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Assessing the potential of electrification concessions for universal energy access: Towards integrated distribution frameworks

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The situation of energy access in Sub-Saharan Africa remains critical. According to the 2019 Tracking SDG 7: The Energy Progress Report, about 573 million people lacked access to electricity in 2017[1]. Despite the proclaimed UN's Sustainable Development Goal #7 (SDG 7) of a global energy access by 2030, the Agency forecasts that nearly 600 million Africans will still live in the dark[2].

As a matter of fact, Sub-Saharan Africa has demonstrated limited progress in energy access over the past decade. Less than a third of the region experienced electrification rates faster than 1% per year[3] due to ailing electrification policies and rampant demographic pressure, and World Bank estimates suggest that the continent may not be in a position to achieve universal energy access with the next 50 years under current policy scenarios[4]. While various governance and financial models have been attempted over the past decades in order to foster private investments in energy access, sustainable and replicable business models for universal energy access remain elusive.

As national utilities still struggle to escape financially unsustainable business models and cycles of regular bankruptcy and bailouts, the new momentum in the energy access sector has sparked growing interest in the development of innovative governance models to restructure the distribution sector and accelerate electrification. An estimated $52 billion of investment is needed per year to reach universal electricity

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[1] IEA, IRENA, UNSD, WB, WHO (2019), Tracking SDG 7: The Energy Progress Report 2019, Washington DC.

[2] *Ibid*

[3] World Bank and IEA (2015), *Sustainable Energy for All—Progress toward Sustainable Energy 2015*, World Bank, Washington, D.C.

[4] Richard Hosier, Morgan Bazilian, Tatia Lemondzhava, Kabir Malik, Mitsonuri Motohashi, and David Vilar de Ferrenbach (2017), *Rural Electrification Concessions in Africa: What Does Experience Tell Us?*, World Bank, Washington, D.C.

access by 2030 – a figure that far exceeds the $30 billion committed in 2015-16[5] and that is out of reach for public agencies. As a result, increased attention is being paid to business models that can attract private capital under socially, politically and economically sustainable terms.

Concession agreements, in which "the government grants a private company the right to extend a specific service under conditions of significant market power,"[6] offer an interesting middle ground between traditional State-owned approaches to distribution and entirely private sector-driven strategies. While this model has already been tested in a number of Latin American, Asian and mostly African countries with mixed results, recent technological breakthroughs and the large experience derived from past experiences in the design and implementation of concessions may now pave the way for bright prospects for universal energy access.

This study aims at demonstrating that properly designed and implemented concession agreements designed at the utility-level may lead to significant breakthroughs in reviving ailing utilities and reaching universal energy access. Building on a brief historical overview of past electrification attempts, the authors of this paper argue that tailored electrification models will be needed to reach universal energy access on the African continent. In practice, a review of past concession experiences demonstrate that national utility-scale concessions may hold the most potential provided that such agreement entail well-defined financial sustainability and energy access-specific clauses open to periodic revision. This paper concludes by proposing an actionable approach to implement concessions to accelerate electrification. It elaborates on the concept of Integrated Distribution Framework, whereby an entity is granted with a well-designed territorial concession and adequate incentives with the mandate of achieving full electrification under stringent quality of service requirements.

I. THE FAILURE OF THE "ONE-SOLUTION-FITS-ALL" APPROACH: TRANSITIONING FROM CENTRALIZED STATE-LED TO POLYCENTRIC AND UNCOORDINATED ENERGY ACCESS STRATEGIES

Energy access has become one of the most dynamic development areas in Sub-Saharan Africa. However, we argue that the fundamentals underlying the current

[5] Sustainable Energy for All (SEforALL) and the Climate Policy Initiative (CPI)2018. Understanding the Landscape – Tracking Finance for Electricity and Clean Cooking Access in High-Impact Countries. License: NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0).

[6] As defined in Hosier *et al.* (2017)

dynamics of rural electrification should be interpreted as a symptom of the failure of current governance models. The retrospective analysis of fifty years of electrification attempts on the African continent could provide academics and decision-makers with unprecedented insight into not only the idiosyncrasies of the Sub-Saharan economies warranting the design of Africa-specific frameworks for universal energy access, but also the key features of possible appropriate governance models.

The early failure of the "one-solution-fits all" approach

Following Western experiences, African States and DFIs engaged as of the 1960's into long-term centralized grid extension projects. The limited results of this approach led to an early questioning of a model that had remained the *de facto* single electrification model.

The low priority given by colonial administrations to peri-urban and rural electrification led to overall electrification rates as low as a handful of percent at the time of their independence[7]. Back in the 1960s, newly independent African States thus faced an acute lack of basic power infrastructures and dramatically low electrification rates—two major bottlenecks for economic and social development. Power grids remained largely undersized for national consumption and their extension generally limited to main urban centers as well as key industrial and mining installations[8,9].

A few countries engaged into early large-scale electrification programs. Convinced that energy access and particularly rural electrification would play a critical role in economic and social development, Tunisia, Côte d'Ivoire and Kenya engaged into electrification programs by grid extension or by providing regional centers with small scale grids usually powered by diesel power generators. These initiatives constituted the first national attempts to address the issue of energy access and extended energy access to secondary cities and to a lesser extent large villages[10].

However, rural electrification remained at an embryonic stage. The direct application of the Western model, without any practical adaptation of traditional electrification policies to radically different socio-economic environments, proved to be particularly ill-suited to African contexts characterized by a limited and sparse demand as well as

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[7] Austin, Gareth (2010), African *Economic Development and Colonial Legacies*, International Development Policy, Graduate Institute of International and Development Studies, Geneva

[8] *Ibid*

[9] Debeugny *et al.* (2017), *L'Électrification Complète de l'Afrique est-elle Possible d'ici 2030 ?* Afrique Contemporaine, Agence Française de Développement, Paris

[10] CNRS (2011), Chronologie *évolutive des recherches sur les énergies solaires en France et à l'international*, available at: http://www.cnrs.fr/ComiHistoCNRS/spip.php?article61

limited ability to pay of rural households—three factors dramatically increasing the cost of grid-based electrification and affecting the economic feasibility of traditional energy access approaches[11].

Shifting away from traditional microeconomics: The emergence of decentralized and solar initiatives

A decade later, the oil shocks of 1974 and 1979 created a new momentum in favor of nascent decentralized and renewable energies. In the aftermath of the 1973 and 1979 oil shocks, renewable energies experienced a wide and rapid technological development and solar energy emerged as a possible but limited solution for rural electrification in developing countries. Poor institutional arrangements, high costs of solar and the lack of local expertise limited solar projects to pilot scales.

Newly invented photovoltaic systems appeared as particularly well positioned to meet the low demand levels characterizing small urban centers and remote rural regions in francophone Africa. This new technology raised high hopes among African States, as these latter became increasingly aware of the limits of grid-based models. The emergence of solar energy in energy access triggered the development of North-South bilateral cooperation programs, as a handful of European technical agencies engaged actively in the diffusion of these disruptive photovoltaic technologies[12].

Due to technological and logistic limitations, the first solar electrification programs were use-specific with direct applications in telecommunication, water supply, irrigation and rural health. Large-scale achievements remained limited to the localized development of irrigation systems in Mali, the installation of a few solar-powered televisions in Nigerien villages and the installation of solar refrigerators in dispensaries in former Zaïre[13]. Concurrently, a substantial number of solar kits were deployed in African countries with a certain success among wealthy rural families. Nearly 5% of Kenyan and Moroccan rural households were equipped with solar home systems, most often with financial support from the diaspora[14].

As African countries experienced non-traditional electrification pathways more suited to low-population density and limited power demand, immature governance

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[11] *Ibid*

[12] Debeugny *et al.* (2017), *L'Électrification Complète de l'Afrique est-elle Possible d'ici 2030 ?* Afrique Contemporaine, Agence Française de Développement, Paris

[13] CNRS (2011), Chronologie *évolutive des recherches sur les énergies solaires en France et à l'international*, available at: http://www.cnrs.fr/ComiHistoCNRS/spip.php?article61

[14] Liébard, N. (2015), *L'évolution de la politique des énergies renouvelables depuis les années 1970*, CGDD, Ministère de l'Écologie, Paris

arrangements for energy access and the lack of adequate business-models for the diffusion of solar home systems prevented solar projects to scale up. Solar products had not yet reached higher levels of resilience and cost efficiency, and most solar kits and lanterns proved to be too costly for most African households. What is more, reliability issues affected the large-scale deployment of these solutions and created a widespread distrust among rural populations towards what was perceived as deceptive "high-price for low-quality" electrification solutions[15]. Also, most projects focused on setting up initial distribution channels while underestimating the critical importance of a broader issue: the development of *local* value chains for solar electrification. Without adequately trained local stakeholders and long-lasting debt financing, the success of grant-based solar programs proved to be unsustainable and largely rely on the support of international donors—mostly bilateral development banks[16,17].

In hindsight, the development of the first generation of solar projects allowed stakeholders to overcome the western "grid-only" dogma of energy access and face, for the first time, the issue of multi-scale electrification programs involving a range of electrification solutions and public and private stakeholders in remote and low population density locations that could not be reasonably reached by national grid on market terms. While many hopes were raised after the two oil shocks, solar energy remained an innovative but still marginal energy access solution. Solar systems were thus constrained to complement national grid-based electrification projects when adequate grant funding from DFIs was available.

The emergence of the first African electrification models: From "pre-electrification" programs to nation-wide integrated electrification policies and the first concessions

The 1980s and 1990s played decisive roles in the structuring of modern rural electrification policies and the emergence of innovative institutional arrangements and the first concessions aiming at improving distribution service quality and energy access. Building on past experience in grid extension and solar-based electrification of rural areas, European technical cooperation agencies launched in 1984 the concept of "pre-electrification," paving the way for nation-wide integrated electrification strategies.

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[15] *Ibid*

[16] *Ibid*

[17] Christensen et al., (2012), *Enhancing access to electricity for clean and efficient energy services in Africa*, UNEP Risø Centre, Technical University of Denmark, Roskilde

Building on the key lessons derived from the 1960's, the central idea of "pre-electrification" programs was to abandon the "one-size-fits-all" approach and to propose a new approach of rural electrification acknowledging radically different levels of demand by distinguishing several levels of electricity service[18,19,20,21]. The advantage of this approach was that it aimed at providing electricity *"in little quantity, everywhere and right now"* while traditional national grid extension projects followed the much more ambitious goal of distributing *"potentially important quantities of electricity, but only here and there...and in the very long term."*

The "pre-electrification" solutions leveraged a wide range of technological but also organizational innovations such as: (i) a fine analysis of the different services that electrification should provide, before ultimately choosing the most appropriate electrification technology and planning; (ii) the joint analysis of both uses and production of electricity, a practice previously unknown in conventional electrification; (iii) the search for large-scale complementarity between grid extension projects, local mini-grids, and individual PV systems; (iv) the introduction of batteries as possible vector of electricity distribution in remote regions characterized by low consumption levels; and lastly, (v) the introduction of efficient and low-consumption bulbs and portable lights, now affordable to low income households and bringing substantial energy savings[22]. These innovations proved to play a key role in the development of modern electrification programs[23].

