IMPROVING ACCESS TO ELECTRICITY THROUGH DECENTRALISED RENEWABLE ENERGY

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POLICY ANALYSIS FROM

INDIA, NIGERIA, SENEGAL AND UGANDA

Dalberg

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CONTENTS

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ACRONYMS

ABT	Availability Base Tariff
ACG	Arab Coordination Group
AD	Accelerated Depreciation
ADB	Asian Development Bank
AFD	*Agence Française de Développement* (French Development Agency)
AfDB	African Development Bank
ANER	*Agence Nationale pour les Energies Renouvelables* (National Agency for Renewable Energy)
ANSD	*Agence Nationale de Statistique et de la Démographie* (National Agency of Statistics and Demography)
ASER	*Agence Sénégalaise pour l'Électrification Rurale* (Senegalese Agency for Rural Electrification)
ASN	*Association Sénégalaise de Normalisation* (Senegalese Association for Standardisation)
AU	African Union
BPL	Below Poverty Line
CBO	Community Based Organisation
CERC	Central Electricity Regulatory Commission
CERER	*Centre d'Etudes et de Recherches sur les Energies Renouvelables* (Center for Study and Research on Renewable Energy)
CNB	National Committee on Biofuels
CRSE	*Commission de Régulation du Secteur de l'Electricité* (Regulatory Commission of the Electricity Sector)
DBT	Direct Benefit Transfer
DDG	Decentralised Distributed Generation
DDUGJY	*Deendayal Upadhyaya Gram Jyoti Yojana*
DFI	Development Finance Institution
DfID	Department for International Development
DISCOMs	Distribution Companies (India)
DISCOs	Distribution Companies (Nigeria)
DRE	Decentralised Renewable Energy
DWRM	Directorate of Water Resources Management
EAC	East African Community
ECN	Energy Commission of Nigeria
ECOWAS	Economic Commission of West Africa
ECREEE	ECOWAS Regional Centre for Renewable Energy and Energy Efficiency
EDT	Electricity Disputes Tribunal
EE	Energy Efficiency
EEEP	ECOWAS Energy Efficiency Policy
EMDP	Energy and Mineral Development Partners
EPSRA	Electricity Power Sector Reform Act
ERA	Electricity Regulatory Authority
EREP	ECOWAS Renewable Energy Policy
ERIL	*Electrification Rurale d'Initiatives Locale* (Local Rural Electrification Initiatives)
ERSEN	Renewable Energy for Senegal Off-grid Solar Energy Programme
ESCO	Energy Service Company

EU	European Union
FER	*Fonds d'Electrification Rurale* (Rural Electrification Fund)
FGN	Federal Government of Nigeria
FiT	Feed-in-Tariff
FMENV	Federal Ministry of the Environment
FMPWH	Federal Ministry of Power, Works and Housing
GBI	Generation Based Incentive
GDP	Gross Domestic Product
GENCOs	Generation Companies
GETFiT	Global Energy Transfer for Feed-in-Tariff
GIZ	*Gesellschaft für Internationale Zusammenarbeit*
GoI	Government of India
GST	General Sales Tax
GW	Gigawatt
GWh	Gigawatt Hour
IA	Implementation Agreements
ICREEE	Inter-Ministerial Committee on Renewable Energy and Energy Efficiency
IEC	International Technochemical Commission
IEDN	Independent Electricity Distribution Network
IFC	International Finance Corporation
INR	Indian Rupee
IPP	Independent Power Producer
IREDA	Indian Renewable Energy Development Agency
IRENA	International Renewable Energy Agency
IRP	Independent Resource Plan
JNNSM	Jawaharlal Nehru National Solar Mission
KfW	Kreditanstalt für Wiederaufbau Development Bank
kW	Kilowatt
KWh	Kilowatt Hour
LHP	Large Hydropower
LPDSE	*Lettre de Politique de Developpement du Secteur de l'Energie* (Letter of Policy Development of the Energy Sector)
MAN	Manufacturers Association of Nigeria
MDA	Ministries, Departments and Agencies
MEDER	*Ministre de l'Energie et du Développement des Energies Renouvelables* (Ministry of Energy and the Development of Renewable Energy)
MEMD	Ministry of Energy and Mineral Development
MFI	Microfinance Institutions
MNRE	Ministry of New and Renewable Energy
MoP	Ministry of Power
MW	Megawatt
MWh	Megawatt Hour
MYTO	Multi-Year Tariff Order
NACOP	National Council on Power
NAEE	Nigeria Alternative Energy Expo
NAPTIN	National Power Training Institute of Nigeria
NBET	Nigerian Bulk Electricity Trading
NDP	National Development Plan
NEEAP	National Energy Efficiency Action Plan
NEMA	National Environment Management Authority
NERC	Nigerian Electricity Regulatory Commission
NESP	Nigerian Energy Support Programme

NGO	Non-governmental Organisation
NIA	Notice for Intended Application
NOTAP	National Office for Technology Acquisition and Promotion
NREAP	National Renewable Energy Action Plan
NSSO	National Sample Survey Organisation
NTP	National Tariff Policy
PASER	*Plan d'Action Senegalais d'Electrification Rurale* (Senegalese Rural Electrification Plan of Action)
PAYG	Pay-as-you-go
PERACOD	Programme for the Promotion of Renewable Energy, Rural Electrification and Sustainable Supply of Household Fuels
PHCN	Power Holding Company of Nigeria
PPA	Power Purchase Agreement
PPER	*Programmes Prioritaires d'Électrification Rurale* (Priority Rural Electrification Programmes)
PUDC	*Programme d'Urgence de Développement Communautaire* (Emergency Programme for Community Development)
PV	Photovoltaic
RE	Renewable Energy
REA	Rural Electrification Agency
REC	Renewable Electricity Certificate
REF	Rural Electrification Fund
REFiT	Renewable Energy Feed-in-Tariff
RESIP/RESP	Renewable Energy Strategy and Implementation Plan
RESP	Rural Electrification Strategy and Plan
RGGVY	Rajiv Gandhi Grameen Vidyutikaran Yojana
RPO	Renewable Purchase Obligation
RPS	Renewable Portfolio Standard
RRA	Renewable Readiness Assessment
RRD	Renewable and Rural Power Access Department
RVEP	Remote Village Electrification Programme
RVO	*Rijksdienst voor Ondernemend Nederland* (Netherlands Enterprise Agency)
SACCOs	Savings and Credit Cooperatives
SE4ALL	Sustainable Energy for All
SEB	State Electricity Board
SECI	Solar Energy Corporation of India
SERC	State Electricity Regulatory Commission
SHP	Small Hydropower
SHS	Solar Home System
SIDA	Swedish International Development Agency
SIE	*Système d'Information Energétique du Senegal* (Energy Information System of Senegal)l
SNA	State Nodal Agency
SON	Standards Organisation of Nigeria
SREP	Scaling-up Renewable Energy Program
TCN	Transmission Company of Nigeria
TT	Technology Transfer
TWh	Terawatt Hour
UBOS	Uganda Bureau of Statistics
UECCC	Uganda Energy Credit Capitalisation Company
UEDCL	Uganda Electricity Distribution Company Limited
UEGCL	Uganda Electricity Generation Company Limited

UETCL	Uganda Electricity Transmission Company Limited
UIA	Uganda Investment Authority
UN	United Nations
UNBS	Uganda National Bureau of Standards
UNDP	United Nations Development Program
UP	Uttar Pradesh
URA	Uganda Revenue Authority
USAID	United States Agency for International Development
VAT	Value-added Tax
VESP	Village Energy Security Program
VGF	Viability Gap Funding

LIST OF FIGURES

1 EXECUTIVE SUMMARY

INTRODUCTION

Despite significant efforts, access to electricity remains inadequate across Sub-Saharan Africa and India. Of the over 1,27 billion people living in Sub-Saharan Africa in 2016, roughly 65% did not have access to electricity. India has made considerable strides in village-level electrification, with 96% of all villages now electrified. Yet 51 million Indian households (244 million people) still lack access to electricity today.[1]

Lack of electricity has severe economic impacts: the costs of power outages can easily reach 1–2% of GDP.[2] At the local level, studies show that schools without electricity have poorer staff retention and educational outcomes than those with and that electrification has positive effects on household incomes.[3] At the macro-level, connectivity, healthcare, agriculture, and small-business development are just a few of the sectors that depend on a reliable energy supply. African firms report losing 5% of their sales because of frequent power outage; that figure rises to 20% for informal firms unable to afford backup generation.

Given the importance of electricity to economic and social development, many countries have announced ambitious electrification goals – yet challenges remain. For example, India and Nigeria plan to reach universal electrification by 2019 and 2030, respectively. However, these goals rarely align with financial, political, and institutional reality on the ground. Numerous challenges persist, including: insufficient power generation, poor transmission infrastructure, last-mile distribution challenges, affordability of power, and inadequate and inappropriate sector funding. Achieving universal access will therefore require coordinated efforts by the development community, government, and the private sector.

Decentralised renewable energy (DRE) has emerged as an important avenue for addressing electricity challenges and improving access, but policy gaps and challenges impede growth of the sector. The International Energy Agency estimates that the creation of mini-grids can best supply electricity for about 40% of the world's un-electrified population.[4] Although DRE is taking off in many countries, growth is often stop-start. Policy-makers face many unanswered questions and cite myriad challenges such as availability of finance, insufficient regulatory frameworks, poor policy implementation, and absence of requisite data.

The accompanying country briefs, commissioned by Facebook and written by Dalberg Global Development Advisors, provide an overview of the DRE landscape in India, Nigeria, Senegal, and Uganda. They summarise current policies impacting off-grid energy, identify key stakeholders, and detail challenges that inhibit the growth of the sub-sector. They also examine promising initiatives in those countries and outline the key questions on the minds of policy-makers and policy influencers that, if answered, could move the sector forward. The reports derive from desk research and interviews conducted with key stakeholders from government, civil society, donor agencies, and the private sector in all four countries. It is critical to note that although the country briefs are similar in format, they are not comparative in nature. Rather, they offer an overview of the common challenges across the countries and identify innovative approaches countries have taken to address some of these obstacles – providing a basis for cross-country learning.

This short introductory chapter synthesises the main findings detailed in the country reports and presents some cross-country themes.

[1] World Energy Outlook (2016), Electricity Access Database

[2] International Energy Agency 2014, Africa Energy Outlook

[3] UNDESA (2014). Electricity and education: The benefits, barriers, and recommendations for achieving the electrification of primary and secondary schools http://www.un-energy. org/publications/13000-electricity-and- education-the-benefits-barriers-and-recommendations-for-achieving

[4] International Energy Agency 2014. Africa Energy Outlook

[5] IRENA 2015, Off-grid renewable energy systems: status and methodological issues

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POLICY TRENDS

Access to affordable and reliable electricity is a key challenge and policy priority across India, Nigeria, Senegal, and Uganda. In Uganda, 81% of the population remains un-electrified. In Senegal, despite two decades of power sector reforms, 39% of the country's population still lacks access to electricity; in rural areas only two in five citizens is connected. In 2014, only 45% of Nigerians had access to electricity.[6] In all countries, electricity quality is low and costs are high. For example, Senegal boasts one of the most expensive electricity tariffs in Africa: over $0.26/kWh.[7] Businesses in Nigeria suffer an average of 25 power outages of 7.8 hours each per month[8] and in India, there are 20 million grid-connected households (95 million people) who receive less than four hours of electricity per day.[9] Given these challenges, the governments of these countries are making sustained efforts to increase electricity access. Policy is moving in the right direction but much more remains to be done.

In March 2016 the Government of India announced a goal of universal household electrification by 2019. The government has identified 18,400 villages and towns to be part of the 'grid extension scheme' and approximately 3,500 remote villages to be electrified through off-grid energy.[10] In addition, the national Ministry of New and Renewable Energy (MNRE) announced targets to build 10,000 renewable energy-based micro- and mini-grid projects across the country in the next five years. To meet these goals, there have been significant policy wins at the national and state level promoting mini-grid development. Notably, the 2016 National Tariff Policy (NTP) addresses some of the long-standing policy uncertainty regarding tariffs and grid interactivity. The 2016 Draft Mini-Grid Policy provides clarity on tariff regulations, streamlines project development procedures for energy service companies (ESCOs), and outlines operational frameworks to work alongside DISCOMs. Unsurprisingly, there is wide variation across states with respect to the adoption of and support for decentralised renewable energy (DRE).

In Nigeria the picture is mixed. The government recently released a number of new DRE policies, with others under development, but some have not yet been ratified and/or lack specific components required for implementation. The government released the National Renewable Energy and Energy Efficiency Policy (NREEEP) in April/May 2015. During its July 2016 meeting, the National Council of Power Meeting (NACOP) approved the corresponding National Renewable Energy Action Plans (NREAP) and National Energy Efficiency Action Plans (NEEAP), but the Integrated Resource Plan (IRP) for the NREEEP is still under development. In July 2016, NACOP also approved Nigeria's Sustainable Energy for All (SE4All) Action Agenda.[11] Despite this policy progress, some stakeholders consider the policy and institutional framework somewhat incoherent, given the many policy documents and overlapping mandates of actors in the sector.[12] In light of this challenge, the SE4ALL Action Agenda calls for an overarching National Energy Plan – this does not yet exist.[13]

In Senegal, the national regulatory framework encourages DRE as a key component to improving rural electrification, yet, there is a lack of specific regulations and the incentives needed to grow the sector. In 2008, the updated national energy policy – the Letter of Policy Development of the Energy Sector (LPDSE) – explicitly acknowledged the importance of renewable energy and laid the groundwork for the passage of the Renewable Energy Law (2010), which regulates the on-grid and off-grid RE sector. However, the law is relatively high-level and implementing decrees are required to determine the specific incentives and regulations (e.g., feed-in tariffs, tax exemptions). Senegal also has a Rural Electrification Plan of Action that relates more directly to DRE, but the government has struggled to successfully implement many of its components. Lastly, the Ministry of Energy and the Development of Renewable Energy (MEDER) recently rejected the draft of the National Renewable Energy

[6] World Energy Outlook (2016), Electricity Access Database

[7] USAID 2016, 2 June - last update, Senegal: Power Africa Fact Sheet [Homepage of USAID], [Online]

[8] Ley, K., Gaines, J. and Ghatikar, A. 2015, The Nigerian Energy Sector: An Overview with Special Emphasis on Renewable Energy, Energy Efficiency and Rural Electrification.

