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GREEN POWER FOR AFRICA: OVERCOMING THE MAIN CONSTRAINTS

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Introduction: Overcoming the Constraints to Green Electricity in Africa

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Abstract The phenomenon of inadequate power supply in sub-Saharan Africa (SSA) has been a subject of great interest over the years because of its intractable nature and its importance for development; SSA accommodates about 55 per cent of the more than one billion people without access to electricity globally. Moreover, in many SSA countries, electricity access rates are decreasing because electrification efforts are slower than population growth. In recent years, however, certain SSA countries have demonstrated that with political will and access to appropriate finance, electricity access can be accelerated. The overwhelming calls for clean (green) energy sources into the energy mix cannot be overemphasised. Drawing from different disciplines, this *IDS Bulletin* provides new perspectives that go beyond the identification of obstacles to renewable energy development in SSA. The contents of these contributions underscore the complexity surrounding the clean electrification challenge in SSA; and demonstrate the benefits of a multidisciplinary approach in the design of interventions.

Keywords: sub-Saharan Africa, clean electricity, technical challenges, economic challenges, political challenges, multidisciplinary approach.

1 Introduction

Nearly ten years ago, sub-Saharan Africa (SSA) was defined as 'underpowered' in a World Bank report diagnosing the state of its physical infrastructure (Eberhard *et al.* 2008). SSA was in the middle of a power crisis, with a deficit of generation capacity, poor quality of electricity supply, very low access rates, and higher prices than other developing countries, but still below cost recovery.

One decade later, sub-Saharan Africa is still underpowered. Eighty per cent of enterprises experience regular power outages (World Bank 2017) and the region hosts 55 per cent of the more than one billion people without access to electricity globally (IEA and World Bank 2017). Reinforcing this gap, only 37 per cent of sub-Saharan Africans have electricity while the second region with the lowest access, South and

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Southwest Asia, provides electricity to 82 per cent of the population. Besides, in many SSA countries, electricity access rates are actually decreasing because electrification efforts are slower than population growth.

The last decade has also brought positive developments. First, populous low-access countries like Kenya, Malawi, Sudan, Uganda and Zambia have shown that rapid progress can be achieved with political will and access to appropriate finance. Second, there is increased awareness in the international development community about the importance of energy for human development, and the need for energy to be 'green'. This reflects in the definition of Sustainable Development Goal 7 to 'ensure access to affordable, reliable, sustainable and modern energy for all' by 2030. What is more, the renewed interest in universal and clean energy in the donor community has made more funding, technical, and policy support available for renewable energy (RE) investment in SSA.

When developing the policy framework to support investment in renewable energy, donors and national governments should learn from the mistakes of the past. In particular, since the 1980s, the World Bank and other donors had promoted a 'one-size-fits-all' approach to power sector reform, consisting in unbundling state monopolies, liberalisation, and privatisation. It was expected that the 'standard model', as it was called, would improve the performance of African state-owned utilities and attract much-needed investment. However, reform did not work as expected. The standard model copied the experiences of countries like Norway, Chile and the UK, but proved inappropriate for the very small power systems and struggling utilities of sub-Saharan Africa. The broken monopolies that emerged had increased their transaction costs and reduced economies of scale, while political meddling persisted despite attempts to liberalise (Besant-Jones 2006). In fact, reform was never consummated in any SSA country. Many of the former state monopolies morphed into 'hybrid models', combining and often confusing the roles of public and private actors (Gratwick and Eberhard 2008).

This *IDS Bulletin* departs from the premise that power sector reform should be context-specific. It follows on from the IDS Research Report *Green Investment Diagnostics for Africa*,[1] that departed from the premise that there are many reasons why there is not enough renewable energy investment in sub-Saharan Africa, but some reasons are more important than others. Policymakers should therefore focus on the most binding constraints. The research proposed a systematic approach to identify these binding constraints and applied it to two countries: Kenya and Ghana. Results showed that both countries needed very different policies to attract investment (Pueyo *et al.* 2017).