Building on this nascent idea of "pre-electrification", Morocco launched in the 1990s an emblematic energy access project that has remained the only African success story in energy access to date (c.f. **Box 1**). This project aimed at reaching "global energy access"—i.e., full energy access at national scale—this new generation of electrification projects involved on- and off-grid electrification solutions and relied on advanced public service delegation agreements adapted to the specific context of rural electrification. Grid extension and mini grids were developed by the State-owned utility, while well-defined territorial concessions allocated to privately-owned

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[18] *Ibid*

[19] Liébard, N. (2015), *L'évolution de la politique des énergies renouvelables depuis les années 1970*, CGDD, Ministère de l'Écologie, Paris

[20] Iskander, Natasha (2005), *Innovating State Practices: Migration, Development, and State Learning in the Moroccan Souss*, Industrial Performance Center, MIT, Cambridge

[21] World Bank (1995), *Photovoltaic Applications in Rural Areas of the Developing World*, ESMAP, World Bank, Washington, D.C.

[22] Debeugny *et al.* (2017), *L'Électrification Complète de l'Afrique est-elle Possible d'ici 2030 ?* Afrique Contemporaine, Agence Française de Développement, Paris

[23] Christensen et al., (2012), *Enhancing access to electricity for clean and efficient energy services in Africa*, UNEP Risø Centre, Technical University of Denmark, Roskilde

companies, more experienced than the ONE in the installation and maintenance of solar systems, allowed for the limited diffusion of solar kits on market terms in remote areas. With the support of the French Development Agency and other European DFIs, the Moroccan government and national electricity company (ONE) launched in 1994 what is currently considered as Africa's (only) success story in energy access, the Global Rural Electrification Program (PERG). Careful preliminary planning and sound governance allowed this program to effectively increase energy access rates up from 15% to 95% in less than 15 years[24]. Under the overall project agreement, electrification by grid extension was complemented in remote areas by solar initiatives whose management was delegated to private operators[25]. However, the success of public service delegation agreements and territorial concessions remained limited to Morocco, where pre-existing institutional, financial, and technical frameworks for electrification allowed for a quick implementation of DFI-backed project.

Morocco's experience in energy access: Lessons from the success of Africa's first integrated approach

Almost a decade after the conclusion of the country's electrification program, three key factors seem to have underpinned the dramatic success of the Moroccan experience. First, the ability of the national electrification program to leverage all possible electrification strategies—including renewables and off-grid at scale, a major innovation at the time. Second, the careful planning of the electrification program based on extensive pre-feasibility analyses matching demand estimates with various possible supply options for all Moroccan villages by using the computer-based models for the power sector available back then. Third, the ability to leverage all possible sources of funding available for energy access around a transparent and financially sustainable public sector/utility-driven model.

The Moroccan case thus demonstrates that the utility-led model, which was used with success in Tunisia, but discarded by the development community in the 1990s, can perform better than traditional rural electrification agency-driven approaches. However, several factors call for prudence as one may be tempted to generalize key success factors for universal energy access in African contexts. Morocco started out with a rural electrification level which was far below those of its comparable neighboring countries. It had—and seized—the opportunity to exploit a high level of cross-subsidization from urban consumers, and it had an economic development level which went far beyond that of most SSA countries. While the Moroccan experience may well confirm the potential of utility-driven electrification policies, it seems important not to relate the dramatic increase in electrification to the implementation model *alone*.

While the Moroccan experience allowed local stakeholders to develop advanced skills in the design, implementation and management of off-grid electrification solutions, most State-led electrification programs remained at an embryonic stage in other

[24] Islamic Development Bank (2013), *From darkness to light: Rural electricity in Morocco*, IsDB Success Stories, Islamic Development Bank, Jeddah

[25] Choukri et al. (2017), *Renewable energy in emergent countries: Lessons from energy transition in Morocco*, Energy, Sustainability and Society, Springer Berlin Heidelberg, Berlin

countries as projects suffered from poorly informed stakeholders; strong short-term political interference; and more generally, the lack of clearly-defined and inclusive technical, economic, financial, and institutional framework for electrification. Electrification rates stagnated at low levels and long-term grid extension projects remained the norm in most Sub-Saharan African countries.

Towards the end of the Western "one-solution-fits-all-approach": Solar energy as new driver for large-scale electrification

It is not until the late 2000's that a conjunction of technological innovations dramatically reinvigorated the moribund sector of rural electrification in Sub-Saharan Africa. The emergence of digital-based businesses and individual solar kits as new drivers of rural electrification have reshuffled the cards of the energy access sector and propelled privately-owned digital off-grid solar solutions at the forefront of universal energy access initiatives[26].

Attracted by supportive regulations, mature solar technologies, and mobile money markets in the late 2000s, a handful of East African start-ups developed a new generation of solar home systems (SHS) providing remote rural markets with sustainable, affordable, and safe electricity on market terms. Usually limited to basic lighting and phone charging, the use of these kits is prepaid by mobile payments allowing companies to significantly reduce the costs associated with bill recovery in remote rural areas, and payments are made on a "pay-as-you-go" (PAYG) basis conciliating affordability and profitability. Specifically, companies set up prepayment pricing schemes based on the usual expense amount traditionally devoted by rural households to traditional energy sources such as kerosene and phone charging. Remote controllers blocking the system once the prepayment balance is spent out—or prolonging (or re-establishing) use after each new prepayment—create strong incentives for rural populations to prepay on time. Lastly, system durability is ensured through a technical warranty and after-sale service covering the whole repayment period, a key factor in establishing a trust relationship between private companies and local populations but also maintaining the profitability of the company's fixed assets[27].

Within less than a decade, digitally financed off-grid solar has transitioned from pilot scale to a diverse and substantial sub-sector of the global off-grid energy market. As of early 2015, more than 2,500 PAYG SHS were sold every day in Sub-Saharan Africa

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[26] Debeugny *et al.* (2017), *L'Électrification Complète de l'Afrique est-elle Possible d'ici 2030 ?* Afrique Contemporaine, Agence Française de Développement, Paris

[27] Alstone et al. (2015), *Off-Grid Power and Connectivity, Pay-as-you-go Financing and digital supply chains for pico-solar*, Lighting Global, IFC, Washington, D.C.

to date by nearly 30 companies operating in at least 30 African countries, independently from public supervision or any national electrification plans. The number of PAYG SHS sold in Kenya is now about to reach 350,000 kits per year[28], which is commensurate with the number of new rural households to be connected to the national grid within the same time range.

The flexibility of "pay-as-you-go" business models allows solar companies to effectively address major economic and financial constraints of rural populations. By integrating within the same structure, the financial, technical, and operation functions previously split between a wide range of local actors—NGOs, MFIs, and solar product suppliers—PAYG solar business models reduce information asymmetries as well as bargaining and coordination issues and ultimately increase connectivity along the entire solar value chain[29].

This model allows companies to focus their activities and investments on high-added value parts of the solar business—innovative extensive low-cost distribution and maintenance channels—and seek the most appropriate capital structure for capital-intensive privately-owned start-ups. The major innovation of PAYG solar initiatives is thus to pursue rural electrification on market terms with high levels of profitability, in sharp contrast with the unattractive records of most traditional actors of the energy access sector. Unsurprisingly, exponential SHS diffusion rates have quickly attracted funding from foundations, international development banks, ventures capital, and private equity investment funds at unprecedented levels at the expense of more traditional stakeholders.

So-called "pay-as-you-go" solar companies have now become the fastest-growing electrification actors in the sector, overshadowing the efforts of NGOs and MFIs but also local utilities that found themselves unable to compete with the dramatic growth of venture-backed private companies developing large-scale solar electrification activities on market terms. Within less than a decade, the private sector thus managed to completely redesign the dynamics of rural electrification by making energy access profitable. Strong political leverage, significant fundraising capabilities, and powerful networks within Western decision-making spheres allowed off-grid solar electrification companies to become one of the most prominent actors of the energy access sector

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[28] GOGLA (2017), *Providing Energy Access through Off-Grid Solar: Guidance for Governments*, GOGLA, Utrecht

[29] Winiecki et al. (2014), *Access to Energy via Digital Finance: Overview of Models and Prospects for Innovation*, CGAP, Washington, D.C.

with significant bargaining power in the design of national electrification programs and regulations[30].

In definitive, the past fifty years have shown that reaching universal energy access in Sub-Saharan Africa would require idiosyncratic approaches departing from Asian, Latin American, and Western experiences. More specifically, the dramatic success of the PAYG solar sector was mainly based on the emergence of a "all-private" independent electrification model, whose development directly derived from—but without aiming at solving—the structural issues paralyzing traditional stakeholders involved in the energy access sectors. The PAYG revolution showed that the most limiting factors for universal energy access may not be technological obstacles (the technologies underlying the PAYG revolution remains very simple), nor financing (the development of electrification business models on market terms has proved to be particularly attractive to international investors), but more generally the *optimal* allocation of resources and the structuring of *coordinated*, *integrated* and *financially sustainable* national electrification programs. Rethinking current governance models along these lines will be fundamental in the development of Africa's own electrification path coalescing a wide range of stakeholders, technologies, and business models.

II. THE POTENTIAL OF INTEGRATED, INCLUSIVE, AND FINANCIALLY SUSTAINABLE ARRANGEMENTS IN UNIVERSAL ENERGY ACCESS POLICY

Fifty years of electrification attempts should now provide decision makers with unprecedented insight concerning the critical role of governance arrangements in the design and implementation of successful electrification policies. Building on the lessons derived from nearly fifty years of electrification attempts in Sub-Saharan Africa and both political economy and knowledge assessment considerations, this chapter demonstrates the critical need for innovative Africa-specific governance frameworks and eventually argues that integrated, inclusive, and financially sustainable governance arrangements shall play a critical role in the design and implementation of successful energy access policies.

Overview of the current literature on governance arrangements in energy access

Unsurprisingly, the question of adequate governance of the power sector in developing countries has been a subject of numerous academic studies over the past

[30] GOGLA (2017), *Providing Energy Access through Off-Grid Solar: Guidance for Governments*, GOGLA, Utrecht

years. However, most of these studies were either limited to a small segment of the energy access sector or covered the entire power sector without special emphasis on power distribution and rural electrification. Surprisingly, the authors have noted that very little insightful reflection on the topic—if any—has been undertaken to date.

The emblematic case of the Electricity Governance Initiative (EGI), led by the World Resources Institute and Prayas Energy Group, addresses the transparency and accountability of decision-making processes in the power sector[31]. The 64-indicator toolkit developed by the EGI allows assessment of policy and regulatory processes and the social and environmental effects of policymaking and implementation in the sector as a whole. What is more, the application of the toolkit has focused on the effects of structural reform—namely unbundling and/privatization—of the power sector in India and South Africa[32,33].