[9] The Climate Group. 2015, The Business Case for Off-grid Energy in India

[10] http://garv.gov.in/dashboard

[11] See: http://www.afdb.org/en/news-and-events/article/nigeria-national- council-on-power-adopts-the-sustainable-energy-for-all-action-agenda-15966/

[12] SE4All 2016, Action Agenda

[13] See SE4All: http://www.se4all-africa.org/se4all-in-africa/country-data/nigeria/

Strategy (2016-2020) because it was not ambitious enough. It is now being rewritten. As a result, there are many gaps in policies and regulations needed to drive the uptake of DRE.

In Uganda, the government recognises that off-grid technologies can be cost-effective in providing electricity to a dispersed rural population. Uganda's rural communities, which constitute 75% of the country's population, are dispersed and demand insufficient electricity (at existing prices) to justify the cost of extending the grid. Going forward, off-grid technologies are likely to play an increasingly important role in bringing electricity to the rural poor. Currently, 4.9% of Ugandan households get their electricity from solar photovoltaic systems and it is estimated that the proportion of households that receive off-grid electricity could grow to 33% by 2030.[14] To address the challenge of energy access, the government has begun a master planning process to determine which rural areas are appropriate for grid expansion and which areas are better suited to off-grid solutions. There is likely to be a coordinated effort to reach universal access under the SE4ALL initiative. There is also talk of the government developing an Access Acceleration Strategy to speed up electrification, in partnership with key stakeholders. To address the challenge of energy access, the government has begun a master planning process and requires technical assistance. The master plan will be informed by SE4all Action Agenda and will include construction plans and timelines.[15]

[14] Ministry of Energy and Mineral Development 2015, Uganda's Sustainable Energy for All (SE4ALL) Initiative: Action Agenda, Ministry of Energy and Mineral Development, Kampala, Uganda

[15] Bena, B. 2015, "Electrification Using Renewable Energy: Uganda's Experience", 'The Development and Mini-Grid Conference' Ministry of Energy and Minerals Development, http://www.Energyfordevelopment.Net/Wp-Content/Uploads/2015/06/Electrification-Using-Renewable-Energy-Uganda-May-2015.Pdf, 11-12 May 2015

KEY POLICY CONSTRAINTS AND CONCERNS

Although DRE is taking off in all four countries, key policy gaps and challenges impede the rapid growth of the sector. Policy-makers in all countries cited four common concerns that need to be addressed:

- Understanding of economics and viability of dre solutions,
- Politics and challenges of state/local level policy implementation,
- Capacity constraints within the government and
- Access to requisite data for planning.

In India, key policy-related obstacles thwarting the growth of DRE include poor state-level implementation of policies, lack of clarity around grid interactivity, the scepticism of policy makers regarding the economics of off-grid solutions, and the absence of useful data to inform policy decisions. Although the cost of power from DRE has fallen significantly over the last few years, it still remains higher than conventional grid options. Numerous stakeholders cited the lack of financially viable and scalable business models as the core hurdle for DRE. At the regulatory level, although recently passed policies provide clarity on what happens when the grid arrives, the government's target to ensure 100% grid electrification by 2019 has significantly increased the risks faced by off-grid enterprises. Finally, although the central and state governments conduct numerous surveys and have reasonably good macro- and micro-data, there is a need for better village and sub-station level data on the extent and quality of electrification.

In Nigeria, policy-related barriers include poor implementation of national policy, a weak enabling environment for DRE financing, lack of data to make informed decisions and develop the market and, as in India, the scepticism of policy-makers regarding the viability of off-grid solutions. Many new policies are not actionable in their current high-level form. For example, the NREEEP lists "implementing a framework for the use of Sovereign Guarantees to support appropriate renewable electricity projects" as a key strategy – but provides no additional detail on how this financing mechanism could work. Many specific policies and regulations remain 'to be determined.' Furthermore, public and private stakeholders lack nationwide data resources related to the electricity sector, including decentralised renewables. This includes data on current energy resources and access, grid expansion plans, high-potential locations for future projects, and consumer needs and preferences across regions and states. This lack of data impedes informed decision-making (for the government) and market development (for the private sector). Finally, some stakeholders claimed that local policy-makers have limited knowledge of off-grid energy. The relative priority of expanding energy access through DRE (vs. the national grid) is low. Policy-makers find it difficult to articulate exactly what kinds of information and data are needed to unlock progress for the sector.

Senegal's national regulatory framework encourages DRE as a key component to improving rural electrification, but more specific regulations and incentives are needed to grow the sector. Many government bodies influence the growth and success of the DRE sector, but there is limited understanding of this ecosystem of actors and their roles. For example, the Ministry of Energy and Development of Renewable Energy (MEDER) has extended the medium tension lines to remote areas that recently developed mini-grids.[16] Furthermore, despite much recent progress, government entities working on DRE via rural electrification often encounter challenges in carrying out their mandates due to capacity that could benefit from further reinforcement; limited financing; and limited empowerment. On the financial front, the Renewable Energy Law (2010) broadly outlines the need for fiscal and financial incentives to support the growth of renewable energy. Yet to date, there are no subsidies for off-grid electrification projects – unlike on-grid electricity – which results in a stark disparity between on- and off-grid tariffs. The latter are three times as high in some parts of the country, and stakeholders noted that the process to set off-grid tariffs is relatively onerous.[17] Finally, policy-makers and policy influencers have limited high-quality, comprehensive data resources related to the DRE sub-sector. This includes data on existing mini-grids, their capacity, performance, end-user access to DRE, and high-potential locations for future projects – which hinders regular tracking and monitoring of DRE electrification efforts.

In Uganda policy support for off-grid electricity is growing, however, the lack of direction on how rural electricity access will increase, in practice; scepticism about the economics of mini-grids; and the lack of appropriate subsidies and financial incentives to drive off-grid uptake remain key policy challenges. While the government has clear targets for electrification and plans to extend the grid to urban, peri-urban and some rural areas, it is unclear how precisely the goals of rural electrification will be reached. Policy-makers feel that while grid extension is not always cost-effective, there are few workable mini-grid business models that can scale effectively. Developers also struggle to demonstrate bankable projects that are small or medium in size. Financially, there are few subsidies for mini-grids or SHS in Uganda, at present, and limited support for early stage project needs (pre-feasibility and feasibility studies). Given the absence of end-user subsidies for off-grid developers affordability challenges hamper off-grid uptake.

QUESTIONS FOR FURTHER RESEARCH

Given this landscape, interviews with experts and desk research revealed a number of common questions. Across all four countries experts raised key questions that mapped to eight overarching themes detailed below. These questions, if answered, could unlock the off-grid sector in India, Nigeria, Senegal, and Uganda.

Theme	Key questions/issues
Planning and resource allocation	• What is the state (quality and quantity) of electrification? • Where should the grid be expanded and where should governments prioritise off-grid alternatives? • Where (i.e., geographic locations) and on what (i.e., type of project, technology) should governments focus their efforts given their limited resources for DRE?
Business models and performance	• What are the different anchor/productive load models that could be viable? • What are the replicable models of DRE electrification? • How have mini-grids performed over time?
Pricing and subsidies	• How should tariffs for DRE be set? • What has been the impact of subsidies/removal of subsidies? • Are there models to provide incentives for community DRE electrification?
Finance and fiscal policy	• What are the trade-offs of lowering taxes/tariffs on off-grid energy equipment? • What are some incentives and/or requirements for the financial sector to support off-grid?
Processes and regulations	• What are success factors, best practices and lessons learned from previous DRE projects – within the country and/or from other countries? • How can governments streamline processes and regulation to support mini-grids?
Standards and KPIs	• What should the standards be around key performance indicators for DRE models (e.g., reliability, affordability, grid compatibility etc.) and how and by whom should they be monitored? • What are technical standards for interconnection with the grid?
Demand ecosystem	• How can you increase demand for off-grid energy? What are some of the ways in which a country can build out a low-wattage, low-cost, appliance ecosystem to drive demand? • How do consumers experience grid electricity relative to off-grid electricity?
Institutional capacity	• How can government agencies be further empowered to fulfill their mandates? • How can governments improve their institutional set-up for rural electrification?

[16] Stakeholder interviews, 2016

[17] Stakeholder interviews, 2016

OPPORTUNITIES

Decreasing costs, improved technology, new sources of finance and increased recognition of the centrality of DRE to universal access are some of the encouraging trends that will help push the sector forward. The country reports that follow illustrate that there are many opportunities for intervention for those interested in assisting countries achieve universal access. These include conducting research to answer the above-mentioned questions, providing additional capacity to governments and making appropriate finance available. These reports also identify innovative approaches countries have taken to further DRE and improve electrification, providing a basis for cross-country learning.

2 INDIA COUNTRY REPORT

EXECUTIVE SUMMARY

India has made considerable strides in village-level electrification, but household-level electrification rates are still low and electricity supply remains inadequate. While 96% of all villages were electrified in 2016, there were still 53 million households (244 million people) that did not have access to electricity. For those who are connected to India's grid, the quality of electricity supply tends to be poor; there are 20 million grid-connected households (95 million people) who receive less than hours of electricity each day.

To address these challenges, in March 2016 the Government of India announced its goal of reaching universal household electrification by 2019, and specified that the national grid is its preferred way to provide electricity. The government has identified 18,400 villages and towns to be part of the 'grid extension scheme' and approximately 3,500 remote villages to be electrified through off-grid energy. Simultaneously, the Ministry of New and Renewable Energy (MNRE) announced targets to build 10,000 renewable energy-based micro- and mini-grid projects across the country over the next five years.

Recently, there have been significant policy wins at the national and state level promoting mini-grid development, but state-level implementation remains uneven and inadequate. Notably, the 2016 National Tariff Policy (NTP) addresses some of the long-standing policy uncertainty regarding tariffs and grid interactivity. The 2016 Draft Mini-Grid Policy also provides clarity on tariff regulations, streamlines project development procedures for energy service companies (ESCOs), and outlines operational frameworks to work alongside DISCOMs. Unsurprisingly, the adoption of and support for decentralised renewable energy (DRE) varies widely by state. States have been waiting for a national policy and to date, Uttar Pradesh is the first and only one to have passed a mini-grid policy

Key policy-related challenges thwarting the growth of DRE include poor state-level implementation of policies, lack of clarity around grid interactivity, scepticism about the economics of off-grid solutions and the absence of data. Stakeholder interviews revealed that the key policy constraints mostly relate to political economy issues rather than lack of information. Nonetheless, a number of key questions emerged, including: What is the extent and quality of electrification across India? How have micro- and mini-grids performed over the last five years? What are the appropriate feed-in tariffs for micro- and mini-grids? Which of the existing off-grid models are replicable at scale and how can their impact and performance be measured in a standardised fashion? And what are the 'real economics' of off-grid energy in India?

While 96% of all villages were electrified in 2016, there were still 53 million households (244 million people) that did not have access to electricity. Furthermore, there are 20 million grid-connected households (95 million people) who received less than four hours of electricity per day.

I. INTRODUCTION

This report presents a policy analysis of the decentralised renewable energy (DRE) landscape in India, with a focus on solar off-grid energy. It details current policies impacting DRE, identifies key stakeholders, and analyses challenges that inhibit the growth of the sub-sector in India (particularly in the least electrified states of Uttar Pradesh and Bihar). It also identifies key questions on the minds of policy-makers and policy influencers and proposes solutions to help answer them. We derived the findings presented in this document through desk research and qualitative interviews with key stakeholders from government, civil society, donor agencies, and the private sector.

The report is structured as follows: Section II sets the stage for the analysis by outlining the current state of electrification and DRE in India – including electricity access, shortfalls between supply and demand, and renewable energy targets. Section III describes the current DRE policy landscape, the key stakeholders active within it and important emerging policy trends. Within this policy landscape and the state of the sector, Section IV presents the key questions posed by policy-makers and policy influencers that, if answered, could move the sector forward. Section V concludes with some key policy challenges in India and highlights opportunities for action.

The goverment seeks to reach universal household electrification by early 2019, and has specified that the national grid is its preferred way to provide electricity. Consequently, the government has been and is reluctant to heavily invest in off-grid options for rural electrification, barring remote villages

II. OVERVIEW OF THE ENERGY SECTOR

Although India has made considerable strides in village-level electrification rates over the last five years, household-level electrifications rates are still low and electricity supply remains inadequate. in 2016, 96% of all settlements (villages and cities) were electrified. A village is considered electrified if (i) it has a distribution transformer and distribution lines, (ii) it has electricity in public places and (iii) electricity is provided to at least 10% of the total households in the village.[18] Therefore, although village-level electrification rates are high and growing, 244 million people, or 19% of the population, still did not have access to electricity as of 2016.[19] Moreover, wide regional variations in household electrification rates exist, with the lowest rates in Bihar (16%), Uttar Pradesh (UP) (37%), Odisha (43%), and Jharkhand (46%).[20]

The Government of India (GoI) has attempted to tackle these access and supply issues through a number of different policies (discussed in the following section), most of which prioritise expanding and strengthening the national grid.[21] GoI announced its goal of reaching 100% village electrification by May 1, 2018 and universal household electrification by early 2019, and specified that the national grid is its preferred way to provide electricity.[22] As a result, GoI has been and is reluctant to heavily invest in off-grid options for the purpose of rural electrification barring remote villages (which are numerous).