With this *IDS Bulletin*, we want to go further than the identification of binding constraints, to reflect on the reality of a wider set of countries (seven SSA countries are included in this issue) from a wider set of disciplines. The authors of the articles in this *IDS Bulletin*

provide insights from power systems engineering, macroeconomics, microeconomics, and political economy to overcome constraints to green electricity in Africa. One of the biggest contributions of this issue is therefore allowing a dialogue between academics and practitioners that would not normally publish in the same journals. The remainder of this introductory article summarises their contributions, grouping them under three sections about technical, economic, and political challenges.

2 Overcoming technical challenges

The articles by Rawn and Louie, and Edwards, Dent and Wade focus on two technical issues particularly relevant for Africa. First, Rawn and Louie explore two potential pathways for electrification in sub-Saharan Africa: grid extension/enhancement and off-grid solutions, taking the perspective of a traditional power system planner. Second, Edwards *et al.* explore the challenges and opportunities of increasing the penetration of variable renewables like wind and solar in the small African power systems, using capacity adequacy assessments.

Rawn and Louie start by highlighting the particularities of SSA as compared to other countries that have successfully achieved universal electrification. As opposed to these previous successful experiences, SSA lacks governments with big surpluses that can pay for the heavy investments required, or a critical mass of mostly urban consumers able to cross-subsidise the poorer rural population. Another important difference is that in the past, grid extension had always been considered as the endpoint of all electrification efforts, but now technological progress has made off-grid solutions increasingly competitive with the grid in rural areas.

The article by Rawn and Louie links to other contributions in this *IDS Bulletin* when it talks about the political economy of each pathway. The grid model requires heavier state intervention and is more open to rent-seeking and patronage; it also generally allows for bigger economies of scale and a cheaper service. As raised by McCulloch, Sindou and Ward in another article in this issue, an off-grid, private sector-based model is more difficult to control by the state. If it deprives the government of useful rents, it could be sabotaged through restrictive regulation or by extending the grid with a subsidised tariff to villages where off-grid systems operate. Coordination with political actors is therefore essential, and a significant role of the state and subsidisation are unlikely to go away.

Edwards *et al*. focus on a particular challenge for grid systems: the variability of some renewable energies, mainly wind and solar. SSA power systems are remarkably unreliable, with frequent blackouts that cause significant economic losses to consumers. Wind and solar energy cannot contribute to avoiding generation caused by blackouts when the wind is not blowing and the sun is not shining. Therefore, many policymakers wonder if they are appropriate solutions for their reliability problems. Edwards *et al.* explore this issue by carrying out a simplified version (due to data availability) of a capacity adequacy

assessment of wind in Kenya. Adequacy assessments are concerned with the risk of there being insufficient resources to supply demand in a given power system. Their analysis compares temporal patterns of wind availability with patterns in system demand and the availability of hydrological resource, to assess the extent to which the resources complement each other. Their results show that the large wind projects that Kenya is building are likely to contribute to the generation adequacy of the system, thanks to the complementarity between wind resource and demand, and between wind and hydro resources. This is possible thanks to the quality and consistency of wind in a number of sites in Kenya. A similar assessment should be done in SSA countries with good or excellent wind resources to understand whether they will contribute to the reliability of power supply.

The analysis by Edwards *et al.* relates in particular to the article by Osiolo, Pueyo and Gachanja, which points at system costs as one of the most important constraints to renewables in Kenya. In particular, Kenya suffers a deficit in transmission infrastructure, and some of the sites with outstanding wind resource are located in remote areas without transmission lines. There is therefore a trade-off between the resource quality and access to transmission infrastructure, an issue that also comes up in the articles by Baker, and Lucas, del Río and Sokona.

3 Overcoming economic challenges

Two articles in this *IDS Bulletin*, by Willenbockel, Osiolo and Bawakyillenuo, and by Lucas *et al.*, look at economic approaches to overcome the challenges to renewables in Africa.