From a more micro perspective, numerous studies have examined users' experience of electricity services from a political economy perspective with a specific emphasis on particular locations or specific challenges of sustainable electricity services, such as unwarranted subsidies or widespread theft[34,35]. The literature on such experiences is dominated by South Asian cases, and Oda and Tsujita[36] remains one of the very few studies providing statistical insight.

Moreover, the recent emergence of PAYG solar as a credible (and competing) alternative to grid extension has also conferred PAYG companies with significant political and bargaining power over governance design. The Global Off-Grid Lighting Association, representing the interests of more than 100 public and private stakeholders involved in the off-grid energy access sector—such as, most importantly, PAYG solar companies and DFIs—issued in October 2017 a report articulating a set

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[31] Dixit et al. (2007), *Benchmarking Best Practice & Promoting Accountability in the Electricity Sector*, Electricity Governance initiative, Washington, D.C.

[32] EGI (Electricity Governance Initiative) South Africa (2006), *The Governance of Power: Shedding a Light on the Electricity Sector in South Africa*, World Resources Institute and Prayas Energy Group, Washington, D.C.

[33] Mahalingam et al. (2006), *Electricity Sector Governance in India: An Analysis of Institutions and Practice*, Electricity Governance initiative, Washington, D.C.

[34] Golden and Min (2012), *Theft and Loss of Electricity in an Indian State*, International Growth Center, London School of Economics and Political Science, London

[35] Jain, V. (2006), *Political Economy of the Electricity Subsidy: Evidence from Punjab*, Economic and Political Weekly, Munich Personal RePEc Archive. Available at: http://mpra.ub.uni-muenchen.de/240/

[36] Oda and Tsujita (2010), *The Determinants of Rural Electrification in Bihar, India*, Discussion Paper 254, Institute of Developing Economies, Chiba

of guidelines for African States in order to promote the development of off-grid electrification. While this report sets a critical precedent in officializing the new role of the private sector—including new entrants—in policy-making and the design of governance models, the scope of this report remains limited in practice to sound and pro-private sector governance guidelines. Most importantly, the coordination of PAYG solar-based electrification initiatives with alternative energy access solutions, such as grid extension or the deployment of mini-grids, is not addressed[37].

Last but not least, the comprehensive review of the existing literature undertaken by Watson *et al.*[38] found a lack of both academic and empirical research focusing on politics and power balances and their impact on modern energy services. Bouille *et al.*[39] confirms this finding and further argues that although political commitment and leadership at different levels have been regularly cited as keys to success in improving access to energy, there has been little systematic investigation of interventions and political dynamics that help overcome these hindering factors. Most importantly, there has been little reflection on experiences of regulation and regulatory authorities in enforcing binding goals and rules for electricity access[40].

Assessing the urgent need for adequate governance models in the power sector

The authors of this paper argue that the need to think and clearly define the key objectives of overall governance arrangements may now be more pressing than ever, as the African continent may be about to move full steam ahead towards dynamic but uncoordinated electrification models.

The recent emergence of the private sector as a new leading actor in the energy access sector reactivates the inconvenient debate of the sharing of responsibilities between stakeholders in the design, implementation, and optimization of national electrification strategies, and more globally of adequate governance arrangements in the power sector. While grid extension-based electrification has long been perceived

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[37] GOGLA (2017), *Providing Energy Access through Off-Grid Solar: Guidance for Governments*, GOGLA, Utrecht

[38] Watson et al. (2012), *What Are the Major Barriers to Increased Use of Modern Energy Services among the World's Poorest People and Are Interventions to Overcome these Effective?*, CEE Review, DFID, London

[39] Bouille et al. (2002), *Power Politics, Equity and Environment in Electricity Reforms*, World Resource Institute, World Resource Institute, Washington, D.C.

[40] Ibid

as a reference model for Sub-Saharan Africa[41], recent technological breakthroughs in renewable energies and mobile network management have allowed private stakeholders to spearhead the design of innovative models in complete independence from any public control or monitoring[42,43]. The current lack of appropriate governance of the electricity sector at national levels may in practice pave the way for the exponential development of independent public- or privately-led, on- or off-grid, and urban, peri-urban or rural initiatives without any structured dialog or cooperation between stakeholders. Fostering competition rather than cooperation and synergies among actors, today's uncoordinated approaches are also very unlikely to lead to optimal electrification schemes mobilizing the best available energy access strategy to meet the local demand.

Furthermore, the dynamism of PAYG solar companies calls for an urgent rethink of governance arrangements. As a matter of fact, the aforementioned threats for the development of coordinated and well-planed electrification strategies have already started to materialize as privately-led PAYG SHS- based electrification initiatives may be about to overshadow grid extension projects in urban and peri- urban - where grid extension could make sense - while leaving aside the less profitable rural markets[44]. Moreover, the strong signal sent by the publication of GOGLA's "Guidelines for Governments" illustrate the current dynamics of a two-speed electrification strategy between inertial traditional stakeholders and fast-growing off-grid solar companies.

Hence, it appears reasonable to affirm that no sustainable electrification model could be deployed on a large scale by African States without clarifying the key objective underlying new governance models adapted to the specific contexts of Sub-Saharan countries.

Harnessing the full potential of existing or potential stakeholders towards universal energy access through inclusive governance models

Inclusiveness should constitute the first cornerstone of sound governance arrangements. More specifically, it further argues that governance models should

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[41] World Bank (1995), *Photovoltaic Applications in Rural Areas of the Developing World*, ESMAP, The World Bank, Washington, D.C.

[42] GOGLA (2017), *Providing Energy Access through Off-Grid Solar: Guidance for Governments*, GOGLA, Utrecht

[43] Lepicard et al. (2017), *Reaching Scale in Access to Energy: Lessons from Practitioners*, Hystra, Paris

[44] *Ibid*

safeguard and promote the objective of universal energy access and thereby coalesce and structure the contribution of a wide range of stakeholders.

The design and implementation of future national governance arrangements should be guided by the objective of providing electricity to all households within a State's boundaries, both in urban and rural areas, at the shortest possible deadline. The scale of such challenge should not be underestimated. While current electrification rates may vary between Sub-Saharan countries, many efforts will be necessary to provide power to nearly 570 million people currently living without access[45]. Moreover, national arrangement for complete electrification should account for a large discrepancy between urban and rural electricity access rates. Aggregate numbers should not overshadow dramatic discrepancies between territories. Nearly 90% of people living without access to electricity live in rural areas[46]. Hence, future governance models may not prove very adequate without clearly acknowledging and answering the magnitude but also diversity of such currently unmet—or partially met—demand.

Moreover, universal energy access should not be perceived through the sole lens of private consumption of local households. The inclusiveness of governance arrangements should not only account for a wide range of ability to pay among households, but also a variety of uses of electricity. More specifically, productive uses of electricity should not be overlooked but rather included within a broader conception of energy access aiming at fostering the emergence of local production capabilities[47].

This objective may only be achieved through open and flexible coalitions of stakeholders. Past electrification attempts have showed that the careful integration within national governance arrangements of a wide range of institutional, financial, or technical stakeholders could be decisive in enhancing energy access. The role of the public and private sector may be approached in a flexible and open way, in marked contrast to current dogmatic and ideological approaches. More specifically, governance arrangements should remain open to—without being restricted to—privately-owned PAYG solar companies and retaining the necessary flexibility to integrate new electrification models that may emerge in the future. Moreover, the inclusiveness of governance arrangements may not be complete without adequate balance of power between stakeholders involved in energy access—and most specifically "thinkers," "planners," and "doers" (financers may fall within any of these three sections). While this topic remains eminently complex, this paper will emphasize

[45] IEA, IRENA, UNSD, WB, WHO (2019), Tracking SDG 7: The Energy Progress Report 2019, Washington DC

[46] *Ibid*

[47] *Ibid*

the critical role of three organizational levels and the need for sound distribution of powers between local actors, African States, and international stakeholders.

As a corollary, it is argued that the design and implementation of inclusive knowledge and information systems are most likely to play a central role in successful governance arrangements. Adequate energy access strategies and policies should be both designed and implemented through extensive cooperation between stakeholders while acknowledging the central role of empowered African States. Achieving such a mission will require structural transparency in energy access policy-thinking, and policy- making, which may not be achieved without transparent, flexible, and most importantly, *inclusive* arrangements for knowledge creation, validation and sharing among stakeholders.

The need for integrated governance models: Balancing the need for large-scale strategies with local and contextualized solutions

The second objective of national governance arrangements shall be to integrate a wide range of electrification solutions and adequate stakeholders within an overall grand national strategy in order to leverage the most appropriate electrification solution where and when appropriate, according to the specificities of each territory. In other words, this paper argues that integrated governance models should be pursued from both a techno-economic and institutional standpoint.

Most importantly, integrated governance models should coordinate the deployment of the main electrification solutions currently coexisting in a poorly or un-coordinated way. Following the aforementioned review of the current dynamics of the African power sectors, these three main electrification means are the extension of national grids, traditionally undertaken by national electricity utilities; the development of mini-grids, either public or private or a partnership; and the diffusion of (mostly "pay-as-you-go") solar home systems, currently exclusively undertaken by privately-owned companies[48,49].

The concrete form that integrated governance models may take will greatly vary among countries and territories. While some densely populated countries may probably heavily rely on grid extension and mini-grid systems, less densely populated countries may lean towards the large-scale diffusion of PAYG SHS in rural areas and restrict grid-based electrification projects to the most feasible urban and peri-urban

[48] Lepicard et al. (2017), *Reaching Scale in Access to Energy: Lessons from Practitioners*, Hystra, Paris

[49] GOGLA (2017), *Providing Energy Access through Off-Grid Solar: Guidance for Governments*, GOGLA, Utrecht

areas. Global energy access will most likely be pursed through a wide range of country-specific paths: as the uniform application of traditional models forged by Western economies may now reach its limit, new electrification models, built at national scales and taking into account the specific needs and conditions of each territory, will be of critical importance to any attempt to reach universal energy access[50,51]. While each country should have to write its own "history of electrification," this story may actually just be about to begin in most African States.

Integrated governance models should be flexible enough to ensure the simultaneous pursuit of both top-down and bottom-up electrification policies. As a matter of fact, past experiences showed that in- depth techno-economic analyses of local uses of electricity in targeted zones constitute a key success factor in the development of electrification projects and an essential preliminary step before choosing the most appropriate electrification technology and business model. The wide array of system designs now available—off-grid, mini-grid, and on-grid solutions—increases the number of pathways available to attain electricity access[52]. Understanding the different uses of electricity may play a critical role in the design of future economically and financially sustainable electrification programs[53]. Specifically, the economic analysis of rural electrification would not be complete without a careful and joint analysis of the use and services it aims at providing. Conventional grid-based electrification projects, intrinsically cash-intensive and dimensioned for meeting high overall levels of demand, thus proved particularly ill-suited to addressing the diversified demand of African rural areas[54].