To achieve these targets, India's USD 11 billion rural electrification programme – *Deendayal Upadhyaya Gram Jyoti Yojana* (DDUGJY) – involves both on-grid and off-grid components. Through DDUGJY, the government has identified 18,400 villages and towns to be connected through the 'grid extension scheme' and approximately 3,500 villages to be electrified through DRE via the Remote Village Electrification Programme (RVEP).[23,24] While work on grid extension is proceeding ahead of schedule (51% of target villages are already connected), the scheme has thus far only achieved 22% of the village-level off-grid target.[25]

[18] Goyal, R. Wiemann, M., Lahiri, S. and Dhage, V. K. 2015, The India Off-grid Electricity Market: Policy Framework, Players and Business Opportunities, EBTC/ARE [19] Census 2011

[20] Census 2011

[21] Brent, W. 2016, India: All Homes Electrified By 2019, Power for All http://www.powerforall.org/blog/2016/2/28/infographic-indias-247-power-for-all-progam [22] Government of India 2016, Key Features of Budget 2016-2017, Government of India, http://indiabudget.nic.in/ub2016-17/bh/bh1.pdf

[23] Under the RVEP, state governments are required to shortlist unelectrified villages in their states that are not likely to be electrified through the grid and have them verified and approved by the Rural Electrification Corporation (REC). These should

[24] Deign, J. 2016, India Gets Serious About Micro-grids, Green Tech Media http://www.greentechmedia.com/articles/read/india-gets-serious-about-microgrids

[25] REC India 2016, GARV Dashboard [Homepage of REC India], http://garv.gov.in/dashboard

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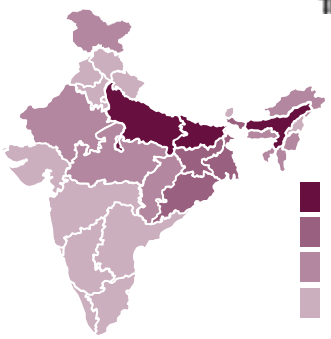
FIGURE 1: OVERVIEW OF THE POWER SECTOR IN INDIA[26]

Access to electricity

2016: 81% of households



Household electrification rates

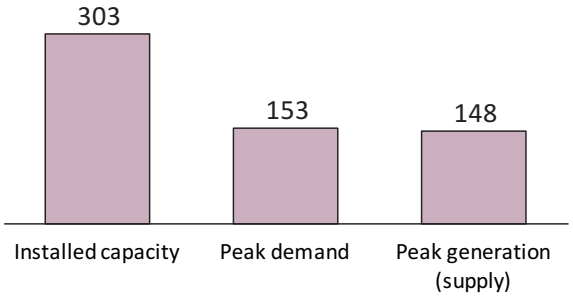
96% in urban areas

74% in rural areas

Target: 100% village electrification by 2018

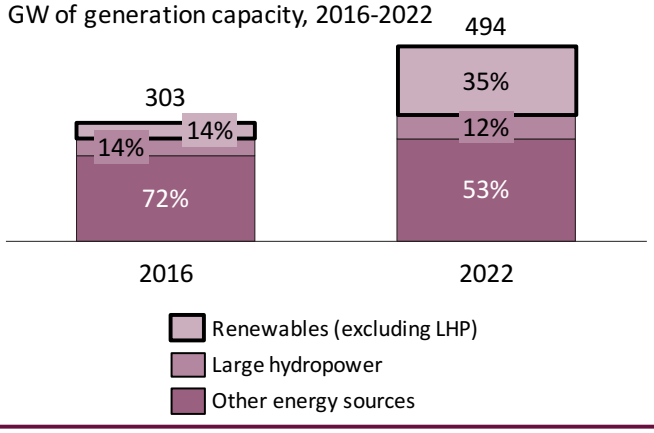
Electricity supply and demand

Electricity supply and demand
GW, 2016



Energy mix

Government of India generation targets
GW of generation capacity, 2016-2022



Renewable energy current capacity and targets
GW generation capacity (% of RE total), 2016 and 2022

Type	2016	2022
Biomass	5 (12)	10 (6)
Small hydropower	4 (9)	5 (3)
Solar	7 (16)	100 (57)
Wind	27(63)	60 (34)
RE total (excl. LHP)	**43 (14)**	**175 (35)**

[26] Sources for Figure 1: Census 2011, Central Statistics Office, 2016, Energy Statistics 2016, Government of India and IEA 2015, World Energy Outlook Special Report: India Outlook Energy, IEA

Most of the current renewable installed capacity is grid-connected, but there are ambitious targets to grow micro- and mini-grids over the next five years. The existing installed capacity of non-hydro grid-connected renewable energy (RE) is 43 GW; 63% is wind and 16% is solar.[27] 90% of current solar installations are grid-connected, urban/peri-urban installations; less than 2% are off-grid installations. The rest are systems for off-grid dedicated institutional users (e.g. telecom towers).[28] GoI has announced that it seeks to install 60 GW of wind power and 100 GW of solar power capacity by 2022.[29] Solar electrification in India is likely to continue to focus on commercially lucrative grid-connected urban and peri-urban installations. That said, the Ministry of New and Renewable Energy (MNRE) aims to deploy at least 10,000 RE-based micro- and mini-grid projects across the country with an aggregate installed RE capacity of at least 500 MW in next five years.[30]

While progress in grid extension and off-grid DRE growth in India continues to be encouraging, quality of energy access remains a key issue for policy-makers – and its importance will only increase. For those who are connected to India's grid, the quality of electricity supply tends to be poor; there are 20 million grid-connected households (95 million people) who receive less than hours of electricity each day. Recent large-scale survey work in Indian states with low access – which has started to focus on this question of energy access quality – shows that the actual electricity access situation remains grim in many of the 'connected' villages. There are low levels of grid uptime and half of nominally on-grid households report an effectively unusable level of energy access due to pervasive challenges of quality, reliability and duration of supply.[31] High levels of electricity-loss due to theft (up to 30%) exacerbate existing grid quality issues.[32] A related challenge is that distribution companies provide little power to rural household customers during peak times, instead supplying scarce power to industrial and urban consumers who pay significantly higher and less regulated tariffs.[33] For households accessing energy through off-grid DRE solutions, the quality issue likewise raises important questions. In most cases the level of energy supplied does not go beyond basic lighting and entertainment uses and does not enable productive energy use.[34] Given these grid quality issues, heavily subsidised kerosene, which costs the government $5 billion annually,[35] continues to be the primary source of lighting for 43% of rural India – despite the growing electrification rate.

[27] Central Statistics Office, 2016, Energy Statistics 2016, Government of India, p18

[28] Central Statistics Office, 2016, Energy Statistics 2016, Government of India, p18

[29] Buluswar, S., Khan, J., Hansen, T., Friedman Z. and Kumar U. J. 2016, Achieving Universal Electrification in India: A Roadmap for Rural Solar Mini-grids, Institute for Transformative Technologies

[30] Government of India 2016, Key Features of Budget 2016-2017, Government of India, http://indiabudget.nic.in/ub2016-17/bh/bh1.pdf

III. POLICY LANDSCAPE

KEY STAKEHOLDERS AND ROLES

Electricity is a concurrent central and state responsibility in India: the central government sets clear policies and guidelines and the state governments are responsible for ensuring energy access to their populations. The policy landscape is complex, with numerous players in the central government, the state government, the private sector, and civil society. A non-exhaustive summary of the key stakeholders follows.

- **The central government** – The Ministry of Power (MoP), which is responsible for the power sector and electrification as a whole, the Ministry of New and Renewable Energy (MNRE), which is dedicated to promoting renewable energy, and the Central Electricity Regulatory Commission (CERC) are the three key central government bodies responsible for setting, executing, monitoring and regulating national policy. Each has direct oversight of the renewable energy sector. There are also numerous technology-specific authorities at the national level, such as the Solar Energy Corporation of India (SECI), which promote renewable energy.

- **The state government(s)** – State governments are tasked with distributing electricity to their populations. State Electricity Boards (SEBs) supply electricity to the state by establishing the grid (in many cases they are bundled utilities dealing with generation, transmission and distribution). The State Electricity Regulatory Commission (SERC) determines tariffs and regulates state-level operations. State Nodal Agencies (SNAs) promote the use of RE at the state level.

[31] The Climate Group 2015, The Business Case for Off-grid Energy in India; and Abhishek, J., Sudatta, R., Karthik, G., Aklin, M., Chao-Yo, C., and Urpelainen, J. 2015, Access to Clean Cooking Energy and Electricity - A Survey of States., Council on Energy Environment and Water, New Delhi, India. http://ceew.in/pdf/CEEW-ACCESS-Report-29Sep15.pdf

[32] Min, B., and Golden, M. 2014, "Electoral cycles in electricity losses in India," Energy Policy, vol. 65, pp. 619-625. http://www.sciencedirect.com/science/article/pii/S0301421513009841

[33] See, Harish, S. M. and Tongia, R. 2014, Do Rural Residential Electricity Consumers Cross-Subside Their Urban Counterparts? Exploring The Inequity in Supply in The Indian Power Sector, Brookings India, http://www.brookings.in/wp-content/uploads/2014/09/Cross-subsidies-working-paper-August-v2.pdf

[34] It is in fact, unclear, that grid-connected households in rural India are more able to access productive energy use than DRE households; reported levels of productive energy use are low and recent research suggests that, as a result, the link between rural electrification and economic growth in India has been tenuous in recent years. See, e.g., http://ei.haas.berkeley.edu/research/abstracts/abstract_wp268.html, see also Burlig, F. 2016, Out of the Darkness and Into the Light? Development Effects of Rural Electrification in India,

[35] Bearak. 2016, Electrifying India with the sun and small loans New York Times http://www.nytimes.com/2016/01/03/business/energy-environment/electrifying-india-with-the-sun-and-small-loans.html?_r=1

• **Financial institutions –** There are two key central-level public financial institutions that fund the vast majority of RE projects in the country: the Rural Electrification Corporation (REC) that finances infrastructure and the Indian Renewable Energy Development Agency Ltd (IREDA) that specifically promotes and provides financial assistance for RE projects. There are also numerous state and rural banks, as well as private sector banks and investors active within the RE space. These include several sector-specific financing initiatives like the recently announced US-India Clean Energy Finance Initiative and the US-India Catalytic Solar Finance Programme.

• **Donors and global foundations –** Numerous donors and foundations work in India. The World Bank, Climate Works, the Shell Foundation, IFC, DfID and ADB are particularly active. In 2015, the Rockefeller Foundation launched the Smart Power for Rural Development (SPRD) programme to bring off-grid electricity to 1000 villages. In 2016, former president Barack Obama launched 'Mission Innovation' in India, which seeks to double clean energy R&D, including research on last mile connectivity challenges, by 2020.

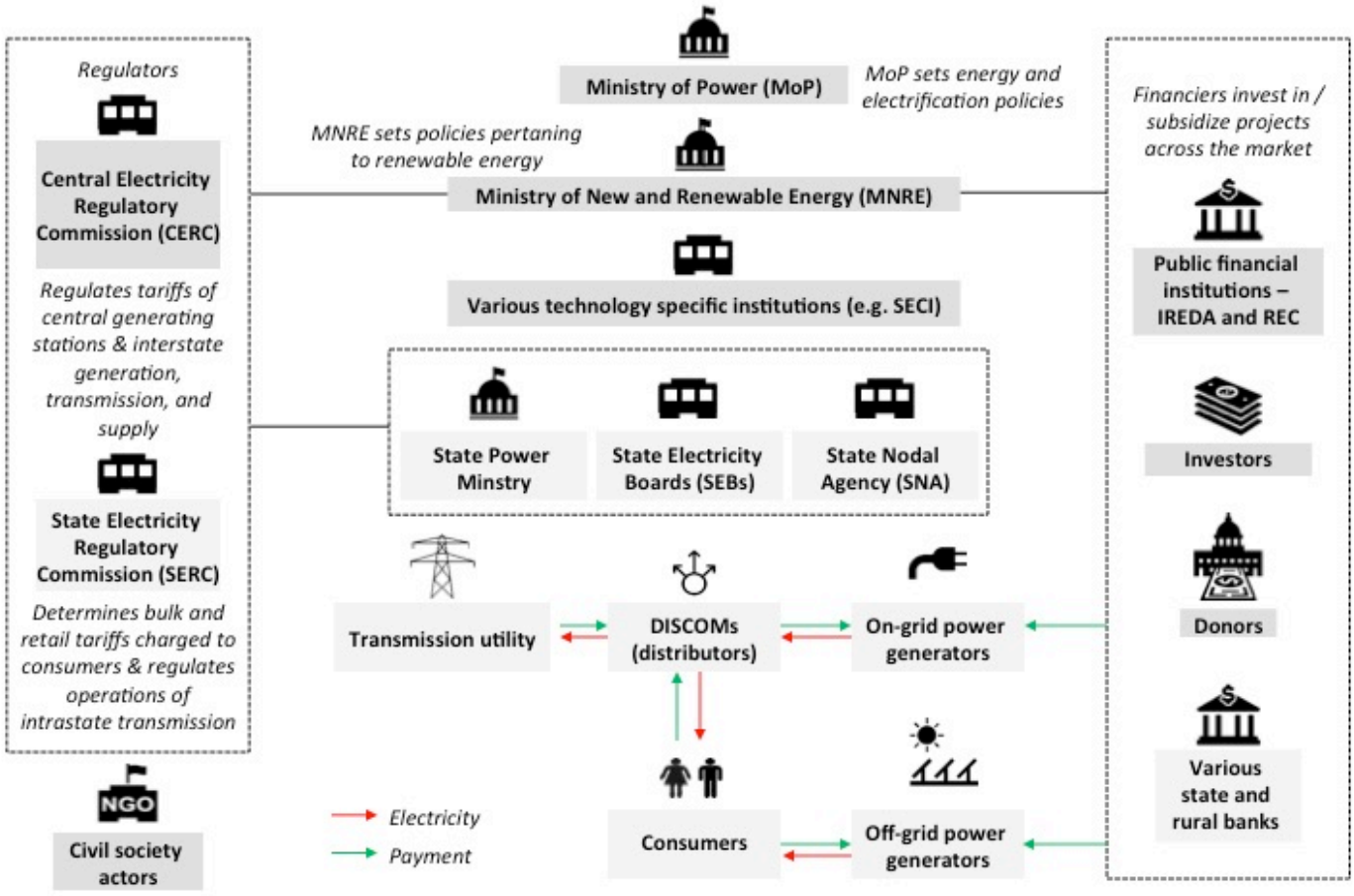
• **Civil society –** India has a robust civil society with a large number of local organisations (think tanks, NGOS, CBOs) dedicated to expanding rural electrification. These organisations have been instrumental in formulating policy, providing evidence and implementing village/community-level DRE electrification projects. TERI, Prayas Foundation, Shakti Foundation, Brookings India, Okapi, and the Institute for Transformation Technologies are particularly interested in developing off-grid enterprises.