The first article, by Willenbockel *et al.* applies a macroeconomic perspective, using computable general equilibrium modelling, to debunk the common narrative that green energy is not compatible with economic growth. The article shows the distributional implications of a shift to renewables in Kenya and Ghana. It concludes that in both countries, it is feasible to reduce the carbon content of electricity generation without adverse consequences for economic growth, and without noteworthy distributional effects. Kenya shows much larger economic benefits than Ghana, though, thanks to abundant low-cost geothermal resources that would reduce electricity prices, and trigger a moderate real exchange rate appreciation (less fossil fuel imports), thus reducing the price of imports and leading to an economy-wide real income gain. Ghana has a much smaller potential for economically viable renewables and has an active domestic fossil fuel extraction sector. Hydro is the only RE option with a clear cost advantage over gas, yet the potential for hydro expansion is limited. There is therefore a moderate scope for an RE transition in Ghana, with marginal impacts on macroeconomic growth. Willenbockel *et al.*'s article shows that Ghana's attraction to a fossil fuel-based model, as described in Bawakyillenuo's article in this *IDS Bulletin*, is justified economically due to the possibility of higher tariffs at the beginning of the transition, the lower cost of gas, and a pre-existing gas infrastructure, as well as

the contribution of natural resource extraction to real gross domestic product (GDP) growth.

The article by Lucas *et al*. uses a microeconomic lens to analyse renewable energy auctions, a policy instrument widely applied in SSA nowadays after the initially successful experience of South Africa. Donors have been heavily involved in the design and implementation of RE auctioning schemes in SSA, providing funding and technical assistance and a package of de-risking and credit enhancement. These measures have mostly attracted large international companies. The authors argue that renewable energy auctions make a lot of sense technically and economically for SSA. As opposed to feed-in tariffs (the previous policy trend in the continent), renewable energy auctions allow the market to set the most competitive price and avoid overloading the administration with unsolicited proposals. They also provide opportunities to reduce risks through the pre-selection of sites and to create local jobs through local content requirements. The authors review the design elements of the auctioning schemes in Ghana, Uganda and Zambia, showing some key elements that seem to be working: the pre-selection of sites, as opposed to geographic neutrality typical in Organisation for Economic Co-operation and Development (OECD) countries; and technology specificity with a focus on solar photovoltaic (PV) due to its decreasing cost, simplicity, and fast turnaround. They also point at some remaining obstacles to successful auctions, mainly poor planning. These reflections mirror those by Rawn and Louie, who in their article emphasise the importance of long-term planning and low technical complexity.

In addition to the challenges raised in the article by Lucas *et al*., the article by Baker in this *IDS Bulletin* shows that even for a policy like renewable energy auctions, that makes perfect economic sense, political challenges can be unsurmountable. Having looked at the articles on the technical and economic dimensions in this *IDS Bulletin*, we now discuss the next set of articles focusing on political economy.

4 Overcoming political challenges

The articles by Baker, Osiolo *et al.*, Bawakyillenuo, and McCulloch *et al*. seek to understand why policies that make perfect technical and economic sense are not implemented, or do not work as expected when they are.

First, Baker describes the history and future prospects of South Africa's Renewable Energy Independent Power Producer Procurement (REIPPP) programme, an auctioning scheme to procure renewable energy-based electricity from private generators. The REIPPP was an economically and technically sound policy, and was a success that many other SSA countries have tried to replicate. It marked the first time that South Africa had both independent power producers (IPPs) and renewable energy, and succeeded in turning South Africa into an attractive destination for commercial-scale renewables. As a result, RE

added a small but significant contribution to the generation mix and many jobs were created as selection criteria included local content and job creation requirements. However, new clouds are endangering the future success of the programme. First, the monopolistic national power utility, Eskom, is acting as a gatekeeper, being reluctant to lose its grip on the sector. Second, grid availability is becoming an obstacle for many potential projects. The connection of a growing number of RE projects located in resource-rich sites is leading to grid constraints in those locations. This second problem could be addressed with geographical incentives to IPPs or the pre-selection of sites with sufficient grid availability. The first problem, however, is eminently political and harder to solve unless there is a coalition of interests in favour or renewables strong enough to counter the power of Eskom.

The article by Baker is a good continuation to the article by Lucas *et al.*, showing that a purely economic perspective is not enough for the successful implementation of auctions in SSA. It also connects to many other articles in this *IDS Bulletin*; for example, to the article by McCulloch *et al.*, showing the importance of donors in the initial success of REIPPP, as well as the need to know the interests of all stakeholders when designing such a policy. Like Osiolo *et al.*, and Rawn and Louie, Baker shows that transmission and distribution infrastructure can become the Achilles heel of RE in Africa, when the state monopoly managing it has no incentives for long-term investment.