Electrification initiatives should thus be designed according to a global approach of energy access integrating in its design the different appliances and types of equipment used of local users. The modeling and anticipation of such differentiated levels of demand will be of first importance in finding the right electric service to offer to rural populations as well as the optimal pricing schemes to adopt in each electrification model.

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[50] Shanker *et al.* (2012), *Accès à l'électricité en Afrique subsaharienne : retours d'expérience et approches innovantes*, Agence Française de Développement, Paris

[51] Debeugny *et al.* (2017), *L'Électrification Complète de l'Afrique est-elle Possible d'ici 2030 ?* Afrique Contemporaine, Agence Française de Développement, Paris

[52] International Energy Agency (IEA) (2017), *World Energy Outlook 2017*, IEA, OECD, Paris

[53] Debeugny *et al.* (2017), *L'Électrification Complète de l'Afrique est-elle Possible d'ici 2030 ?* Afrique Contemporaine, Agence Française de Développement, Paris

[54] Grimm et al., (2016), *Demand for off-grid solar electricity: experimental evidence from Rwanda*, IZA DP No. 10427, IZA, Bonn

From a more institutional perspective, specific attention may be given to the articulation of the specific role given to the public and private sectors within national governance arrangements. Beside the sole inclusion of each type of actor within national governance arrangements, the concrete role and responsibility of each sphere should be assessed and clearly defined. While on the one hand the only implementation of new regulations at the State level would not be sufficient to overcome current obstacles to global energy access, past experiences show on the other hand that a "private sector-only" approach of rural electrification—where privately-owned solar companies would be responsible for reaching all off-grid customers in complete independence of any regulation—would be counterproductive and lead to significant retention of information and knowledge.

The effective articulation of various electrification means by both public and private actors may require the adoption of not only inclusive but also *integrated* knowledge systems—in other words, knowledge systems that do not only consist of sharing critical information among key stakeholders (inclusive) but actively foster feedback loops and interactions between knowledge generation and management as well as among stakeholders (integrated). The flexibility and reactivity of future electrification strategies to changing environments will rely on the ability of future governance arrangements to overcome open-loop knowledge management models. More specifically cooperation and feedback between "thinkers", "planers" and "doers" along the entire electrification value chain are key in the design and implementation of successful energy access strategies.

As a corollary, the development of integrated governance models may raise two institutional challenges. First, the identification of the stakeholder—or consortium of stakeholders—able to effectively spearhead the development of an integrated governance model. Although energy ministries, regulatory bodies, rural electrification agencies, renewable energy development agencies, and national electricity utilities play important roles in electrification initiatives, none of these actors are currently properly equipped nor empowered to plan and organize universal electrification programs at national scale. The second expected challenge is to establish a clear and transparent balance of power between stakeholders involved both in the design and implementation of energy access policy[55], with the objective of ensuring a transparent and fluent exchange of information and knowledge between planners and doers from both the public and private sectors. Addressing these two challenges may prove to be key in the design of structurally integrated governance models.

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[55] Bouille et al. (2002), *Power Politics, Equity and Environment in Electricity Reforms*, World Resource Institute, World Resource Institute, Washington, D.C.

The imperative of financial sustainability: Providing electricity at the fairest price by balancing accessibility and profitability

Financially sustainable and transparent governance models constitute the third key angular stone of successful electrification frameworks. Rural electrification models shall integrate long-term financial schemes ensuring both affordability for rural population and profitability for electricity providers, far beyond the traditional and widespread approach of electricity as a natural and free commodity. While current electricity tariffs largely lean towards the consumer's interests, this paper argues that new governance models should rebalance current financial arrangements in favor of the interest of local utilities.

The aforementioned key lessons derived from past experiences, and most notably the success of the Moroccan General Rural Electrification Plan, show that electricity delivery should be approached and designed as a *commercial* service. Reasoned and long-term financial structuring appears critical in the success of rural electrification initiatives. Financial strategies should obey the double constraint of affordability for local consumers and profitability for electricity providers. Tariffs should thus be set accordingly through specific cost analyses, by considering the different parts of the electricity value chain.

While strong political and social pressures have maintained electricity tariffs at non-cost-reflective levels, usually far below break-even prices of electricity providers, this status of electricity as political variable proved disastrous for most national utilities and deterred private capital from flowing into the energy access market. Successful electrification initiatives in Morocco and recently in Kenya showed the importance of developing cost-reflective electricity tariffs for both on- and off-grid solutions. More specifically, tariffs shall integrate the three different types of cost inherent to electricity complex value chains: those of generation (more or less renewable, on- or off-grid), distribution (through cables and/or batteries), and customer service appliances (electronics and/or electromechanics) depending on the local electrification strategies adopted in each territory.

Rural electrification programs should thus be based on viable financing models for electricity providers. This profitability constraint, naturally considered by privately-owned electricity utilities that do not naturally benefit from public subsidies or debt financing, is much less common among State-owned electricity companies benefiting from large public grants and subject to strong political pressures to extend their power grids. Several levels of profitability could be considered and effectively achieved by electricity companies, irrespective of their capital ownership structure, namely (in increasing order of importance) the (i) *"small equilibrium"* (revenues covering the marginal cost of electricity production, transport and distribution, as well as management costs), (ii) the *operational equilibrium* (revenues covering the previous expenses but also heavy material maintenance and replacement costs), and most importantly, (iii) a *"grand equilibrium"* (integrating all expenses, including investment). In practice, the large investments necessary to provide electricity services to rural populations currently seems out of reach to the vast majority of electricity companies already unable to sustainably manage their current infrastructures, and significant progress should be made to this respect. While meeting the grand equilibrium shall be considered as an absolute prerequisite for any company considering further expanding its operation in rural areas, it is worth pointing that only 70% of African electricity companies managed to achieve an operational equilibrium in 2008[56]. It is argued that no compromise should be made on financial sustainability within States-owned structures and "grand equilibrium" should be actively ensured by public utilities.

In definitive, decision-makers could derive unprecedented benefits from understanding the key reasons underlying past market failures, identifying possible success factors, and anticipating future challenges in energy access. Fifty years of electrification programs showed that global electrification would not be achieved through a wild blend of individual initiatives but rather result from the design of electrification strategies thought at the national scale, leveraging a wide range of technical, financial, and institutional stakeholders and technologies on the basis of extensive preliminary feasibility studies seeking to foster cooperation and synergies among local as well as international actors. In other words, through integrated, inclusive, and financially sustainable governance models well-suited to each African State.

However, past experiences give as many answers for the present as they raise new issues for the future. New opportunities offered by the recent emergence of digital solar business models call into question the traditional institutional and financial frameworks for rural electrification and allow stakeholders to develop a first understanding of the major challenges for the years to come while leaving ample space for the development of country-specific strategies most suited to the social, economic, financial, and political characteristics of each territory.

In practice, current governance models remain far from reaching the above-mentioned objective of integrated, inclusive, and financially sustainable governance arrangements for energy access. The next chapter analyzes more specifically the

[56] EGI (Electricity Governance Initiative) South Africa (2006), *The Governance of Power: Shedding a Light on the Electricity Sector in South Africa*, World Resources Institute and Prayas Energy Group, Washington, D.C.

African experience in concessions and the potential contributions of such approaches to universal energy access.

III. ACCELERATING ENERGY ACCESS: THE POTENTIAL OF NATIONAL UTILITY-SCALE CONCESSION PROGRAMS

While Morocco's experience may not be directly transposed to more complex geographies, the success of the public service delegation strategy adopted by the country may provide an interesting base to rethink traditional public sector-driven approaches to energy access. While Morocco's government managed to provide the adequate expertise and more than half of the funding required to achieve its electrification program, similar skills and investments may be out of reach to most highly-indebted sub-Saharan economies facing similar if not more dauting electrification challenges[57]. Hosier *et al.*[58] identifies more than 200 electricity concessions of varying nature and scope in about 15 Sub-Saharan African countries, from small mini-grids to national utility-scale concessions, while 12 countries attempted to implement concessions and either cancelled existing concessions or abandoned implementation plans.

A common answer is to bridge the financing gap by leveraging the resources of the private sector through so-called "public-private partnerships" (or PPPs). Electricity concessions, constituting one particular form of PPPs at the interface between State-led programs and private sector-driven approaches, have been experienced in various forms—mostly in Sub-Saharan Africa—with more or less success.

While most attempts proved unsuccessful, a few success stories—all pertaining to national utility-scale concessions—yield invaluable feedback on the potential of such models to revive the distribution sector and achieve universal energy access. A detailed analysis of past experiences in concessions shows that while such approaches have already yielded very positive results in restoring financial visibility in previously financially ailing distribution utilities, utility-scale concessions have had limited to no real impact on energy access. However, recent studies show that concessions may also make unprecedented contributions towards energy access provided that electrification becomes fully part of flexible concession agreements prioritizing the financial sustainability of the distribution sector.

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[57] Hosier *et al.* (2017), *Rural Electrification Concessions in Africa: What Does Experience Tell Us?*, World Bank, Washington, D.C.

[58] *Ibid*

Electricity concessions, a promising middle ground between State-owned utility-led approaches and private sector-driven strategies

According to the World Bank, a concession can be defined as "any arrangement in which a firm obtains from the government the right to provide a particular service under conditions of significant market power."[59] While such arrangements "need not involve the private sector, since governments can award concessions to public enterprises," most concessions are usually granted to privately owned firms for the aforementioned reasons.

Concessions have mainly been implemented in two different forms[60] (c.f. **Fig. 1**). In the leasing model (now widely referred to as *affermage concessif* using a French terminology), the private contractor takes responsibility over the exploitation and maintenance of assets as well as bill recovery while the public sector retains ownership over all existing assets and remains responsible for new investments. Under strict concession agreements, the private contractor is responsible for exploiting, maintaining, and expanding its assets according to pre-defined terms, with the obligation to return all assets to the public sector at the end of the concession period.

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[59] Kerf, Michel, R. David Gray, Timothy Irwin, Celine Levesque, Robert R. Taylor, and Michael Klein (1998), *Concessions for Infrastructure: A Guide to Their Design and Award*, World Bank, Washington, D.C.