• **Project developers**[36] **–** There are more than 80 companies operating in the solar mini-grid and SHS sector. These enterprises vary considerably in size and provide on-grid and off-grid products and services. Most companies operate in UP and Bihar, which collectively have 35 million unelectrified households. There are also a number of developers in Karnataka and these businesses tend to be connected to MFIs and rural banks that provide easy consumer financing. On average, each SHS enterprise sells about 1000 units per year and DRE enterprises serve 1000-2000 households each through their total installed capacity. Typically, smaller enterprises focus on single regions, whereas bigger players work in multiple states.

Figure 2 provides a schematic overview of the key players, their roles and relationships to each other. Annex 2.1 provides an extended list of key stakeholders.

[36] See: The Climate Group 2015, The Business Case for Off-grid Energy in India, for detailed list and overview of various businesses active within the sector in India

FIGURE 2: KEY STAKEHOLDERS, THEIR ROLES AND RELATIONSHIPS IN INDIA



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CURRENT POLICIES

Although policy attempts to promote renewable energy (outside hydroelectric energy) date back to the 1970s, the 2003 Electricity Act was the turning point for renewable energy in India. The Act removed licensing requirements for electricity generation and distribution in rural areas and allowed DRE enterprises to grow. Several other policies since aimed to support rural electrification through renewable energy.[37] The government's flagship electrification programme, the 2005 *Rajiv Gandhi Grameen Vidyutikaran Yojana* (RGGVY), recently retitled as *Deendayal Upadhyaya Gram Jyoti Yojana* (DDUGJY), outlined the importance of off-grid projects and provided subsidies for them. The Remote Village Electrification Programme (RVEP) (2005) initially supported the distribution of SHS in remote villages, and today provides up to 90% of capital subsidy for remote village-level DRE utilities.[38] The 2005 Village Energy Security Programme (VESP) (discontinued in 2012) provided capital subsidies of up to 90% for biomass-gasifier based off-grid systems through community based models.[39,40] The Jawaharlal Nehru National Solar Mission (JNNSM) (2010) boosted solar energy all across the country by incentivising solar power through 30% subsidy on capital costs and 5% on interest-bearing loans. Figure 3 summarises the key policies related to renewable energy and a comprehensive list of policies and programmes is provided in Annex 2.2.

[37] See Upadhyaya,S., and Badoni, M., 2014. A Handbook of Legal Options for Universal Service Obligation for the Energy Services in Rural India, Shakti Foundation for a detailed history of electrification policies in India

[38] Under the RVEP, state governments are required to short list unelectrified villages in their states that are not likely to be electrified through the grid and have them verified and approved by the Rural Electrification Corporation (REC). These should be villages where grid connectivity is either not feasible or not cost-effective. Off-grid energy will be provided to these villages.

[39] Mishra, A., Sarangi, G. K. and Wadehra, S. 2016, 'Off-grid Energy Development in India: An Approach towards Sustainability,' Economic & Political Weekly, vol. LI, no. 22

[40] The Climate Group 2015, The Business Case for Off-grid Energy in India

Photo credit: Image from PWRDF https://www.flickr.com/photos/45005153@N07/5257440405/in/photolist-91zKSe-4TL5sh-4TL2suPage

FIGURE 3: KEY POLICIES AND PROGRAMMES RELATED TO RENEWABLE ENERGY AND ELECTRIFICATION IN INDIA

Policy	Description
Electricity Act (2003)	• Removed the mandatory licensing requirement for distribution of electricity in rural areas • Mandates SERCs to take steps to promote RE and prescribes guidelines for SERCs to determine feed in tariffs (FiTs)
Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) (2005) *Deen Dayal Upadhyaya Gram Jyoti Yojana* (DDGJY) (2015)	RGGVY: • First supported the distribution of SHS and lanterns in remote villages and then supported mini-grid installations in villages that do not fall within the central grid extension schemes • Provided up to 90% capital subsidy for villages to install DRE utilities DDUGJY: • Replaced RGGVY in 2015 with an outlay of INR 760 billion (USD 11 billion) for implementation of the projects • In addition to providing electricity to all villages, the scheme aims to (i) develop feeder separation to ensure sufficient power to farmers and regular supply to other consumers, (ii) improve the sub-transmission and distribution network to improve the quality and reliability of the supply, and (iii) implement metering
Jawaharlal Nehru National Solar Mission (2010)	• Aims to install 20,000 MW of grid-connected solar PV systems and 20,000 MW of off-grid solar PV systems to provide electricity access by 2022 • Provides 30% capex subsidies for solar projects • Resulted in the creation of IREDA, which is responsible for refinancing solar projects
National Tariff Policy (2016)	• Promotes RE as viable energy solution, outlining details regarding tariffs for grid interactivity to be implemented by the state governments • Increases renewable purchase obligations (RPO) to 8% by 2022 (currently RPO is below 1% in most states)
Draft Mini-Grid Policy (2016)	• Goal is to mainstream RE mini grids to enhance access to affordable energy services and improve the local economy • Sets norms and standards for establishing mini-grids. Includes project development procedures, tariffs, financing, subsidies and operational frameworks • Provides guidelines on grid interconnectivity • Still in draft stage and in the process of review of public comments

KEY TRENDS

Recently, India has seen substantial policy wins at the national and state level promoting mini-grid development. Notably the National Tariff Policy (NTP) (2016) addresses some of the long-standing policy uncertainty regarding tariffs and grid interactivity. The NTP outlines preliminary regulations for interaction between the grid and mini-grids, which should, in theory, improve project and investor security. It also increased state renewable purchase obligation (RPO) targets to 8% by 2022 and removed inter-state transmission loss charge for renewable power, making it financially viable for project developers in a resource-rich state to target PPAs in another state.[41]

Similarly, the Draft Mini-Grid Policy (2016) – on which MNRE is still soliciting comments – provides clarity on tariff regulations, streamlines project development procedures for ESCOs and outlines operational frameworks to operate alongside the DISCOM, among other measures. The policy binds the ESCO to set tariffs with the state government if the ESCO has utilised a state subsidy. Other recommendations include creating local committees for payment collection and specifying quality and performance standards. Once public comments are incorporated, the policy will be modified and enter the ratification process (which could take up to a year). Once ratified, individual state governments will announce their policies for implementation. These policy developments are resulting in wider awareness of mini-grids as a viable solution for rural electrification. All in all, the policy landscape in India is considerably more conducive to DREs than even just a year ago.

The GoI has also developed the Renewable Energy Certificate (REC) mechanism to ensure that different states, despite their different endowments of renewable resources, are able to meet their renewable purchase obligations (RPOs). ESCOs and states that generate renewable energy are issued tradable RECs, allowing states to fulfill their RPO obligations by buying certificates from states that exceed their RPO obligations.[42] The GoI also allows off-grid enterprises to trade RECs, thereby providing them with an additional source of revenue – though typically RECs are utilised by larger RE enterprises. The REC system is in early stages and it remains to be seen how effective it is in supporting the growth of RE in the country.

The GoI seeks to develop more coherent RE policies and has, for this purpose, formulated a Draft Renewable Energy Act. The Act establishes a comprehensive framework for domestic and foreign investment in RE, clearly outlines the institutional structure and powers (central, state, regulation) regarding RE, legislates the need for a national renewable energy policy, mandates a detailed renewable energy resource assessment, and seeks to establish a national RE fund and appoint a National Renewable Energy Advisory Group. Once the Act is passed, it is likely that MNRE will develop an integrated national renewable energy policy soon after to provide clear guidelines and targets.

Despite the fact that the central government sets a single set of policies for the entire country, variations in electrification outcomes are vast, as Figure 1 illustrates. State governments are in charge of adopting and implementing electrification policies. For example, the National Tariff Policy 2016 is a guideline, which states have to adopt. Similarly, each state is required to come up with its own rural electrification plan. At the same time, each state has its own set of political-economy concerns and imperatives. Typically, states with politically influential rural constituencies have higher rates of electrification. For example, Maharashtra has historically had powerful rural communities, which have directed state energy policy accordingly. Rural communities in other states like Odisha have been less able to sway political parties to focus on their economic and energy needs.[43] Unsurprisingly, there is also wide variation among states in the adoption of and support for DRE. States with low electrification rates such as UP, Bihar, and Odisha have been pushing off-grid generation more aggressively in recent years than other more electrified states, such as Maharashtra. There policy efforts are focused on strengthening the grid. Different states have different incentives for and capacity to develop and implement DRE/electrification plans.

[41] http://www.ey.com/IN/en/Newsroom/News-releases/ey-national-tariff-policy-greatest-impact-on-renewables

[42] "Renewable energy generation companies can sell electricity to a local distribution licensee at the rates for conventional power and can recover the balance cost by selling certificates to other distribution companies and obligated entities enabling the latter to meet their RPOs" National Tariff Policy 2006 (2016), p30

[43] Kale, S. 2014. Electrifying India: Regional Political Economies of Development. Stanford University Press

In mid-2016, Uttar Pradesh became the first state to formulate and pass a mini-grid policy that provides clarity on tariffs and grid interactivity. The policy separates projects into two categories:

(i) State-subsidised: These projects receive 30% capital subsidy as long as the developer establishes the project in a village identified by the state government and provides it with at least eight hours of electricity per day. For such projects, the state has set the tariff at INR 60/month for a 50 watt load and INR 120/month for a 100 watt load of eight hours of electricity per day. ESCOs argue that these rates are 50% of what they consider to be financially sustainable.[44] Accordingly, these tariffs are now under review.[45]

(ii) Self-identified: For self-identified projects (under 500 kW) that do not utilise government subsidies, there are no restrictions on site selection, tariffs, generation, or distribution.

In both cases, the exit processes for when the grid arrives are clear – the grid will receive the energy generated from the mini-grid for a tariff that is mutually decided (although it is not clear what would take place if the two parties cannot come to an agreement). The project can be transferred to the DISCOM if the developer so chooses. Other poorly electrified states like Bihar and Odisha are learning from UP and developing their own mini-grid policies, in consultation with civil society groups and ESCOs.[46]

Finally, there are also several promising developments within the DRE financing landscape. Recently, domestic actors, international donors, multilaterals, and development finance institutions have announced plans to support DRE activities in India. For example, the US government and GoI recently announced the $20 million US-India Clean Energy Finance Initiative and the $40 million US-India Catalytic Solar Finance Programme.[47] Both seek to mobilise resources from US foundations and GOI – and together these initiatives could unlock nearly $1.5 billion in capital.[48] Meanwhile, the World Bank announced it seeks to provide more than $1 billion in financing to support solar energy generation in India. As a last example, in late 2015, BMZ/KfW announced one billion euro German-Indian solar partnership, which will in part fund off-grid solar facilities over the next five years.[49] Although most of this financing is geared towards grid-connected solar, overall financing trends are positive and could help fuel future growth of the DRE sector.

The National Tariff Policy (NTP) (2016) addresses some of the long-standing policy uncertainty regarding tariffs and grid interactivity. which should, in theory, improve project and investor security.