The second article using a political economy approach, by Osiolo *et al.*, looks in depth at the policies that might address three prevailing constraints to RE investment in Kenya: the poor state of the transmission and distribution infrastructure, a very low rural demand, and high levels of local opposition to RE infrastructure. The article looks at how these constraints came to be, which policies could address them, and which actors could block or support these policies.

Even if Kenya is championing market-led approaches for the provision of off-grid electricity, rural poverty and the high costs of reaching remote, poor populations remain a key issue, as in many other SSA countries. Despite the decreasing costs of off-grid solutions (as highlighted in Rawn and Louie's article), these are still beyond the means of a majority of the rural poor. On the other hand, smaller off-grid solutions, such as solar lamps, can increase welfare through better quality light and mobile phone charging, but do not enable new productive uses to escape poverty. Sometimes the gap between the small urban elite and the large rural poor manifests violently in Kenya, through protests against new energy infrastructure that delay or block projects, and scare investors. The authors argue that an important role for donors and the state is unavoidable in Kenya, despite the dominant 'market-led' narrative. Donor support will be needed for the affordability of rural electrification, and to increase the ability of the population to pay through the promotion of productive uses. A strong state will also be necessary to allocate cross-subsidies that bridge the

affordability gap, to coordinate on- and off-grid efforts, and to invest in transmission and distribution infrastructure.

The article by Osiolo *et al.* dialogues with other articles in this issue; for example, with Lucas *et al.* who also point at the importance of pre-selecting and de-risking sites to reduce investment uncertainty. Lucas *et al*. also recommend the introduction of social criteria for bid assessment, to reduce historical inequalities, which is particularly relevant for Kenya as it designs its own auctioning scheme.

The article by Bawakyillenuo departs from a similar premise as the preceding article by Osiolo *et al*., arguing that the best policies to solve Ghana's constraints to investment in RE might not be politically feasible. The article explores three constraints in depth: the poor creditworthiness of the off-taker, the inadequate power sector regulation, and lack of access to appropriate finance. The author argues that a dominant natural gas-based paradigm in the political class and the national psyche, and the lack of an organised civil society that demands renewable energy make it hard to implement RE policies in the country. Some donors are intervening to solve the financial problems of the off-taker, the Electricity Company of Ghana, pushing for the privatisation of the retailing branch of the utility. However, a large share of the population opposes privatisation, mainly for fear of price increases. As McCulloch *et al.* recommend, donors should understand the motivations of all the actors involved and try to build local coalitions before pushing for an unpopular privatisation. Otherwise the privatisation could be reversed just as rapidly as it was implemented.

The final article, by McCulloch *et al.*, brings to the forefront an underlying thread to all other articles in this *IDS Bulletin*: the essential role of donors to achieve sustainable energy for all in Africa. Their article looks in particular at the use of political economy analyses by donors to improve the effectiveness of their interventions for power sector reform. The authors argue that donors, with the high rotation of their staff and the consultants they hire to implement their programmes, are responsible to some extent for the uniform approach to reform that has failed in the past. The incentive structure is also wrong for targeted, politically aware interventions. Donors are often incentivised to spend their money, without the possibility to change or stop programmes once they have started and no *ex-post* reflection about successes and failures. The case of Tanzania is used to illustrate the failure of reform when it does not take into account political realities. Finally, McCulloch *et al.* recommend that donors carry out an analysis of the underlying motivations of key actors before they push for reform, to uncover politically feasible reform pathways. If this analysis concludes that reform is impossible, donors should then 'work with the grain', supporting legitimate credible domestic actors to challenge the status quo.

In summary, the contributions to this *IDS Bulletin* underline the enormity of the clean electrification challenge in Africa; and

demonstrate the benefits of a multidisciplinary approach where technical, economic, and political perspectives are involved in the design of interventions. We hope that this *IDS Bulletin* will inspire future initiatives, where many other disciplines not covered here can jointly contribute to overcome the constraints to RE investment in SSA.

Notes

1 That report and this *IDS Bulletin* is part of the Green Growth Diagnostics Project led by IDS in partnership with KIPPRA, ISSER, the universities of Durham and Newcastle, and the Policy Practice, www.ids.ac.uk/project/green-growth-diagnostics-for-africa.
2 The rationale and methodology for Green Growth Diagnostics was inspired by the Growth Diagnostics approach developed by Hausmann, Rodrik and Velasco (2004).

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