[60] *Ibid*

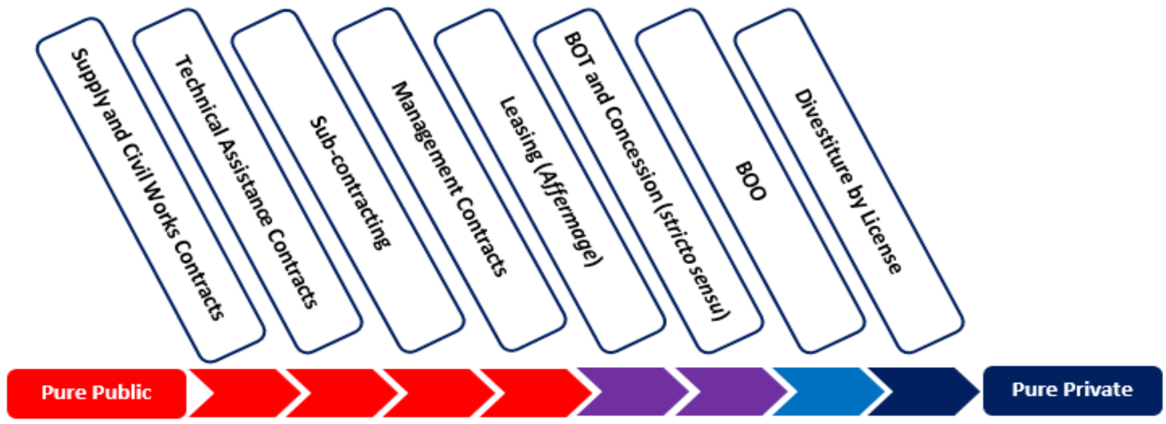

Figure 1[61]. Concession models: A middle ground between pure public and pure private approaches.

Hosler *et al.* classifies rural electrification concessions into four broad categories, namely solar home system concessions, mini-grid concessions, rural zonal concessions, and national utility concessions (c.f. **Table 1**), and provides unprecedented assessment of the success of each concession model.

Table 1. Overview of the four types of rural electrification concessions[62]

Concession type	***Typical Scale (number of connections)***	***Demographic of clientele***	***Power source***	***Electrification technology***
Solar home system concessions	5,000–30,000 systems	Rural	Solar home system	Isolated solar home systems
Mini-grid concessions	100–10,000 customers	Rural	Small integrated generation and distribution networks (in some instances operated as localized distribution utilities selling power from the national grid)	Mini-grids

[61] Hosier *et al.* (2017), *Rural Electrification Concessions in Africa: What Does Experience Tell Us?*, World Bank, Washington, D.C., adapted from Kerf *et al.* (1998)

[62] Adapted from Hosler *et al.* (2017)

Rural zonal concessions	5,000–30,000 to begin, with the intent that they could grow beyond that size	Rural	Various: large, centralized power stations, small isolated generators, or solar home systems	All possible technologies
National utility concessions	100,000 or more	Urban and rural	Large, centralized power stations	All possible technologies

Solar home system concessions: A poorly adapted framework for electrification?

The main purpose of solar home system concessions is to provide fast and flexible electrification solutions to populations hardly reachable by grid extension or mini-grids. In practice, experience has shown that the solar home system (SHS) concessional model, solely implemented in South Africa with very limited results (c.f. **Box 2**), may not show much promise for private sector involvement in future electrification projects[63]. The natural competition in the solar sector as well as the dynamism of fast-growing pay-as-you-go companies currently operating in more than 30 African countries may soon render SHS concession agreements obsolete.

As a matter of fact, while solar home systems are an increasingly viable option for rural electrification across Africa, the SHS concession model could hardly be recommended as a promising option. The level of subsidies required and the difficulty of adapting these subsidies to different SHSs and populations renders the administration of such concessions hard to manage from a public perspective. Government actions should focus on establishing well-designed cross-subsidies systems between different electrification technologies while ensuring that adequate regulatory frameworks are established for independent solar companies to install, maintain, and possibly finance SHS.

The South African SHS Concessions: An outdated concession model?[64]

The SHS concession model has been only implemented in South Africa, with limited impact to date. To reach non-grid areas, the government introduced a system of Solar Home

[63] Hosier *et al.* (2017), *Rural Electrification Concessions in Africa: What Does Experience Tell Us?*, World Bank, Washington, D.C.

[64] Source: Castalia (2015), *Evaluation of Rural Electrification Concessions in sub-Saharan Africa, Detailed Case Study: The South African Solar Home System (SHS) Concessions, Report to the World Bank*, Castalia Advisory Group, Paris.

Concessions in 1999. Following a competitive process, concessions were awarded to six companies with the objective of installing 50,000 in each territorial concession. The concessions conferred a five-year exclusive right to access government subsidies for installation of solar home systems in the concession area. The subsidy was set at 80 percent of the capital cost of each solar home installation. The concessionaire had the responsibility of refinancing the remaining 20 percent of the cost, to install the system, and then to provide maintenance for all systems for 20 years. The concessionaire's revenue would come from monthly fees from the users, with all lower-class users qualifying for monthly government subsidies.

Twenty years after their implementation, prospects for these concessions are bleak. The concession system has so far resulted in the installation of around 100,000 solar home systems, less than a third of the 350,000 systems initially planned, and only around 60,000 are still operational. Only three of the concessions that were set up around 1999 are still operational in the same format as they were at the outset.

These results have led the government to officially abandon the concession model and opt instead for more flexible approaches whereby the public sector contracts with private providers for installations and hands over maintenance to user cooperatives. Such models, adapted to large-scale solar systems, may prove hardly replicable in geographies covered by competitive and fast-growing PAYG solar companies integrating financial, operational, and technical functions within a single company.

A number of reasons can be traced to the disappointing performance of the South African concession model. First, a lack of initial planning from the public sector side. Contracts had not been designed at the time the tender was advertised and the start of operations were delayed, leading to a major scaling back of the original deployment plans. Second, the competition from the grid and unwillingness of local populations to pay for what they perceived as a permanent alternative to the main grid. Lastly, the lack of regulatory preparedness. Few areas were approved for subsidized installations each year, thereby affecting the very viability of the concessionaires' business model.

Other major problems include difficulties in bill recovery, in getting municipalities to pay the monthly subsidies to local populations on time, and the extension of the grid into areas which had been thought as "unreachable areas dedicated to SHS."

Mini-grid concessions: A high potential despite limited results to date

A mini-grid concession aims at providing service to settlements where demand is limited and the costs of extending the national grid to the area either are prohibitively high or cannot be financed in a timely manner. Most mini-grids remain small and operate in remote areas, where they generate and distribute power for sale to local consumers.

Mini-grids have been developed in many low-access countries by independent entities under a "laissez-faire model" (i.e., private initiative, no territorial concession, direct negotiation between developer and community on tariffs, licensing exempted under a certain capacity). This is not the subject of this section, which focuses on two kinds of concessions: bottom-up (where governments and rural electrification agencies call for proposals to electrify unspecified areas at a certain service standard) and top-down (where those governments and agencies pre-define the concession areas and invite proposals under prescribed conditions).

The development of most mini-grid concessions has long followed an informal, or "bottom-up" model[65]. Once adequate frameworks and subsidy models have been established by public agencies—most of the time by a consortium of Ministries and the local electrification agency or fund, local projects are proposed, evaluated, and approved by public authorities. Interestingly, no national plans mention targeted areas as areas of specific interest for mini-grids and feasibility studies have exclusively remained at the charge of the local communities—or any form of local contractor.

Tenenbaum *et al.*[66] has shown that while few African countries actively encouraged private mini-grids, adequate regulatory frameworks were still absent at the time, creating significant confusion and uncertainty, especially with regard to subsidy regimes and the regime of connection to the grid. More recently, several countries have introduced dedicated policies and regulations to address key issues related to mini-grid development, including licensing, tariff setting, main grid arrival and financial support. Their effectiveness has been limited, but efforts are being made and continue in countries like Nigeria.[67]

Despite the proclaimed objective of several African countries to actively support mini-grid concessions, adequate regulations and institutional frameworks remain elusive. An average 4-6 years elapsed between the development of national laws for mini-grid

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[65] Hosier *et al.* (2017), *Rural Electrification Concessions in Africa: What Does Experience Tell Us?*, World Bank, Washington, D.C.

[66] Tenenbaum, Bernard, Chris Greacen, Tilak Siyambalapitiya, and James Knuckles (2014), *From the Bottom Up: How Small power Producers ad Mini-Grids Can Deliver Electrification and Renewable Energy in Africa.* World Bank, Washington, D.C.

[67] https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Oct/IRENA_mini-grid_policies_2018.pdf

concessions and the award of the first concessions in Mali, Uganda, and Madagascar[68,69,70].

In practice, these small-scale mini-grid concessions have proven successful in attracting *local* private capital and skills. Most projects entailed private funding accounting for 10 to 60% of the total investment costs (c.f. **Table 2**).

Table 2. Overview of the financial status of existing mini-grid concessions in Sub-Saharan Africa[71]

Country	***Private investment in concession***	***Public investment in concession***	***Financial sustainability of concession***
Burkina Faso	—	—	Coopels are unlikely to meet long-run marginal costs of operation (?)
Guinea	$0.4 million	$1.737 million	No evidence available on financial sustainability of concessions (?)
Madagascar	$5.95 million	$13 million	When government stopped subsidizing diesel, 17 of 47 mini-grids closed down. Long-term term financial viability unclear (?)
Mali	$13 million	$39 million	Ability of concessions to cover long-run marginal costs and achieve full sustainability not yet clear.
Senegal	—	—	ERIL mini-grids were meant to be bottom-up mini-grids largely funded by development partners. Insufficient evidence available on financial sustainability.
Uganda	$12.3 million	Initial grant of $14.75 million from REA using World Bank funds	After initial financial difficulties, tariff rise and restructuring, WENRECo appears on target to achieve 15 percent return on equity. Insufficient information to judge the situation of three of the five concessionaires.

Mini-grid concessions have demonstrated very positive local impact despite their limited geographic scope. Most importantly, field studies in the countries mentioned in **Table 2** have shown a dramatic involvement of local entrepreneurs and communities in the financing, installation, and maintenance of installations, unleashing local businesses and productive businesses best suited to local contexts. The decentralized

[68] Castalia (2015), *Evaluation of Rural Electrification Concessions in sub-Saharan Africa, Detailed Case Study: Madagascar, Report to the World Bank*, Castalia Advisory Group, Paris.

[69] Castalia (2015), *Evaluation of Rural Electrification Concessions in sub-Saharan Africa, Detailed Case Study: Uganda, Report to the World Bank*, Castalia Advisory Group, Paris.

[70] Castalia (2015), *Evaluation of Rural Electrification Concessions in sub-Saharan Africa, Detailed Case Study: Mali, Report to the World Bank*, Castalia Advisory Group, Paris.

[71] Adapted from Adapted from Hosler *et al.* (2017)

nature of mini-grids has proved well suited to local entrepreneurship and the involvement of communities[72].

Several key challenges now hamper the large-scale development of mini-grids. In terms of financial viability, mini-grid concessions have demonstrated mixed results to date. Past experiences show that while most concessionaire usually raise adequate equity and debt to establish mini-grids and manage to recover their operation, current bottom-up models have limited the financial viability of these projects and their ability to maintain and expand their asset base[73]. First, the small size of most mini-grids prevents concessionaires from benefiting from economies of scale (c.f. **Table 3**). Second, the bottom-up nature of mini-grid projects limits the ability of concessionaires to negotiate adequate cost-reflective tariffs and well-targeted subsidy schemes. Lastly, local populations are often unwilling to pay higher prices compared to grid-based services. In Mali, for example, most mini-grids located within a close distance from the grid had to be purchased by the national utility and charge grid tariffs in order to avoid local unrests[74].