[44] Palit, D. 2016. Scaling up Micro-grids in India: Connecting the dots. Microgrid News. http://microgridmedia.com/scaling-micro-grids-in-india-connecting-dots/

[45] Stakeholder interviews, 2016

[46] Stakeholder interviews, 2016

[47] FACT SHEET: The United States and India – Moving Forward Together on Climate Change, Clean Energy, Energy Security, and the Environment 2016, [Homepage of Office of the Press Secretary, The White House]:https://www.whitehouse.gov/the-press-office/2016/06/07/fact-sheet-united-states-and-india-%E2%80%93-moving-forward-together-climate

[48] World Bank, 2016. India Sign Deal to Boost Solar Globally 2016, [Homepage of World Bank Group], http://www.worldbank.org/en/news/press-release/2016/06/30/world-bank-india-sign-deal-to-boost-solar-globally

[49] KfW, 2015 Strong support for climate protection in India 2015, [Homepage of KfW], https://www.kfw.de/KfW-Group/Newsroom/Aktuelles/Pressemitteilungen/Pressemitteilungen-Details_304448.html

FIGURE 4: OVERVIEW OF CURRENT POLICIES RELATED TO DRE IN INDIA

Policy area	Current policies	Gaps and challenges
High-level strategy and targets		
Energy mix	• At present, RE (excluding large hydropower) forms 14% of total generation capacity (wind 64%, solar 12.6%, and biomass 11.7%)[50] • Target: RE should constitute 36% of total generation capacity by 2022 • Aggressive push to improving India's energy security and diversifying energy mix through a range of RE policies (see Appendix B)	
On-grid electricity	• The government's top priority is to extend the grid. Goal is to electrify 100% villages by 2018[51] • 90% of solar projects are grid connected urban/peri-urban installations[52]	• Multiple barriers related to financing, state level implementation and political issues, infrastructure challenges, and theft/loss, among others. Not covered in detail in this document
Off-grid electricity	• Numerous policies to support the generation of off-grid electricity, most recently the Draft Mini-Grid Policy 2016 and NTP 2016 • <2% of existing solar generation is off-grid (<1% SHS, 1% community mini-grids)[53]	• Despite major progress and a promising new Draft Mini-Grid Policy, a number of issues are likely to remain including (i) setting appropriate tariffs for mini and micro grids, (ii) lack of clarity about when the grid could arrive (which has implications for off-grid business models) • Translation of the national policy into state-level enabling regulations (currently only early stage example in UP)
Grid interactivity	• National level: NTP 2016 and Mini grid regulations provide much needed clarity on grid interactivity, providing guidance on tariffs and operation • State level: UP Mini-grid regulation provides clarity on grid interactivity. Other states are yet to develop their policies	• See details in previous row • Planning: Lack of integrated transmission planning considering RE and weak and old transmission infrastructure. No clear technical standards for mini-grids to be compatible with the grid (MNRE's responsibility) • Construction: No uniform grid interconnection process, inadequate funds for transmission infrastructure development, numerous right of way and local challenges • Operation: Difficulty forecasting and scheduling RE and managing grid instability • State-level policy development and implementation: Only UP has a Mini-Grid Policy, other states still have to develop theirs

[50] Central Statistics Office, 2016, Energy Statistics 2016, Government of India

[51] Government of India 2016, Key Features of Budget 2016-2017, Government of India

[52] Buluswar, S., Khan, J., Hansen, T., Friedman Z. and Kumar U. J. 2016, Achieving Universal Electrification in India: A Roadmap for Rural Solar Mini-grids, Institute for Transformative Technologies

[53] Buluswar, S., Khan, J., Hansen, T., Friedman Z. and Kumar U. J. 2016, Achieving Universal Electrification in India: A Roadmap for Rural Solar Mini-grids, Institute for Transformative Technologies

Electricity regulations and incentives		
Economic/fiscal	• **Taxation:** Most RE inputs are exempt from duty. Local VAT and other taxes amount to 5% in most states at present • **Tax exemption DRE** enterprises benefit from a 10-year tax exemption • **Cess on coal:** There is a 400 Rs/tonne cess on coal, making solar more price competitive • **Kerosene subsidy:** kerosene (40%) subsidy available to the rural poor through the public distribution system. 2016 policy shift to convert the subsidy into a direct cash transfer. Implementation will take place in eight states. Providing cash to consumers may make off-grid solutions more commercially viable[54]	• **Upcoming general sales tax (GST) policy:** The upcoming shift to GST could result in 12-20% increase in input cost/tariffs in renewables because at present there is no import duty or indirect tax on solar modules. Under GST, 17-20% tax would be levied. 55 There are some ongoing discussions taking place at MNRE about solar products becoming GST-exempt[56] • **Kerosene subsidy:** This subsidy is likely to continue to skew incentives against off-grid solutions at the consumer level. Although eight states are experimenting with direct cash transfer, it will take a long time before the subsidy is eliminated (if at all)
Tariffs	• **On-grid:** Tariff determined by SERCs in each state and ceiling is set by CERC • **Feed-in tariff:** NTP 2016 stipulates that feed-in-tariffs will be determined by competitive bidding process to keep the tariff low. Where procurement is not taking place through competitive bidding, the tariff ceiling is set by CERC[57] • **Off-grid:** For off-grid systems, ESCO can set the tariff in mutual agreement with customers. In UP, the state government sets the price if ESCO utilises a state subsidy • **Inter-state trading:** NTP 2016 stipulates that no inter-state transmission charges and losses can be levied on renewables	• **On-grid:** Concern that there is a large variation between FIT approved by SERCs across states and FIT determined by CERC, whereas, capital costs, return on finance, etc. remain the same across states • **Feed-in-tariff:** At present state governments set FiT based on larger capacity grid-connected systems. But FiTs for mini and micro grids should not be the same as FiT for larger capacity grid-connected systems[58] • **Off-grid systems:** In UP, ESCOs argue that the tariff set by the state government for those ESCOs that use state subsidies is too low for financial viability.[59] Governments need assistance in setting appropriate tariffs.[60]
Licensing and contracts	• **Generation:** Electricity Act 2003 states that no license is required to "establish, operate and maintain a generation station" in a rural area as long as technical standards are met. • **Distribution:** Electricity Act 2003 states that operators require distribution license unless under exemption (e.g. local authority, cooperative society, village councils *(panchayat)*, NGOs of franchisees)[61] • **Renewable Purchase Obligations (RPO):** NTP 2016 increased solar RPO to 8% of the total energy consumption by 2022. Wide variation across states. • **Renewable Electricity Certificate (REC) mechanism:** Although designed for state electric companies to meet their RPOs, the GoI allows off-grid enterprises to receive and sell RECs.	• **RPO:** No uniform RPO M&E mechanism in place and no clear penalty for non-compliance with RPO. Poor financial health of DISCOMs makes it difficult for them to meet their RPO targets • **PPAs:** Although PPAs are being standardised, they vary substantially at present and this makes project due diligence and closure time consuming. There maybe scope to bring in models of PPA from elsewhere. • **RECs:** Registration and monitoring costs of RECs are high and discourage small ESCOs from taking advantage of them. Larger enterprises could find them attractive, but not much uptake has taken place until now[62]

[54] Singh, P.S., 2016 Direct transfer of kerosene subsidy: All you need to know. Business Standard http://www.business-standard.com/article/economy-policy/direct-transfer-of-kerosene-subsidy-all-you-need-to-know-116010200252_1.html

[55] Bridge to India 2016, GST poses a big risk for the Indian solar industry, Bridge to India http://www.bridgetoindia.com/blog/gst-poses-a-big-risk-for-the-indian-solar-industry/

[56] Ministry of New and Renewable Energy (MNRE), 2016. Implications of GST on delivered cost of renewable energy

[57] Ministry of Power 2016, Tariff Policy, No. 23/2/2005-R&R (Vol-IX), http://powermin.nic.in/sites/default/files/webform/notices/Tariff_Policy-Resolution_Dated_28012016.pdf.

[58] Palit, D. 2016. Scaling up Micro-grids in India: Connecting the dots. Microgrid News

[59] Palit, D. 2016. Scaling up Micro-grids in India: Connecting the dots. Microgrid News

[60] Stakeholder interviews, 2016

[61] Ministry of Power 2003, The Electricity Act 2003

[62] The Climate Group 2015, The Business Case for Off-grid Energy in India, for detailed list and overview of various businesses active within the sector in India

Financial support	• **Grants and subsidies:** Numerous grants and subsidies under the various policies that can add up to 90% of capital costs (see Figure 3): • Generation based incentives (GBI) is a direct subsidy paid over and above the tariff for each unit being fed into the grid e.g., GBI for wind in 2016 is 0.50/kWh • Accelerated depreciation (AD) speeds up the depreciation in value of wind projects in the financial year after commissioning of a project, reducing tax liability. GoI allows up to 80% AD in the first year. One of the most significant drivers of added RE capacity, primarily benefitting the rooftop solar market. AD will likely be phased out/reduced in 2017. • Rooftop solar subsidy scheme has allocated USD 70 million for rooftop solar. It provides 30% capital subsidy for rooftop installations in 'general category' states and 70% for 'special category' states • National Clean Energy Fund established to fund projects and research in renewable energy • *Deendayal Upadhyaya Gram Jyoti Yojana* has $11 billion for rural electrification • **Lending:**[63] • Priority sector lending policy stipulates that 40% of bank lending must be to "priority sectors," which includes renewable energy • IREDA has refinancing facility which makes loans to off-grid solar projects • Foreign lending is possible but RBI approval is difficult and time-consuming	• **Grants and subsidies** • Difficulty receiving timely disbursements of GBI from IREDA • Applications for financing are time consuming • All subsidies are capex subsidies and there are no operations/management subsidies available. This comes from an entrenched approach to providing subsidies as once off disbursements rather than ongoing results-oriented disbursements[64] • **Lending** • Although there are numerous financial players interested in the RE space, there is effectively little priority lending for the RE sector given the perceived risk • Insufficient long tenure finance and debt in the market and debt interest rates are high for most off-grid enterprises
Procurement policies	• **DISCOMs:** Purchase RE power at state-stipulated feed-in-tariff rates or via RECs • **Open access consumers:** Buy power through open access, putting up captive generation plants	
Enabling policies		
Mobile regulations	• Mobile operators are required to work with banks to provide mobile money services[65] • Regulations of PAYG systems are currently the responsibility of the Reserve Bank of India	• Having to work with banks limits the scalability of mobile money (e.g. cannot use shopkeepers who sell airtime as banking vendors)

[63] The Climate Group 2015, The Business Case for Off-grid Energy in India, The Climate Group, http://www.dalberg.com/wp-content/uploads/2015/02/The-business-case-for-offgrid-energy-in-India.pdf

[64] Stakeholder interviews, 2016

[65] Mirani, L., 2016: Why mobile money has failed to take off in India, Quartz: http://qz.com/222964/why-mobile-money-has-failed-to-take-off-in-india/

Project development		
Site identification and permissions	• Private ESCOs arrange for land and right-of-way permissions, seek local government and community consent, and deal with other aspects. The draft Mini-Grid Policy recommends simplifying and standardising project development practices and creating a single window support channel (e.g., a special RE mini-grid promotion cell instituted for this purpose).	• Process of site selection and obtaining all the requisite clearances is very time consuming.
Resource assessment	• **State-level:** The MNRE conducts resource assessments for various renewable energy sources. • **Project-level:** The project developer/ESCO assesses resources	
Land procurement	• Land policies vary by state • Land has to be secured by project developer • If the state desires, it can acquire land under eminent domain through the Land Acquisition Act, as long at it determines that the project is in the 'public interest' and resettles and rehabilitates people living on the land	• Finding land, obtaining appropriate clearances and right of way is a major and time-consuming hurdle faced by most project developers

IV. EMERGENT POLICY QUESTIONS

Desk research and interviews with key stakeholders revealed four important points that help frame the emergent policy questions:

1. The grid, however faulty, is likely to reach most villages in the medium-term, and indeed most central and state government electrification efforts are geared towards ensuring this. The imminent arrival of the grid has implications for DRE players, which are discussed below.
2. Policies at the national level are largely in place or under development. The main challenge, according to those we interviewed, is not lack of information, but rather key political-economy challenges at the state level.
3. Most existing renewable energy projects are grid-connected and urban/peri-urban. There are concerns that the economics do not work in rural areas, especially given the presence of the grid.
4. Improving the quality of electricity access is a core policy priority. In particular, the question of how to ensure sufficient electricity for productive economic activities is an increasingly important one.

Given this, Figure 5 below summarises the key policy questions that emerged through desk research and interviews with key stakeholders in India:

FIGURE 5: SUMMARY OF KEY QUESTIONS FOR POLICY-MAKERS AND INFLUENCERS IN INDIA

Stakeholder	Key questions
	High-level strategy and targets

Policy-makers	• **Electrification quality:**
	  o What is the extent and quality of electrification across India? "*Take a village that has been declared as so-called "electrified" and examine what has actually taken place and what still needs to be done to ensure meaningful access?*" [66]
	  o What is the most effective way to ensure sufficient energy for productive economic activity in rural areas (DRE vs. low-quality grid)?
	• **Grid vs. off-grid:** Where should the grid be expanded and where could mini-grids be cheaper than the grid, if at all? This data would assist with remote village identification at the state level.
	• **DRE business models:** What are the kinds of anchor loads different kinds of village/community/ set of activities can produce?
	• **Plant performance:** How have mini and micro-grids performed over the last five years?
	• **Tariffs:** What is the appropriate FiT for micro/mini-grid? (Current FiT are determined for large-scale, grid-connected solar)
	• **Replicability and scale:** "*Which of these DRE models are replicable at scale and how can we measure their impact in a standardised fashion?*" [67]
	• **Grid interactivity:**
	  o What happens when the grid arrives? What is the evidence from existing mini-grids?
	  o "What are the 'dangers' and solutions of adding wind/solar to the grid? Grid-stabilising is a common argument used against micro-grids and evidence is needed to change the narrative" [68]
	  o How can a private mini-grid utilise any existing public infrastructure in an area that has government-built poles and cables but has no actual electricity? Where the grid already exists, what are the possible models for utilising existing grid infrastructure? What are the cost implications?
	• **Efficacy of subsidies:** "*You've had up to 90% capital subsidy available for DRE for years and yet you only have a handful of projects that have taken off. Why is this? How could subsidies be designed/implemented more effectively?*" [69]
	• **Effectiveness of RECs:** Have RECs been an effective way of increasing renewable generation at the local level? What are the barriers to their effectiveness?
	• **Policy impact:** What has been the impact of the UP Mini-Grid Policy on the growth of DRE?What are the key learnings here for other states?

Policy influencers (private sector companies, NGOs, donors)	• **Local energy access visualisation:** "*What does energy access looks like in a particular area, e.g., if I go to X town/village, who do I need to work with? What are the companies in the area - their sales, rating and customer satisfaction?*" [70] • **Standards and ratings:** "*Can we develop standards for off-grid RE products, suppliers and service providers, which should include consumer-relevant parameters like quality and output, development of star rating systems for RE consumer products, third-party certification from approved laboratories etc?*" [71] • **Making micro-grids scalable:** "*Could you use data to make micro-grids scalable and large enough for a commercial bank/local government or decision maker to be interested in them? Could we use satellite data to understand village layouts, and build optimal grids (main cost of the grid is laying it down) comprising a series of micro-grids so that collectively they are 50MW? Suddenly more players will be interested in playing in this space and more resources will be available. The bigger portfolio could be taken to a range of decision makers.*" [72] • **Big picture cost analysis:** While costs have fallen dramatically for RE, it is not clear how much this is a function of explicit subsidies, implicit subsidies and externalities of RE not priced in. What are the 'real' economics of DRE in India? [73]

[68] Stakeholder interviews, 2016 [69] Stakeholder interviews, 2016 [70] Stakeholder interviews, 2016 [71] Stakeholder interviews, 2016 [72] Stakeholder interviews, 2016

[73] Tongia, R. 2016. How will India's ambitious clean energy targets be financed? Brookings India http://www.brookings.in/brookings-india-roundtable-discusses-prospects-of-clean-energy-clean-tech-in-india/

	• **Financial data:** What is the current gap between demand and supply, benchmark costs and project returns for DRE in various areas? "*Lack of quality data in the public domain…financial institutions do not understand the nuances of the market*"[74] • Are there **models to provide incentives for community DRE electrification** (e.g. household is provided a one-time subsidy for getting connected to the mini-grid)? How would they be structured and what would they cost? • **Local manufacturing value chain:** What is the feasibility of large-scale manufacturing of RE technologies in India? A thorough operational analysis to determine the feasibility ideally could be done in partnership with an established utility provider who can commit to large-scale advance procurement guarantees.

