part of this mandate. The Rwanda Utilities Regulatory Agency (RURA, http://www.rura.gov.rw/) regulates both the electricity and gas sectors. The regulator was created on 13th September 2001. The national electricity access rate is 20%.
Seychelles	The Ministry of Environment and Energy is responsible for energy regulation. The Energy Act 2012 gives the Seychelles Energy Commission responsibility for regulation of the electricity sector, as well as the promotion of fair and efficient market conduct in the energy sector. The Public Utilities Corporation (PUC) was established under the Public Utilities Corporation Act 1985. The Act stipulates that PUC not only provide, but also ensure, continued supply of electricity, potable water and sewerage services to the population of Seychelles. Seychelles has about 99 % access to electricity rate.
Sudan	The Ministry of Water Resources and Electricity has the responsibility for formulating and implementing the energy policies in the country. The Electricity Regulatory Authority (ERA) is responsibility for regulation of the energy sector, as well as the promotion of fair and efficient market conduct in the electricity sector. Sustainable energy falls under the purview of the Ministry of Water Resources and Electricity, which regulates the Sudanese energy sector. The Renewable Energy Master Plan does not detail specific regulatory mechanisms for the promotion of sustainable energy. Urban electrification in 2009 stood at roughly 52%, with rural electrification at 28%.
Swaziland	The Ministry of Natural Resources and Energy (MNRE) has the responsibility for formulating and implementing the energy policies in the country. The Swaziland Energy Regulatory Authority (SERA, http://www.sera.org.sz) was established by the Energy Regulatory Authority Act of 2007. The Act establishes the Authority as an independent corporate body, with the power to sue and be sued in its own name.

COUNTRY	RURAL ELECTRIFICATION FRAMEWORK
	The overall infrastructure coverage is 70 % and the national access rate is 61 %. It is estimated that 77% of urban areas and 50 % of rural areas are electrified.
Uganda	The Ministry of Energy and Mineral Development (MEMD, www.energyandminerals.go.ug) is responsible for overall management of the country's energy sector, dealing with policy formulation, implementation and monitoring. The Electricity Regulatory Authority (ERA, http://www.era.org.ug/) was established following the enactment of the Electricity Act 1999. The mandate of the Rural Electrification Agency (REA, http://www.rea.or.ug) is to facilitate provision of electricity in rural areas. The REA was established as a semi-autonomous Agency by the Minister of Energy and Mineral Development through Statutory Instrument 2001 no. 75, to institute the Government's rural electrification function under a public-private partnership. About 15% of the population had access to the electricity grid. In rural areas, where more than 85% of the population lives, roughly 2 % of the households are connected to the grid.
Zambia	The Ministry of Energy and Water Development (MEWD) has the overall responsibility to develop and implement policy on energy. The Energy Regulation Board (ERB, www.erb.org.zm) was created under the Energy Regulation Act of 1995, Chapter 436 of the Laws of Zambia, and become operational in 1997. The Rural Electrification Authority (REA, http://www.rea.org.zm/) established through an Act of Parliament in 2003, is in charge of developing and implementing master plans for the systematic electrification of rural areas. The functions of the authority include: developing mechanisms for the operation of a grid extension network for rural electrification, as well as applying a subsidy for capital costs on projects designed to supply energy in rural areas. The rural electrification program also contemplates the use of solar technology that has been applied so far only in pilot projects, with encouraging results. In 2009, approximately 18.8% of the Zambian population had electricity access. In 2008, the urban access rate was 44%, with the rural access rate being just 2.2%.
Zimbabwe	The Ministry of Energy and Power Development (www.energy.gov.zw) has overall responsibility for energy issues in Zimbabwe. The Zimbabwe Electricity Regulatory Commission (ZERC, www.zerc.co.zw) is a statutory body established under the Electricity Act, (Chapter 13:19) No. 4 of 2002, as amended by the Electricity Amendment Act No. 3 of 2003. It became operational in August 2003. The Rural Electrification Fund Act (13:20) created a Rural Electrification Agency (REA, www.rea.co.zw) that has the mandate for the total electrification of all rural areas, funded by electrification levies and government stipends. The main functions of the agency are the planning of projects, the raising and accounting of rural electrification funds, and the monitoring of project implementation. The overall electrification rate is approximately 44 %. It is estimated that 80 % of urban areas and 20 % of rural areas are electrified.