From a planning perspective, current bottom-up models suffer from the lack of coordination with larger-scale electrification projects and a structural inability to tap international funding sources. Most importantly, mini-grids are developed independently from each other on an individual basis following local requests[75,76]. In the absence of detailed pre-feasibility studies, common management and ownership, and large-scale integrated planning—for example, through geospatial planning tools—mini-grids are unlikely to benefit from economies of scale and adequate subsidy schemes. Mini-grids also generally develop without grid connection clauses, thereby threatening the viability of the projects while the grid arrives. What is more, the local nature of mini-grids usually prevents developers from directly taping into international equity and debt financing, being limited to public funding through Ministries or eventual rural electrification agencies or funds (if any)[77].

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[72] Hosier *et al.* (2017), *Rural Electrification Concessions in Africa: What Does Experience Tell Us?*, World Bank, Washington, D.C.

[73] Castalia (2015), *Evaluation of Rural Electrification Concessions in sub-Saharan Africa, Detailed Case Study: Mali, Report to the World Bank*, Castalia Advisory Group, Paris.

[74] *Ibid*

[75] *Ibid*

[76] Castalia (2015), *Evaluation of Rural Electrification Concessions in sub-Saharan Africa, Detailed Case Study: Madagascar, Report to the World Bank*, Castalia Advisory Group, Paris.

[77] Hosier *et al.* (2017), *Rural Electrification Concessions in Africa: What Does Experience Tell Us?*, World Bank, Washington, D.C.

Despite these obstacles, the positive impact of mini-grids warrants focused attention to supporting their deployment in areas that are likely to remain unserved by the grid in the short or medium term. This entails improving access to international funding and private capital, developing well-targeted customer cross-subsidization schemes within the mini-grids, ensuring cost-recovery for developers and operators for long-term sustainability of supply via adequate subsidies, adopting transparent licensing, permitting and grid arrival clauses, and encouraging shared management and ownership.

Table 3. Overview of existing mini-grid concessions in Sub-Saharan countries[78]

Country	*Mini-grid program name*	*First year of operation*	*Number of mini-grid concessionaires and mini-grids in operation*	*Total number of connections*	*Average number of connections per mini-grid*
Burkina Faso	Cooperatives d'electricite (Coopels)	2003	Concessionaires = 92 Mini-grids = 92	14,250	155
Guinea	Decentralized Rural Electrification (PERD) Project	2006	Concessionaires = 26 Mini-grids = 26	8,248	317
Madagascar	Mini-grid concessions	2005	Concessionaires= 30 Mini-grids = 30	7,100	237
Mali	Projets de Candidatures Spontanées d l'énergie Domestique et de l'Electrification Rurale (PCASER)	2003	Concessionaires = 68 Mini-grids = 250	78,000	312
Senegal	Projets d'Electrification Rurale d'Initiative Locale (ERIL)	2003	Concessionaries = 4 Mini-grids = 4	500	125
Uganda	West Nile Rural Electrification Project	2003	Concessionaire = 1 Mini-grids = 1	6,800	6,800
	Small grid extension concessions	2006	Concessionaire=5 Mini-grids = 5	31,600	6,320

[78] Adapted from Hosler *et al.* (2017)

Territorial electrification concessions: An unsuccessful experience, but key lessons to be learned

The territorial concession model has been implemented in Senegal as of the early 2000's in the aftermath of the much-celebrated Moroccan national electrification program PERG (*Plan d'Electrification Rurale Global* in French). In contrast to the State-owned utility-driven model adopted by Morocco, Senegal opted for a zonal concession approach granting rights to provide electrical services to external companies within preliminarily agreed-upon delimitated areas. While this program may have yielded very limited results, key lessons pertaining to the structuring of concessions and the potential of zonal and national-scale concessions could be drawn from the Senegalese experience.

The Senegalese experience in territorial concessions: Coordination with local utilities is key[79]

The key objective of the concession program was to leverage private sector resources to electrify areas identified by the electrification agency ASER as poorly or not deserved by the national utility SENELEC. After the initial identification of the target zones in 2003, calls for bids were launched as of 2004 and the first concessions were awarded in 2008 and became operational in 2011, almost a decade after the launch of the program. Out of the original 10 zones, six were still operational as of 2015 and three had already started connection programs. Senegalese companies were prevented from biding and all concessions were awarded to foreign utilities (Morocco's ONEE, Tunisia's STEG, or France's EDF) or producers of renewable energy equipment (such as ENCO/Isofoton).

Concessions were designed to be technology-neutral and to comprise 10,000 to 30,000 in order to guarantee minimum economies of scale to contractors. Contractors were free to use any electrification strategy to follow pre-determined connection and service quality targets. Concessionaires had the obligation of charging cost-reflective tariffs based on their own costs of operation and maintenance for *each* technology deployed and special offtake prices were negotiated in order to purchase electricity

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[79] Sources:

Hosier *et al.* (2017), *Rural Electrification Concessions in Africa: What Does Experience Tell Us?*, World Bank, Washington, D.C.

Castalia (2015), *Evaluation of Rural Electrification Concessions in sub-Saharan Africa, Detailed Case Study: Senegal, Report to the World Bank*, Castalia Advisory Group, Paris.

Shanker *et al.* (2012), *Accès à l'électricité en Afrique subsaharienne: Retours d'expérience et approches innovantes*, Agence Française de Développement, Paris from SENELEC whenever electrification would be grid-based. Subsidies would only be allocated for initial investment, while operation and maintenance costs had to be entirely covered by the tariffs negotiated with the regulator. The specifics of the Senegalese concession program are detailed in **Table 4**.

Table 4. Overview of the territorial concession model adopted in Senegal since 2003[80,81]

What is concessioned?	*25-year rights to provide electrical service within a defined area.*
General obligations on the concessionaire	Design and build the installations, maintain and renew the equipment. Perform electrical installation for new customers. Provide services for at least six hours per day (7 pm–1 am). Recover tariffs from users and be responsible for the operation of its assets.
Specific obligations related to electrification	Concessions are awarded on the basis of the number of households that the private parties propose to electrify in the first three years of the concession. The winning bidders have contractual obligations of between 7,500 and 27,000 connections each.
Main sources of finance for investment	The government provides significant up-front funding of capital costs. In Senegal, the share of private financing ranges from 22 to 68 percent of the total financing.
How costs are recovered	Concessionaires must recover their investment costs and the costs of ongoing operations and maintenance through their tariffs.
How tariffs are set	A tariff system is agreed with the regulator (CRSE). For small residential subscribers, the tariff is fixed depending on the number of lighting and power outlet points. For subscribers who require more power, billing is done according to measured consumption.
Type and extent of subsidy	The concessionaires receive a subsidy from the rural electrification agency (ASER) for a portion of their initial investment cost. They do not receive a subsidy of their ongoing operation and maintenance costs.
How the concessions are awarded	The concession contract is awarded following an international tender. The winner is the operator that proposes to connect the largest number of households during the concession's first three years, in return for a pre-determined output-based subsidy.
Why Senegal chose this model	Senegal has attempted several times to increase private sector participation in electricity so as to reduce the burden on the state of subsidizing the operations of the national utility, SENELEC.

In practice, the lack of preliminary planning and the reluctance of SENELEC to provide electricity to concessionaires dramatically reduced the scope and viability of the

[80] From Hosler *et al.* (2017)

[81] Shanker *et al.* (2012), *Accès à l'électricité en Afrique subsaharienne: Retours d'expérience et approches innovantes*, Agence Française de Développement, Paris

program. The preparation stage lasted for almost a decade and concessionaires struggled to determine minimum-cost strategies within their areas of operation. Tariffs were solely based on the technology used in a given household, preventing cross-subsidization schemes between urban and rural areas. What is more, SENELEC engaged reluctantly into the concession program and refused to sign offtake agreements, thereby limiting the ability of concessionaires to pursue grid extension programs.

While successful in attracting private capital, the zonal concession program failed short of its electrification targets (c.f. **Table 5**). Unable to purchase electricity from the grid, facing limited economies of scale in remote rural areas, and given the limited viability of mini-grids at the time, concessionaires realized nearly 60% of their connections through solar home systems.

Table 5. Status of currently operating territorial concessions in Senegal as of 2015[82,83]

Name	*Targeted number of connections*	*Actual number of connections*	*Total value of concession investment ($ million)*	*Private share of investment costs (percent)*
Dagana-Podor-St. Louis (COMASEL-ONEE)	19,574	2,367	18.36	67.8
Kaffrine-Tamba-Kedougou (ERA-EDF)	18,001	1,194	13.46	36.2
Louga-Linguere-Kebemer (COMASEL-ONEE)	11,826	165	15.64	22.5

A decade after inception, the Senegalese territorial concession program yields important lessons pertaining to the design and implementation of large-scale and technology-neutral concessional in challenging environments. First, that cooperation between concessionaires and local utilities is key. SENELEC proved unwilling to coordinate with contractors while extending its assets and did not sign off-take agreements to provide concessionaires with electricity, rendering grid extension-

[82] Adapted from Hosler *et al.* (2017)

[83] Castalia (2015), *Evaluation of Rural Electrification Concessions in sub-Saharan Africa, Detailed Case Study: Senegal, Report to the World Bank*, Castalia Advisory Group, Paris.

based projects unfeasible in most regions. Second, implementing large-scale concessions takes time and requires extensive experience from an institutional, financial, and technical perspective. Senegal was first in developing territorial concessions and the connections took place nearly ten years after the inception of the program. Third, sustained political support is key in ensuring the design and implementation of concessions that run much beyond the typical 5-year political horizon. In Senegal, political connections between regulators, electrification agencies, and SENELEC limited the leverage of international companies in negotiating favorable agreements.

The experience of Senegal in territorial concessions is mixed but yield important lessons that could pave the way for successful zonal concessions in the future, provided that adequate institutional, planning, and regulatory measures are taken. The critical condition of local utilities, the recent development of fast-growing solar technologies, and the advent of GIS-based technologies may now allow countries to further explore the potential of territorial concessions.

Utility-scale electrification concessions: A successful model yet to be opened to energy access

Four national utility-scale concession programs have been implemented in Sub-Sahara and were still in operation in 2015 in Cameroon (ENEO), Côte-d'Ivoire (CIE), Gabon (SEEG), and Uganda (Umeme). All four were implemented with the idea of relieving the public sector from the burden of inefficient State-owned electricity utilities and to draw on private resources to revive ailing distribution sectors by improving sector performance and ensuring financial viability (c.f. **Table 6**). ENEO, CIE, and SEEG are all vertically-integrated utilities with substantial public ownership while Umeme is exclusively involved in the distribution sector. While the overall experience proved positive with regard to the revitalization of previously financially unsustainable utilities, none of these concessions was implemented to accelerate energy access, and their impact on electrification might be limited to date[84]. However, the resilience and flexibility of the utility concession model leaves ample room for adjustments and integrates energy access into well-designed concession agreements without compromising on financial sustainability.