V. POLICY CHALLENGES AND OPPORTUNITIES

Assessment of current policies and expert interviews suggest that lack of clarity around grid interactivity, scepticism of the economics of off-grid energy, and lack of data to inform policy-maker and market decisions are barriers to the growth of DRE in India. Other notable barriers include limited capacity at the local level and insufficient and inappropriate finance. The sections below provide additional detail on each of the top three barriers, current efforts to address them, and remaining opportunities.[75]

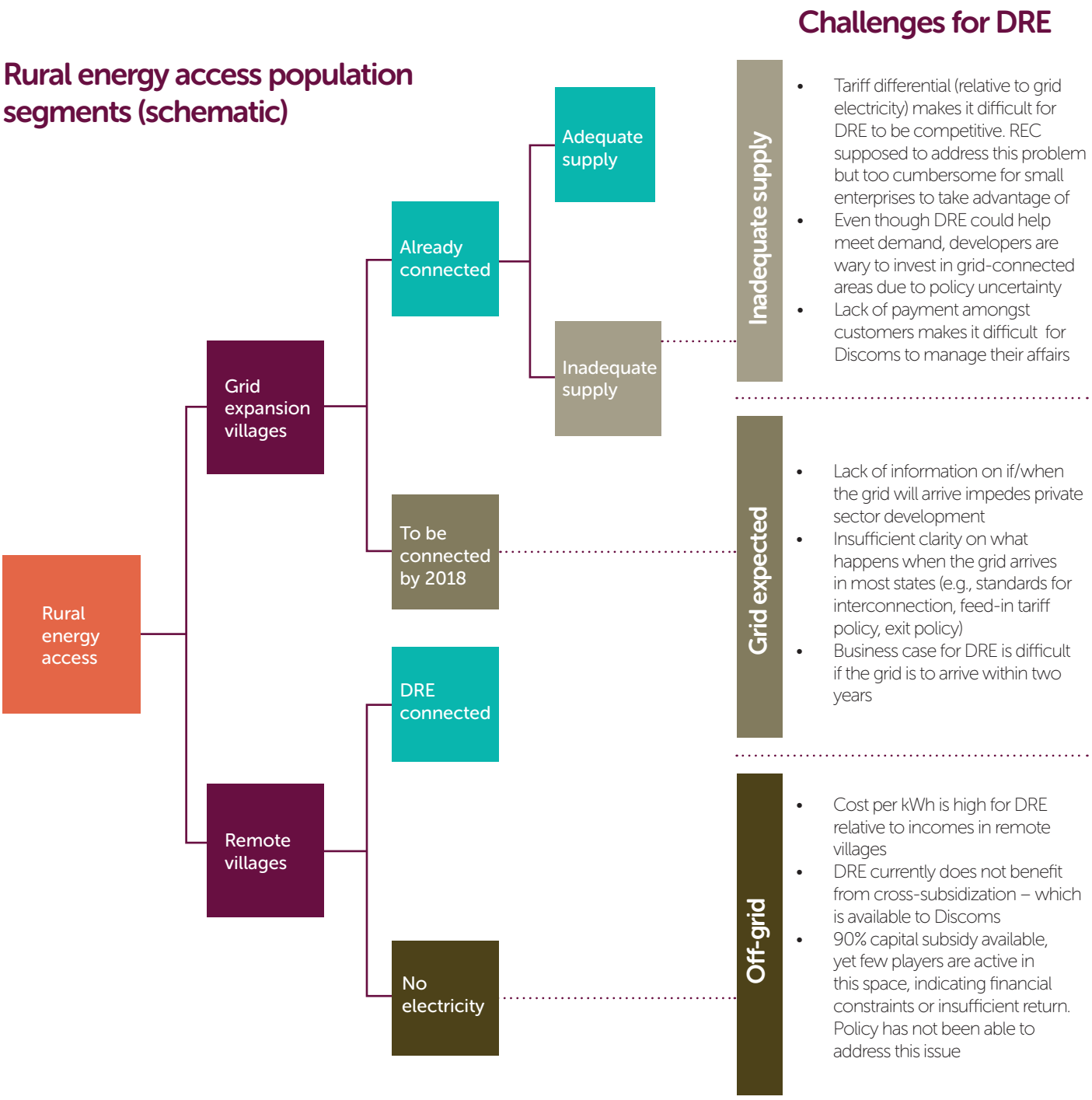
Before diving into the challenges, it is important to recognise that the DRE landscape in India is segmented and that the challenges are different for each of the segments. If increasing energy access is a combination of increasing the number of connected households and ensuring meaningful electrification then rural India has three key groups: (i) grid connected villages with inadequate supply, (ii) villages where the grid is expected to reach in the next 2-5 years, and (iii) unelectrified remote villages.

Figure 6 provides a schematic overview of the challenges each segment faces and they are discussed further below.

[74] The Climate Group 2015, The Business Case for Off-grid Energy in India, The Climate Group, http://www.dalberg.com/wp-content/uploads/2015/02/The-business-case-for-offgrid-energy-in-India.pdf., p65

[75] Please see the policy insights Excel (to be completed at the end of the engagement) for a comprehensive list of barriers

FIGURE 6: CHALLENGES TO DRE GROWTH BY VILLAGE SEGMENT IN INDIA



LACK OF CLARITY AROUND GRID INTERACTIVITY

Description: Although the Draft Mini-Grid Policy and the NTP provide clarity on what happens when the grid arrives, GoI's target to ensure 100% grid electrification by 2018 (which will likely not be met in a meaningful way) has significantly increased the risks faced by DRE ESCOs. The challenges are two-fold. First, those villages that are already grid connected but do not have adequate supply face the challenge of differential pricing (where the grid electricity is provided at a highly subsidised rate to farmers and tends to be much cheaper than the DRE option). Second, for those villages where the grid is to come in the next 2-5 years, the business case for DREs becomes much more difficult.

There is no policy clarity on when the grid will arrive because the government cannot provide it. Given that access to electricity is an electoral issue, it is difficult for the government to announce which areas will be grid-electrified first, last, or never. There are concerns about lack of data/guidelines on core operational elements of the mini-grid when encountering the grid, particularly around the price at which the government/DISCOM will buy electricity or assets from the DRE enterprise.

Efforts to address the barrier: Different states view the challenge of grid interactivity differently, with some states like UP, Bihar and Odisha keen on expanding off-grid solutions. State governments are aware that there is scope for an expanded REC policy to address the differential pricing problem and provide greater clarity on grid interactivity at the state level to ensure that DRE becomes a complement to rather than competitor to the grid. UP's Mini-Grid Policy is a step in that direction and other states are likely to announce their own policies based on the outcomes of the UP Mini-Grid Policy.

Opportunities:

- **Monitor and evaluate UP's mini-grid policy** and derive lessons for other states
- **Assist various state governments with developing their own mini-grid policies** to address grid interactivity in their own states
- **Develop clear technical standards for grid compatibility**, allowing mini-grids to easily connect to the grid when it arrives

SCEPTICISM ABOUT THE ECONOMICS OF DRE

Description: Although the cost of power from DRE has fallen significantly over the last few years, it still remains higher than conventional grid power. Numerous policy-makers cited the lack of scalable and financially viable business models as the core reason the government does not actively promote DRE over the grid. Policy-makers and investors feel that although there are examples of profitable mini-grid operators, it remains unclear whether their model is replicable and/or scalable. Furthermore, mini-grid plant performance (and data collection on plant performance) is not convincing and/or adequately measured. Investors and policy stakeholders consistently demand proof-points on plant-level performance; in its absence, credibility of the commercial viability of the sector remains low. Moreover, plant/model data does not exist in a standardised and comparable manner, making it difficult for the government to understand the viability of one model relative to another. Finally, ESCOs are often reluctant to share their pricing data, making them difficult to evaluate.

Efforts to address the barrier: The Rockefeller Foundation is conducting a study of the mini-grids that are part of their Smart Power for Rural Development initiative. This will begin to shed light on this question, but more research and advocacy needs to be done.

Opportunities:

- **Assessment of anchor load models:** Conduct research to answer what are the different kinds of productive anchor clients (besides telecom towers) that would make mini-grids viable? What kind of communities and activities can produce what kind of anchor loads? Studies at present are ad hoc and not systematically assessed to feed into a decision tool.
- **Research to promote scale:** How can DRE models be replicated? Which models of DRE can be replicated in which areas? Some case studies exist but studies need to be generalizable.
- **Assess existing mini-grids**: Conduct a large-scale study of mini-grids plant performance to understand location, profitability, tariffs, subsidy received, etc.

ABSENCE OF DATA

Description: Although the central and state governments conduct numerous surveys and have reasonably good macro- and micro-data, a number of interviewees cited the need for better village and sub-station level data on the extent and quality of electrification. At present this data is collected through the Census, the NSSO, and through state government reports. Estimates of true rates of electrification vary across sources. The lack of this data significantly impacts the ability to plan at the local level.

Efforts to address the barrier: Some states e.g., Karnataka and Andhra Pradesh, monitor grid-connected data in real time through a SCADA (supervisory control and data) system, which captures information on load shedding, energy usage, etc. at the local level. Targeted survey work by some researchers reveals that deeper micro-data is valuable in examining the question of energy access quality.[76]

Opportunities:

- **Conduct an electrification survey focused on quality:** Support national or regional electrification surveys to include electricity generation/distribution at the substation level, connection, electricity access, electricity quality, load shedding, costs, use, and willingness to pay.

[76] Jain, A., Ray. S., Ganesan, K., Aklin, M., Cheng, C. & Urpelainen, J. 2015, Access To Clean Cooking Energy And Electricity: Survey of States, Access. http://ceew.in/pdf/CEEW-ACCESS-Report-29Sep15.pdf

ANNEX 2.1: KEY STAKEHOLDERS

Name of institution	Function
Central government	
Ministry of Power (MoP)	Ministry concerned with perspective planning, policy formulation, processing of projects for investment decision, monitoring of the implementation of power projects, enactment of legislation regarding thermal, hydro power generation, transmission, and distribution
Ministry of New and Renewable Energy (MNRE)	Nodal ministry for all matters relating to renewable energy
Central Electricity Regulatory Commission (CERC)	Electricity regulator at the central level that regulates tariffs of central generating stations as well as interstate generation, transmission and supply
Central Electricity Authority (CEA)	Created to provide assistance and advice to state electricity boards. It also advises the government on matters relating to the national electricity policy, sets standards for construction of electrical plants, electric lines and connectivity to the grid, installation and operation of meters and safety and grid standards
State government	
State ministries of power	State ministries that are responsible for perspective planning, implementation of power projects, and enactment of legislation regarding power generation, transmission, and distribution in their states
State Electricity Regulatory Commission (SERC)	Electricity regulatory body at the state level whose main functions include determining bulk and retail tariffs charged to consumers and regulating operations of intra-state transmission
State Electricity Boards (SEBs)	Supplies electricity to the state by establishing the grid. The SEBs were bundled utilities dealing with generation of electricity, developing the transmission and distribution network as well as engaged in distribution and retail sale of electricity or servicing the retail consumers. They have the power to frame their own tariff. Since 1995, many states have unbundled SEBS to introduce privatisation and competition in the sector
State Nodal Agency (SNA)	Promotes the use of renewable energy resources at the state level

Key financial institutions	
Rural Electrification Corporation (REC)	Public infrastructure finance company that provides loan assistance to State Electricity Boards, State Government Departments and Rural Electric Cooperatives for rural electrification projects
Indian Renewable Energy Development Agency Ltd (IREDA)	Public financial institution that promotes, develops and extends financial assistance for renewable energy, energy efficiency and conservation projects
Indian development financial institutions	IFCI, IL&FS, IREDA, NABARD, REC
International donors and development finance institutions	ADB, DfID, GiZ, IFC, KfW, WB, EIB, UNIDO e.g. (i) GoI is negotiating a one billion Euro soft loan with KfW3 for expanding solar rooftop installations (ii) two funds being established, by CIIE and Climate Group, which will both invest in off-grid solutions, including the mini-grid sector
Equity funds	Aavishkaar, Acumen, Infuse, Ncubate, Neurus Capital
Foundations	Among many - Aga Khan, Climate Works, Khemka, Rockefeller, Shell Foundation, and Tata Trusts e.g., Rockefeller Foundation aims to electrify 1,000 villages in the next three years through Smart Power for Rural Development initiative.
Key civil society organisations and academic institutions*	
Think tanks and academic institutions	Brookings India Institute The Energy Resources Institute Prayas Foundation Shakti Foundation The CLEAN network The Climate Group Ashden India Energy collective Bridge to India Institute for Transformative Technologies Centre for Science and Environment
Key off-grid developers*	
Solar micro/mini-grid	Azure Power, Gram Power, OMC Power, Husk Power, Saran Renewable Energy, Mera Gao Power, Desi Power, Naturetech Infra, Gram Oorja, Solkar, and Biotech India, among others
Solar home systems	Boond, Simpa networks, Visionary Lighting and Energy, Onergy, SELCO, Orb Energy, and Duron Solar, among others

* Not exhaustive

ANNEX 2.2: KEY POLICIES AND PROGRAMMES

CENTRAL GOVERNMENT POLICIES

Policy	Description
Electricity Act 2003	• Removed the mandatory licensing requirement for distribution of electricity in notified rural areas • Mandated SERCs to take steps to promote RE and prescribes guidelines for SERCs to determine FITS
Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) 2005-2014	• At first supported the distribution of SHS and lanterns in remote villages and then supported mini-grid installations in villages that do not fall within the central grid extension schemes • Provided up to 90% capital subsidy for villages to install DRE utilities • The scheme was replaced by the *Deen Dayal Upadhyaya Gram Jyoti Yojana* (DDUGJY) in 2015
Rural Electrification Policy 2006	• The policy aimed to: a. Provide electricity to all households by year 2009 b. Supply quality and reliable power at reasonable rates. c. Provide a minimum lifeline consumption of 1 unit per household per day • It required state governments to develop rural electrification plans
Jawaharlal Nehru National Solar Mission (JNNSM) 2010	• Aims to install 20,000 MW of grid-connected solar PV systems and 20,000MW off-grid solar PV systems to provide electricity access by 2022 • Capital subsidies (30-90 %) made available for solar projects • The key goal of the project is to reduce the cost of solar energy and reach grid parity by 2022 through (i) long term policy, (ii) large scale deployment goals, (iii) aggressive R&D, and (iv) domestic production of critical raw materials, components and products • Resulted in the creation of IREDA which is responsible for refinancing solar projects
Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) 2015	• Replaced the RGGVY scheme as the country's national electrification scheme with an outlay of INR 760 billion (US$11 billion) for implementation of the projects • In addition to providing electricity to all villages, the scheme aims to (i) develop feeder separation to ensure sufficient power to farmers and regular supply to other consumers, (ii) improve sub-transmission and distribution network to improve the quality and reliability of the supply, and (iii) implement metering
National Tariff Policy (2006) Amendments 2016	• Promotes RE as viable energy solution, outlining details regarding tariffs for grid interactivity which will be implemented by states • Lays down preliminary regulations for interaction between grid and mini-grid such as regulations around tariffs • Proposes increasing RPO to 8% by 2022 (currently RPO is below 1% in most states)
Draft Mini-Grid Policy 2016	• Goal is to mainstream RE mini grids for enhancing access to affordable energy services, and improving local economy • Sets norms and standards for establishing mini-grids. Includes project development procedures, tariffs, financing, subsidies, and operational frameworks

Draft Renewable Energy Act 2015 (To be passed)	• Establishes a comprehensive framework for investment into renewables • Outlines the institutional structure and powers (central, state, regulation) with regards to renewables • Appoints National Renewable Energy Advisory Group • Legislates need for national renewable energy policy • Mandates a detailed renewable energy resource assessment • Establishes a national RE fund and state green funds

STATE GOVERNMENT POLICIES [77]

State policy	Status and link
Andhra Pradesh Solar Power Policy, 2015	Andhra Pradesh Solar Power Policy, 2015
Chhattisgarh State Solar Energy Policy, 2012-17	Notified in 2012
Gujarat Solar Power Policy, 2015	Notified on 13th August, 2015
Haryana Solar Power Policy, 2014	Notified on 4th September, 2014
Jharkhand Solar Policy, 2015	Notified on 10th August, 2015
Himachal Pradesh Solar Policy, 2014	Himachal Pradesh Solar Power Policy, 2014
J&K Solar Power Policy	Notified on 18.03.2013
(i) Karnataka Solar Policy, 2011-16 (ii) Karnataka Solar Policy, 2014-21	(i) Notified on 01.07.2011 (ii) Notified on 22.05.2014
Kerala Solar Energy Policy, 2013	Notified on 25.11.2013
Madhya Pradesh Solar Power Policy, 2012	Notified in 2012
Odisha Solar Policy, 2013	Draft Solar Policy,2013 notified in 2013
Rajasthan Solar Energy Policy, 2011	(i) Notified on 19th April,2011 (ii) First Amendment dated 09.08.2011 (iii) Second Amendment dated 18.09.2012
Tamil Nadu Solar Energy Policy, 2012	Notified in 2012
Telangana Solar Power Policy 2015	Telangana Solar Power Policy 2015
Uttarakhand Solar Energy Policy, 2013	Notified on 27.06.2013
Uttar Pradesh Solar Power Policy, 2013 Uttar Pradesh Mini-Grid Policy, 2016	Notified in 2013 Notified in 2016

[77] See GoI 2015 Compendium of state government policies on renewable energy sector in India http://www.ireda.gov.in/writereaddata/CompendiumStatePolicyRE/Program.htm for full descriptions of each policy

3

NIGERIA COUNTRY REPORT

EXECUTIVE SUMMARY

Inadequate access to energy poses a critical challenge to Nigeria's economic development. Less than half of the population has access to electricity and those who do face insufficient and unreliable supply.[78] Fueled by these challenges, Nigeria is in the middle of a transformation of its power sector, which included the privatisation of the electricity market in 2013. Yet to date, renewable energy – both on-grid and off-grid – has played a small role in these sector reforms. Excluding large hydropower, less than 1% of electricity in 2012 came from renewable sources.[79] That said, the decentralised renewable energy (DRE) sub-sector is growing slowly.

As one vehicle to grow energy access, the Nigerian DRE policy landscape is evolving with a number of new policies recently released or under development – yet uncertainty remains. In 2015, the federal government released the high-level National Renewable Energy and Energy Efficiency Policy (NREEEP). In 2016, the National Council on Power (NACOP) approved the National Renewable Energy Action Plans (NREAP), the National Energy Efficiency Action Plans (NEEAP), and the Sustainable Energy for All (SE4All) Action Agenda. Furthermore, the Nigerian Electricity Regulatory Commission (NERC) also drafted and approved dedicated Mini-Grid Regulations in autumn 2016. However, implementation of the NREEEP, its action plans, and relevant NERC regulations is limited to date. Similarly, the Rural Electrification Strategy and Implementation Plan (RESIP) is yet to be finalised and approved by the government. The transfer of power at federal level, which has resulted in unfilled federal government leadership positions, has further stalled progress on these new policies.

Notable policy-related barriers include poor implementation of national policy, a weak enabling environment for DRE financing, lack of data to make informed decisions and develop the market, and scepticism of DRE. Moreover, local policy stakeholders have limited knowledge of DRE and the relative priority of expanding energy access through DRE (vs. the national grid) is low.[80] As a result, policy-makers find it difficult to articulate exactly what kinds of information and data are needed to unlock progress for the sector. Nonetheless, key questions emerged regarding the current state of electricity access and quality; where the government should focus its limited resources to grow DRE, how the government can help unlock private capital, the role of states in growing DRE, and best practices for DRE policy – stemming from in-depth analysis of the Nigeria context as well as the experiences of more advanced markets.

Less than half of the population has access to electricity and those who do face insufficient and unreliable supply. Yet to date, renewable energy – both on-grid and off-grid – has played a small role in electrification.

[78] Ley, K., Gaines, J. and Ghatikar, A. 2015, The Nigerian Energy Sector: An Overview with Special Emphasis on Renewable Energy, Energy Efficiency and Rural Electrification. Note that electricity access statistics vary by source but most Nigeria estimates fall into the 40-50% range

[79] Federal Ministry of Power 2015, National Renewable Energy and Energy Efficiency Policy (NREEEP) Approved By FEC for the Electricity Sector, Federal Ministry of Power. Including large hydropower, the % of electricity from renewable sources is ~10% (assuming total includes 12,500 MW from self-generation). Other sources, such as Power Africa, cite 20-30% electricity from RE sources, including large hydropower

[80] The SE4All Action Agenda notes: "There is need for high level executive decision/policy makers to understand the role of clean energy technologies and sustainable energy policy and planning process in the economic and social development of the population"

Photo credit for Nigeria report cover page: Solar electric light fund https://www.flickr.com/photos/solarelectriclightfund/7844745990

I. INTRODUCTION

This report presents a policy analysis of the decentralised renewable energy (DRE) landscape in Nigeria. It details current policies impacting DRE, identifies key stakeholders, and analyses challenges that inhibit the growth of the sub-sector in Nigeria. It also identifies key questions on the minds of policy-makers and policy influencers, and proposes solutions to answer them. We derived the findings presented in this document through desk research and qualitative interviews with key stakeholders from government, civil society, donor agencies, and the private sector.

The report is structured as follows: Section II sets the stage for the analysis by outlining the current state of Nigeria's power sector – including electricity access, shortfalls between supply and demand, and renewable energy targets. Section III describes the current DRE policy landscape, the key stakeholders active within it, and important emerging policy trends. Within this policy landscape and the state of the sector, Section IV presents the key questions posed by policy-makers and policy influencers that, if answered, could move the sector forward. Section V concludes by summarising the key policy challenges in Nigeria and highlights opportunities for action at a macro-level.

II. OVERVIEW OF THE ENERGY SECTOR

Nigeria is in the middle of a transformation of its power sector. Since 2001, the federal government has undertaken a liberalisation process, including privatisation of the electricity market in 2013. Yet, in 2014, only 45% of the population had access to electricity – with vast regional and rural-urban disparities.[81] Beyond access, electricity quality is low: businesses suffer an average of 25 power outages totaling 197 hours each month.[82] Most people with access are connected through the national grid, where electricity demand far outstrips supply. The national grid provides between 3000 and 4500 MW of power at peak generation capacity for its more than 180 million citizens.[83,84] This equates to roughly 0.025 kW per capita, an over thirty-fold difference in comparison to South Africa's over 0.8 kW per capita.[85] Nigeria's population is expected to reach 300 million within the next quarter century, which could further decrease this value.[86] Moreover, the grid is weak and unreliable due to myriad challenges that span power generation, transmission, and distribution. Motivated by the need to reform the sector and improve service delivery, the liberalisation process seeks to improve access and reliability by addressing these challenges.

Recently, political transition and a challenging macro-economic situation have exacerbated historical challenges. After taking office in 2015, President Buhari combined the Ministries of Power, Works and Housing into one entity and appointed Babatunde Fashola – previously Governor of Lagos state – as minister. Since this change in government, leadership vacancies across key power-related Ministries, Departments, and Agencies (MDAs) have slowed progress in the sector. Meanwhile, declining commodity prices since late 2014 have significantly reduced government revenues and decreased the value of the naira.[87] On June 20, 2016 alone, the value of the naira fell 30% after the government unpegged its currency from the US dollar.[88] One day before, four states served by the Port Harcourt Electricity Distribution Company went without power due to a collapse of the national grid. [89]

Despite economic malaise and power sector dysfunction, energy access remains high on the political agenda. After taking office, President Buhari promised 2000 MW in added capacity to the national grid in 2016 and 10,000 MW in electricity generation within three years.[90] In his inaugural speech, Minister Fashola established transmission and embedded generation for industry as his top power priorities.[91] Overall, energy access serves as a proof point for the new government's ability to deliver on its promises to Nigerians.

[81] World Energy Outlook (2016), Electricity Access Database

[82] Ley, K., Gaines, J. and Ghatikar, A. 2015

[83] Ley, K., Gaines, J. and Ghatikar, A. 2015

[84] In early 2016, operational generation capacity fell to 2800 MW, the lowest value in over a year. Source: Owete, F. 2016, Buhari promises 10,000 megawatts of electricity, Premium Times. Peak generation capacity in 2016 was ~5000 MW, according to the SE4All Action Agenda

[85] USAID 2016, 27 May 2016 - last update, Nigeria: Power Africa Fact Sheet; USAID 2016, South Africa: Power Africa Fact Sheet; 2015 United Nations Population Division, World Population Prospects

[86] Rosenthal, E. 2012, Nigeria Tested by Rapid Rise in Population, New York Times

[87] International Monetary Fund 2016, Regional Economic Outlook Sub-Saharan Africa: Time for a Policy Reset, International Monetary Fund

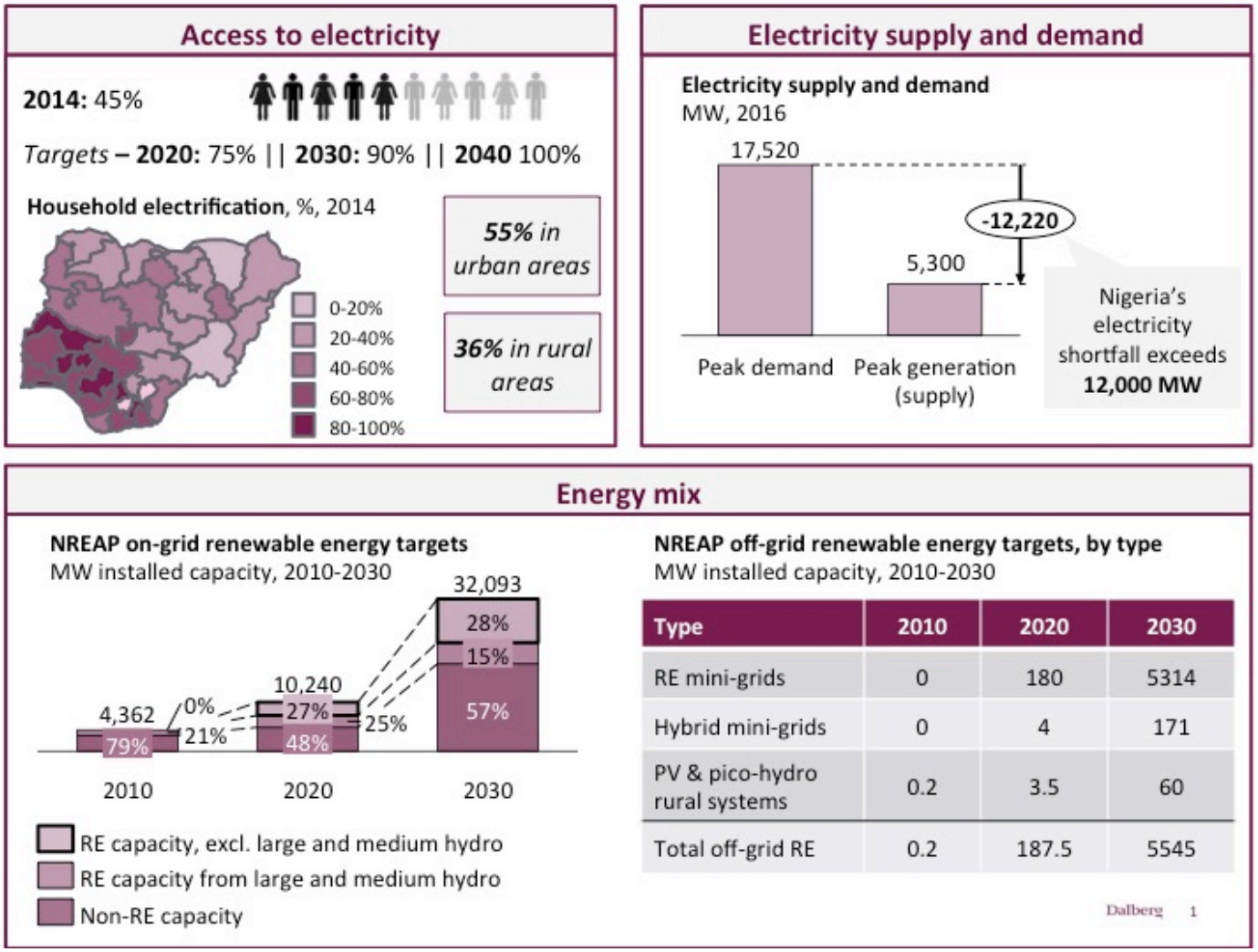
[88] Wallace, P. & Onu, E. 2016, Nigeria's Naira Slide Deepens Even as Central Bank Sells Dollars, Bloomberg