Interestingly, Hosler *et al.* record that nine other sub-Saharan countries have attempted – unsuccessfully – to implement utility concession programs and still have not abandoned the idea, what confirms the difficulty of implementing efficient and

[84] Hosler *et al.* (2017), *Rural Electrification Concessions in Africa: What Does Experience Tell Us?*, World Bank, Washington, D.C.

financially sustainable concessions. Most of these experiences remain undocumented. However, the limited amount of information available shows that most of these attempts failed at the inception stage during negotiations over tariff increases and the implementation of cost-reflective tariffs along with targeted subsidies.

Table 4. Overview of the typical structure of national utility concessions[85]

What is concessioned?	The right to operate an existing distribution grid to sell power to customers, collect revenue from customers, and extend the grid within the service area.
General obligations on the concessionaire	Providing electricity that meets specified power quality, reliability, and customer service standards. Maintaining assets and hand them back in good condition at the end of the concession. Employ staff of the state-owned utility.
Specific obligations related to electrification	Connecting everyone within a pre-defined distance from the grid There are often additional obligations related to extending the grid. These may be to connect a specified number of people in the service area (e.g., in Gabon) or to take over and operate grid extensions financed and built by a rural electrification program (e.g., in Cameroon).
Main sources of finance for investment	Predominantly privately financed. The owners invest equity in the concessionaire, which is usually a special purpose vehicle. The concessionaire (that is, a company set up specifically to operate the concession) also brings in commercial finance in the form of long-term debt, both from commercial banks and international finance intermediaries, such as the International Finance Corporation (IFC) or KfW.
How costs are recovered	Operating and maintenance costs, the cost of purchased power, and a return on capital invested are usually recovered fully through the tariff, with notable exceptions.
How tariffs are set	The concession contract establishes a tariff regime and allows for periodic revisions. Public entities involved in the determination of this tariff regime have limited discretionary power and disagreements about the tariff can usually be appealed to international arbitration.
Type and extent of subsidy	Cross subsidies toward low-use residential consumers are common. Direct output-based payments from government to cover the costs of new connections for poor households are sometimes provided. Government may build lines into new areas and hand them over to the concessionaire for operation and in-fill electrification or densification. In some cases, governments absorb part of the cost of purchased energy or fuel costs in order to reduce tariffs for all customers.
How the concessions are awarded	Through international competitive bidding.
Why governments have chosen this model	The main motivation has been to solve finance and service problems with a state-owned utility. Often this has occurred when losses at the utility level have contributed to an unsustainable fiscal position due to periodic bailouts.

[85] Adapted from Hosler *et al.* (2017)

Overview of currently operating utility concessions

Overall, all four concessions led to significant improvements in service quality and financial condition of the national power utilities. In the absence of any well-structured clauses pertaining to universal electrification, the impact of these concessions on energy access remains unclear—if any.

In **Cameroon,** the utility concession was awarded to the privately-owned consortium AES SONEL (ENEO since 2014) for 20 years in 2001[86]. The privatization of the Cameroonian power sector under a utility concession model has led to the revitalization of the distribution segment. Annual performance targets pertaining to operational efficiency, reduction of losses, and network extension have been met while the financial viability of the company has been consistently maintained over the past two decades[87]. Maintaining the concession in operation has required significant public involvement. ENEO's viability, guaranteed by cost-reflected tariffs that remain one of the highest in Sub-Saharan Africa, is further safeguarded by increasing public subsidies aiming at filling the gap between frozen electricity tariffs and rising operational costs[88]. Significant tension has emerged over tariff negotiation and the concession agreement was renegotiated three times in 2006, 2011, and 2015 at ENEO's request in order to update electricity tariffs and subsidy schemes[89].

Cameroon's approach to energy access has been singular. While the concession contract originally set mandatory annual connection targets—leading ENEO to focus on urban and peri-urban connections, regional energy access targets were later defined. In order to avoid affecting ENEO's financial viability, grid extension is financed by the rural electrification agency (*AER* in Cameroon) and assets are later returned to ENEO, which can then densify connections before AER proceeds to new extensions. The development of mini-grid concessions remains embryonic as high tariffs have remained politically unacceptable for the local regulatory agency to date[90].

Regarding **Côte d'Ivoire**, the concession was awarded to CIE (or *Compagnie Ivoirienne d'Electricité*) to operate the assets of the vertically integrated power utility

[86] Castalia (2015), *Evaluation of Rural Electrification Concessions in sub-Saharan Africa, Detailed Case Study: ENEO Concession Cameroon, Report to the World Bank*, Castalia Advisory Group, Paris.

[87] *Rapports annuels* (2013 to 2017), ENEO, Douala

[88] Castalia (2015), *Evaluation of Rural Electrification Concessions in sub-Saharan Africa, Detailed Case Study: ENEO Concession Cameroon, Report to the World Bank*, Castalia Advisory Group, Paris.

[89] *Ibid*

[90] *Ibid*

for 15 years in 1990 and renewed for another 15 years in 2005[91]. As in Cameroon, energy access projects remain almost exclusively financed through public projects, thereby allowing CIE to focus on the operation, maintenance, and upgrade of its current asserts and safeguarding CIE's long-term financial stability[92].

As for **Gabon**, the concession contract was awarded to SEEG (or *Société d'Energie et d'Eau du Gabon)* for 20 years in 1997. A decade of preparation of the institutional, financial, and operational aspects of the concession agreement have allowed the country to operate on a single contract without major revision for nearly 20 years[93]. SEEG's financial sustainability is ensured by the company's ability to charge annual revised tariffs in most regions and to benefit from public subsidies for "social customers"—for which tariff increases are capped at 1%[94].

SEEG's electrification mandate is confined to its concession perimeter, which extends within 400 meters of the existing grid—a limited commitment that contributed to the good financial state of the utility[95]. Long-term investments in grid extension whose payback period exceeds the duration of the concession are the responsibility of the public sector, which then returns assets to the national utility and reassesses the new extension of the concession perimeter. This strategy has allowed the national utility to connect 98% of customers in urban areas where densification of the existing grid within the concession area is cheapest and to increase the overall electrification rate from 74% to 89% between 2000 and 2012, against a mere 45% access rate in rural areas. The remaining 3,000 villages unserved by the grid are considered as outside of the utility's perimeter of action.

Uganda's concession was awarded to Umeme Limited—a Special Purpose Vehicle spearheaded by Eskom, Globeleq, and Actis—for 20 years in 2004 with the support of the World Bank and the Multilateral Investment Guarantee Agency[96]. Umeme accounts for 95% of the country's distribution network, while small-size grid and mini-

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[91] Castalia (2015), *Evaluation of Rural Electrification Concessions in sub-Saharan Africa, Detailed Case Study: ENEO Concession Cameroon, Report to the World Bank*, Castalia Advisory Group, Paris.

[92] Hosler *et al.* (2017), *Rural Electrification Concessions in Africa: What Does Experience Tell Us?*, World Bank, Washington, D.C.

[93] International Finance Corporation (2010), *Gabon: Société d'Energie et d'Eau*, Public-Private Partnership Stories, IFC, Washington, D.C.

[94] Tremolet, Sophie (2002), *Multi-Utilities and Access*, Public Policy for the Private Sector, World Bank, Washington, D.C.

[95] World Bank (2015), *Gabon: Access to Basic Services in Rural Areas and Capacity Building Project*, World Bank, Washington, D.C.

[96] Hosler *et al.* (2017), *Rural Electrification Concessions in Africa: What Does Experience Tell Us?*, World Bank, Washington, D.C.

grid concessions account for the remaining 37,000 customers[97]. Uganda's case differs from the previous three in the sense that the national utility operates in a fully unbundled power sector and in a common law country (as opposed to French law in Cameroon, Cote d'Ivoire, and Gabon).

The main objective of the concession was to relieve public finances by revitalizing of the distribution sector through loss reduction and increased bill recovery rates. Umeme's case is traditionally considered as one of the most successful concession experiences in Sub-Saharan Africa with regard to the transformation of an ailing State-owned utility into a profitable business able to meet service stringent quality requirements. According to Hosler *et al* [96], system losses fell from 38% in 2005 to 21% in 2014 and bill collection rates increased from 80% to 99.1% over the same period. However, this success may—as in previous cases—stem from the absence of cash-intensive rural electrification requirements in the concession agreement.

Umeme's responsibility in energy access is limited to its concession zone, which extends within 1km of the existing grid[98]. The extension of current lines to rural areas has suffered from competitive projects and limits the potential for large-scale electrification projects. As a matter of fact, the extension of the grid into rural areas is currently financed by public entities—mainly the Ugandan rural electrification agency—and assets are later transferred to local concessionaires, sometimes operating within Umeme's operation zone[99]. While public investments are later transferred to the national utility in Cameroon and Côte d'Ivoire, the fragmenting of the distribution sector resulting from public sector financed grid extension leads to significant duplication of efforts and may limit the potential for economies of scale.

Uganda's electrification rate thus follows a slow but steady upward trend, up from 9% in 2000 to 14% in 2016[100]. Around a third of Umeme's new connections have been made in rural areas[101].

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[97] Castalia (2015), *Evaluation of Rural Electrification Concessions in sub-Saharan Africa, Detailed Case Study: Uganda, Report to the World bank*, Castalia Advisory Group, Paris.

[98] *Ibid*

[99] Hosler *et al.* (2017), *Rural Electrification Concessions in Africa: What Does Experience Tell Us?*, World Bank, Washington, D.C.

[100] *Ibid*

[101] World Bank World Development Indicators (accessed on July 5th 2019)

The next frontier: Integrating energy access into financially sustainable utility-scale concession agreements

While the four national utility-scale concession programs have proved successful in restructuring distribution utilities from periodically bailed out companies to financially sustainable structures able to meet stringent service quality targets, energy access has remained out of scope of all concession agreements and has experienced limited progress. However, past experiences show that concessionaires in Cameroon, Cote d'Ivoire, Gabon, and Uganda have proved willing to cooperate with national governmental energy access projects, provided that adequate supporting frameworks were implemented. A set of key lessons[102] could be derived from their experience and prove helpful in the design of future concessions best able to achieve *meaningful* universal electrification—i.e., energy access and high quality of service in an entire country.

First of all, utility-scale concessions were not designed to address the challenge of energy access but may prove resilient and flexible enough to accommodate universal electrification requirements. The experience of the four aforementioned countries shows that utilities were both willing and able to expand their concession area and engage into *well-targeted* electrification programs *within their area of action* provided that adequate guarantees, subsidies, and flexibility regarding the mode of electrification (through grid extension, mini-grids, or SHS) were granted. The adequacy and extent of this supportive environment then determines the scope and speed of electrification.

Second, proactive political support plays a key role in the design and implementation of resilient concessions. Such support will prove all the more important if energy access becomes part of concession agreements and fosters further institutional, financial, and operational cooperation between public and private stakeholders. The major advantage of national utilities over smaller-scale concessions is their negotiation power over public institutions and ability to set up more favorable conditions best able to support financially sustainable frameworks for action.

Lastly, a major challenge for the next decades will be to integrate a universal energy access mandate to concessions agreements without compromising on the financial health and increased performance of the concessionaire (and of macroeconomic stability and controlled indebtedness for the public sector). Energy access targets should be defined in a holistic manner entailing both connections and quality of service. Electrification should then be pursued concurrently

[102] As determined by Hosler *et al.* (2017)

with pre-defined profitability requirements and minimal financial sustainability levels. New blended finance models will be needed in order to provide concessionaires and public agencies with the right types and amounts of grants, debt, and equity best able to support cash-intensive electrification programs on the basis of pre-agreed electrification clauses attached to the concession agreements.

National utility concessions have the potential to bring unprecedented disruption to the distribution sector by both reviving ailing distribution companies and empowering power companies to face the daunting challenges of universal energy access—provided that performance and financial sustainability objectives are safeguarded. While most electrification efforts have historically focused on the limited concession zone surrounding the existing grid, national utility-scale concessions have the geographic scope and resilience to engage into large-scale electrification programs best able to leverage all possible electrification technologies and modern planning methods under both bottom-up and top-down approaches.

IV. A NEW APPROACH OF UTILITY-SCALE CONCESSIONS: TOWARDS INTEGRATED DISTRIBUTION FRAMEWORKS

A conjunction of technical, operational, and financial innovations and the rich experience derived from nearly fifty years of electrification attempts may now provide the academic community and practitioners with unprecedented insights into possible business models best able to further push the frontiers of electrification and achieve universal energy access by the earliest possible deadline. Past chapters have shown that idiosyncratic models may now be needed in order to achieve such challenges, and that utility-scale concessions may constitute a sound basis upon which to build sound governance arrangements for energy access.

This paper argues that a new generation of business models, that could be best described as “Integrated Distribution Frameworks,” informed by recent innovations and designed in the light of half a century of electrification attempts in Africa, Latin America, and Asia, could make significant contribution towards universal energy access. The Integrated Distribution is built upon three key objectives: (i) providing guidance for integrating energy access into financially sustainable national utility concessions, (ii) fostering the emergence of a supportive environment best able to support the design and implementation of these concessions, and (iii) accelerating the overall pace of electrification in order to meet SDG7. The following insights can help us to define the contours of integrated distribution frameworks (thereafter IDF):

1. **Explicit universal electrification mandates**: Inclusive and quality electrification is unlikely to be achieved without an explicit electrification mandate and responsibility for providing universal energy access should fall on

clearly defined stakeholders. One possibility would be to give this responsibility to an entity utility operating under a regional or national concession;

2. **Integrated and coordinated planning**: Careful preliminary planning leveraging all possible electrification strategies—i.e., grid extension, mini-grids, and solar home systems—play a decisive role in successful electrification programs. Energy access strategies would benefit from being developed from a holistic manner at the national level, leveraging all possible electrification techniques in a timely and coordinated manner;
3. **Long-term vision:** Electrical supply must be permanent in time, meaning indefinitely available. This indispensable component of sustainability requires an institution in charge, with a long-term vision and commitment. This paper characterizes this structure as "utility-like," meaning a similar level of service commitment as traditional utilities, even if a different business format is adopted.
4. **Harnessing private resources**: To exit the vicious circle where they are trapped, incumbent distribution—whether they are privately or publicly owned—may need to partner with privately owned structures best able to provide capital, advanced technologies, and sound management practices so that reliable service, loss reduction, and a new consumer engagement approach can be achieved in a timely manner.

Outlining integrated concession arrangements

These four imperatives should guide the development of future concession-based electrification programs. While many other options could be considered along a continuum of possible governance arrangements, from purely public to purely private and from top-down to bottom-up approaches, the following guidelines may prove helpful in designing and implementing successful utility-scale concessions.

The Integrated Distribution Framework defines the distribution activity as a territorial concession, i.e., a company with a comprehensive obligation of electricity supply in the assigned territory by any possible means. The company operates under clearly defined responsibilities and a default obligation for off-grid supply using the least-cost delivery modes with a predefined minimum level of performance in its areas of operation.

Necessary managerial, operational, and financial changes could be achieved through the partnership between all capable publicly- or privately-owned local utilities, mini-grid developers, and solar companies under a *single* long-term (e.g. 15 to 25 years) concession agreement.

Consumer engagement is a critical component of any successful distribution policy. New distribution strategies shall aim at a change of public perception and customer mindset towards the electricity supplier. A satisfactory quality of service is a necessary condition for any attempt to introduce cost-reflective tariffs and address unpaid bills and illegal connections.

Policymakers should acknowledge the central role of well-targeted and transparent subsidies in *any* sustainable distribution model and universal energy access strategy. The total amount of subsidies required to ensure the viability of the distribution sector could be lowered through: planning to find the least-cost mode of electrification; consumer satisfaction and advance metering allowing for a drastic reduction of illegal connections and unpaid bills; tariff cross-subsidization of lower-income households by high-consumption residential, commercial, and industrial (C&I) customers; and the creation of activities around electricity access to stimulate residential and commercial demand.

In practice, a critical question will remain: is this approach *bankable*? Distribution companies operating under stringent energy access targets need subsidies to be viable. In other words, distribution companies cannot cover their costs solely via collected tariffs unless a subsidy is provided in some form, whether paid directly to the end consumers or as a lump sum paid directly to the distribution company. Determining concrete institutions best able to cover market and country risks remains key. Furthermore, guarantee mechanisms should respect the limited capability of local States to incur any additional sovereign liabilities.

The ability of any existing utility to engage into advanced technical and financial partnerships with other structures will depend on the specific context of every country. In some countries the public has a negative perception of private sector participation in electricity supply. The specific format of any external financial participation will be very country dependent, as this format will have to comply with existing policies regarding privatization or private involvement in economic activities and in the power sector in particular. Second, the need for medium- to long-term regulatory reforms may act as a potential barrier to the timely implementation of this “utility-like” approach. Depending on the specific legal framework, these policy and regulatory reforms may take a significant amount of time. Making possible the efficient complementarity of off- and on-grid solutions would be a first step and could be adopted relatively quickly.

Finally, we reiterate that the entire distribution business model will not be viable until a satisfactory solution is available for covering any existing viability gap.[103]

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[103] A cost-reflective revenue requirement is key to the financial viability of a distribution company. If tariffs are not cost-reflective, it is necessary to establish priority in the order of payments to different

At the end of the day, it seems important to emphasize that this "utility-like" approach has the versatility to be adapted to the diverse circumstances of the many developing countries that face access challenges, with modifications suited to different power-sector structures and regulatory regimes.

The central role of off-grid solutions in accelerating electrification

This distribution framework approaches the distribution challenge and electrification technologies—i.e., grid extension, mini-grids, and SHS—in an integrated and coordinated manner. All three solutions have been developed in a largely uncoordinated manner with different entities involved, leading to competition rather than complementarities. Holistic electrification planning can identify the solutions that are a best fit for different unelectrified rural communities and harness synergies between various technologies and business models.

It further promotes a dynamic, rather than static, vision of energy access. In a dynamic electrification process, robust regulations need to be in place that address sustainability aspects of off-grid solutions (e.g., quality standards for standalone solar systems, regulatory interventions in mini-grid tariffs) and deal with the implications of main-grid arrival, especially for mini-grids. Electrification plans, no matter how comprehensive, are susceptible to changes in the political landscape and availability of financing, and in some cases, are not published for fear of provoking backlash from communities. In this context, different regulatory approaches are needed to address the investment risk associated with untimely main-grid arrival.

When the grid reaches mini-grid sites before concessions have expired or generally before assets have been amortized, the mini-grid could be integrated within the grid or its owner must be compensated. Mechanisms for both must be put in place ahead of time to minimize risk and allow proper planning (financial and otherwise) for mini-grid development

In conclusion, off-grid solutions have the potential to play a critical—if not central—role in future electrification processes provided that key conditions are met. Concessionaires should make use of integrated planning programmes, such as geoplanning modeling tools; clearly defined institutional bodies should be responsible for the design, implementation, and monitoring of the plan; and dedicated policies and regulations should set up national concession programs, transparent cost-reflective

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activities and to decide how to cover the "viability gap," which most frequently is assigned to the distribution activity, since its remuneration is traditionally regulated and, in most developing countries, the distribution company is publicly owned.

tariff frameworks along with cross-subsidization subsidy schemes, and lastly, address the investment risks faced by mini-grids due to the potential for main-grid arrival.

This paper aimed at demonstrating the inadequacy between governance arrangements in energy access and today's objective of universal energy access and at highlighting the possible prospects for change under well-designed utility concession programs.

Fifty years of electrification attempts in Sub-Saharan Africa showed the critical importance of pursuing tailor-made energy access strategies. The emergence of PAYG solar business models showed that the status-quo was not a fatality and that well-designed, integrated solutions developed on market terms to specifically tackle Africa-specific technical, social, economic, and institutional obstacles to energy access could attract unprecedented financing and revitalize a moribund power sector. As a corollary, a key message of this paper is that governance and regulatory issues, rather than financing or technical limitations, may now remain the most critical obstacle to the development of successful energy access strategies.

In practice, while experiences in concessions have remained mixed, national utility concessions may hold an important potential to disrupt the distribution sector by providing a sound framework for public-private cooperation and make a large contribution to universal energy access strategies. Building on past experiences and the lessons derived from past and currently operating concession programs in Africa, Latin America, and South East Asia, this paper proposes a new approach of national utility concessions, namely an integrated distribution framework, best able to integrate energy access within concession agreement without compromising on financial sustainability and applicable to a diversity of social, political, and institutional contexts.

However, concessions only represents one of many solutions along a continuum of possible strategies ranging from pure public to pure private business models for electrification. Echoing Holser *et al.*[104], the authors of this report couldn't emphasize enough the fact that concession arrangements are "not an end in themselves, but a means to provide incentives and protections that can attract private resources and expertise to the challenge of accelerating electrification in rural Africa." The objective of this report is to provide policy-makers and the academic community with a condensed appraisal of past experiences in energy access with a focus on concessions and to propose a new approach that, it is hoped, will make a contribution to addressing the universal energy challenge by the earliest possible deadline.

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[104] Hosler *et al.* (2017), *Rural Electrification Concessions in Africa: What Does Experience Tell Us?*, World Bank, Washington, D.C.

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