[89] Nigerian Electricity Hub 2016, 20 June 2016 - last update, Four Nigerian States in Total Darkness as National Grid Collapses

[90] Owete, F. 2016, Buhari promises 10,000 megawatts of electricity, Premium Times

[91] "Setting the Agenda for Delivering Change" text of the inaugural media briefing of the Federal Ministry of Power, Works and Housing

FIGURE 7: OVERVIEW OF THE POWER SECTOR IN NIGERIA [92]



Type	2010	2020	2030
RE mini-grids	0	180	5314
Hybrid mini-grids	0	4	171
PV & pico-hydro rural systems	0.2	3.5	60
Total off-grid RE	0.2	187.5	5545

[92] Sources for Figure 7: Access to electricity: IEA 2015, World Energy Outlook; USAID 2016, 27 May 2016 - last update, Nigeria: Power Africa Fact Sheet; Ley, K., Gaines, J. and Ghatikar, A. 2015. Electricity supply and demand: SE4All 2016, Action Agenda. Energy mix: Federal Ministry of Power 2016, NREAP. Notes for Figure 7: Access to electricity: Estimates of access vary by source, but are typically within the 40-50% range. Electricity supply and demand: Estimated peak demand includes latent and suppressed demand. This concept is difficult to measure given the widespread use of captive diesel generators. Energy mix: Targets vary considerably based on the document. In particular, the NREAP updates the targets from the NREEEP and therefore contains different values. There are some inconsistencies within the NREAP document itself

However, renewable energy – on-grid and, particularly, off-grid – has received relatively limited attention throughout the energy sector transformation process. Currently, the bulk of renewably sourced energy comes from hydropower, which provides approximately 20% of electricity.[93] Although gaining prominence, the current presence of other renewable energy sources – including solar, wind, and biomass – is negligible. There is limited data on current levels of investment in the renewable energy sector, but financing responsibilities are increasingly shifting from the public to the private sector.[94] Moreover, as Figure 7 above demonstrates, the prevalence and importance of renewable energy is expected to grow in the next 15 years.

Within renewable energy, decentralised off-grid programmes are growing but remain sub-scale. Investment from the development community (e.g., DfID's SolarNigeria Programme) and interest from state and federal stakeholders are increasing. One interviewee estimated that at least 20 states are engaged in DRE projects – but most are in early pilot stages.[95] There are also a rising number of mini-grid developers (e.g., Arnergy, Green Village Electricity) but minimal evidence of scale achieved, to date. As of 2015, 53 companies had installed 115 MW of off-grid solar PV capacity through mini-grid and standalone systems.[96] Some innovative pay-as-you-go (PAYG) business models (e.g., Nova-Lumos) have experienced recent fundraising successes that could enable future growth.[97] Yet overall, the DRE sector remains nascent.

III. POLICY LANDSCAPE

KEY STAKEHOLDERS AND ROLES

Key stakeholders within the electricity sector include public, private, and civil society actors – and their roles have shifted in recent years:

- Nigeria's public sector operates at three levels: federal, state, and local. The Federal Ministry of Power, Works, and Housing (FMPWH) sets the overarching policy for the sector – which is then carried out by various agencies and parastatals. In addition, most of the 36 states and the Federal Capital Territory have their own State Ministries of Energy and/or Electrification Boards that engage in power generation and distribution at the local level.

- Following privatisation in 2013, private sector actors now play a crucial role in power generation and distribution – and increasingly, in financing and investment. These actors include the newly-privatised Gencos and Discos,

- Independent Power Producers (IPPs), and off-grid developers. Private financiers include some commercial banks and fund investors.

- Lastly, many international and civil society organisations and donors support Nigeria's DRE sub-sector through several functions, including but not limited to: project financing and implementation, technical assistance to the government, knowledge sharing, and stakeholder coordination.

  Figure 8 summarises key actors, their roles and relationships to each other.

[93] Exact % depends on whether or not MW from diesel generators are counted as part of the total or not. Federal Ministry of Power 2015; USAID 2016, 27 May 2016- last update, Nigeria: Power Africa Fact Sheet

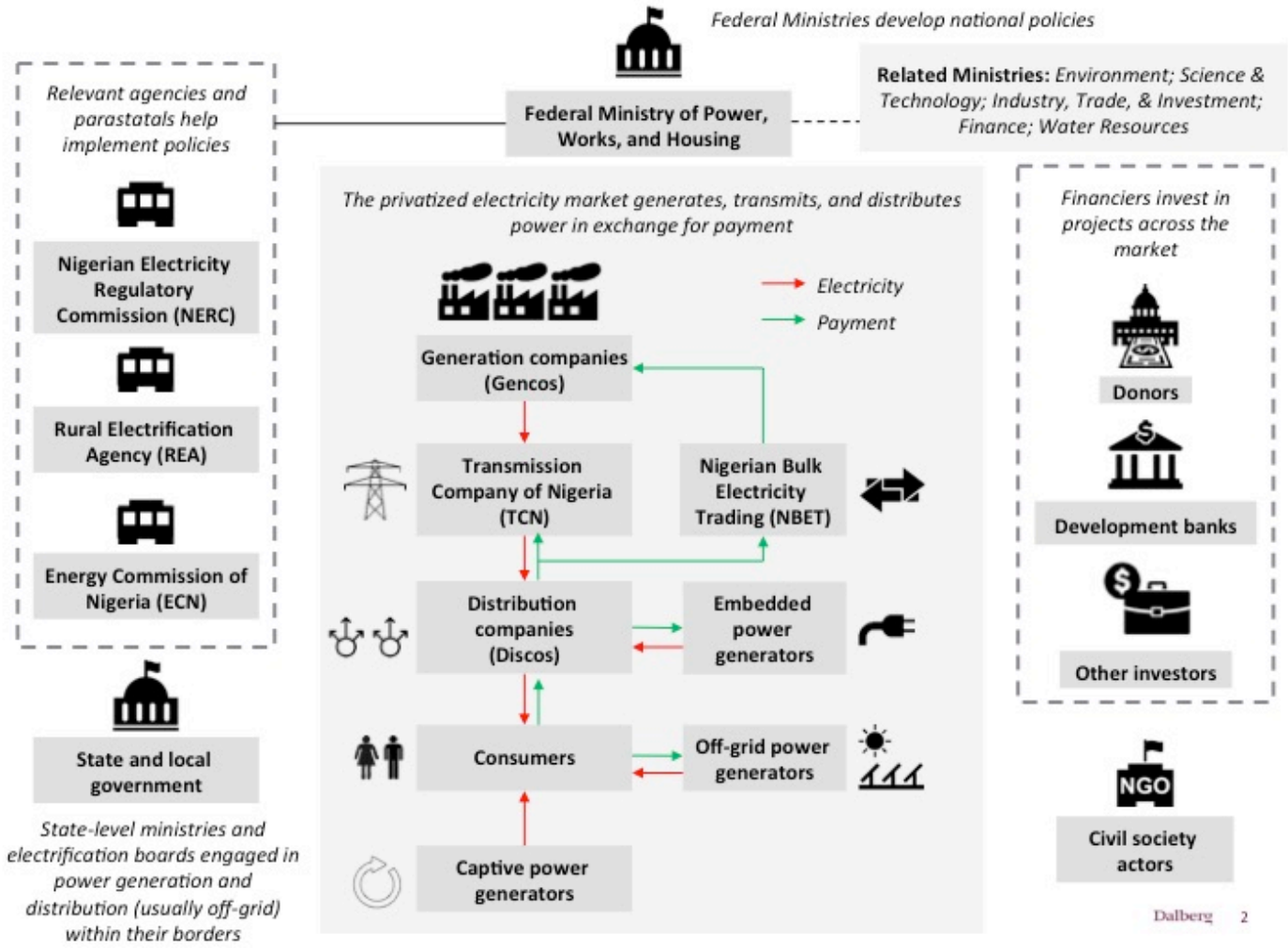
[94] Federal Ministry of Power 2015; Stakeholder interviews, 2016

[95] Stakeholder interviews, 2016

[96] Ley, K., Gaines, J. and Ghatikar, A. 2015. Data comes from NESP survey of 53 companies in 2015

[97] Nova-Lumos recently received a £150,000 grant from the DfID SolarNigeria Programme (SNP) and $15 million in financing from the US Overseas Private Investment Corporation (OPIC)

FIGURE 8: KEY STAKEHOLDERS, THEIR ROLES AND RELATIONSHIPS IN NIGERIA



CURRENT POLICIES

The Nigerian government recently released a number of new DRE policies, but it is too early to assess implementation efforts. The government released the National Renewable Energy and Energy Efficiency Policy (NREEEP) in April/May 2015. During its July 2016 meeting, the National Council of Power Meeting (NACOP) approved the corresponding National Renewable Energy Action Plans (NREAP) and National Energy Efficiency Action Plans (NEEAP). The Integrated Resource Plan (IRP) for the NREEEP is still under development. In July 2016, NACOP also approved Nigeria's Sustainable Energy for All (SE4All) Action Agenda.[98] Despite this policy progress, some stakeholders consider the policy and institutional framework somewhat incoherent given the many policy documents and overlapping mandates of actors in the sector.[99] In light of this challenge, the SE4ALL Action Agenda calls for an overarching National Energy Plan – but this does not yet exist.[100] Figure 9 below summarises key policies, and Figure 10 provides a detailed overview of the targets, regulations, and incentives they set forth as well as the gaps that remain.

FIGURE 9: KEY POLICIES RELATED TO DECENTRALISED RENEWABLE ENERGY IN NIGERIA[101]

Policy	Description	Status
Electricity Power Sector Reform Act (EPSRA, 2005)	Established the legal foundation for privatisation and set forth early market rules; established Rural Electrification Agency (REA) and the National Bulk Electricity Trading Company (NBET)	In force as of 2005
National Renewable Energy and Energy Efficiency Policy (NREEEP, 2015)	High-level national policy document that supersedes previous policies related to renewable energy and energy efficiency.[102] It outlines the government's objectives, strategies, and targets for both RE and EE	Finalised in 2015. The action plans were approved and adopted in late July 2016 during the National Council of Power Meeting
National Renewable Energy Action Plans (NREAP, 2016)	Action plan that accompanies the NREEEP and consists primarily of updated, detailed targets for renewable energy up to 2030. It also includes responses to section 4 of the ECOWAS Renewable Energy Policy (EREP). A key target is the 'Electricity 30:30:30 vision:' reaching 30 GW of power by 2030 with at least 30% renewable energy in the electricity mix	Approved and released in July 2016

[98] See: http://www.afdb.org/en/news-and-events/article/nigeria-national-council-on-power-adopts-the-sustainable-energy-for-all-action-agenda-15966/

[99] SE4All 2016, Action Agenda

[100] See SE4All: http://www.se4all-africa.org/se4all-in-africa/country-data/nigeria/

[101] This is not an exhaustive list of all policies in the electricity sector, but rather a synthesis of those that relate to DRE

[102] Ley, K., Gaines, J. and Ghatikar, A. 2015

Draft Rural Electrification Strategy and Implementation Plan (RESIP, 2015)	Guiding policy for the REA that targets 75% electrification by 2020, with an estimated cost of $1.9-3.3 billion.[103] The RESIP expects the private sector to lead implementation, with coordination and minimal funding from the government	Drafted in 2015, but final document has not been approved or released
NERC Feed-In Tariff Regulations for Renewable Energy Sourced Electricity in Nigeria (2015)	Renewable energy feed-in tariffs (REFIT) for electricity procured from small solar PV, wind, hydro, and biomass power plants (between 1-30 MW, depending on the technology). The REFIT also establishes a renewable energy purchase obligation for Discos and the NBET	Finalised in November 2015 and put into action in February 2016
Draft NERC Mini-Grid Regulations (2016)	Regulations for mini-grid electricity generation (capacity less than 1 MW) that aim to accelerate electrification of areas unserved or underserved by the national grid. They articulate simple permit and tariff procedures applicable to all mini-grids to reduce administrative burden, and also aim to address key risks of mini-grid development: (i) changes in tariff policies and (ii) arrival of the national grid	Approved by NERC in October 2016 but not yet put into action
Regulations for Independent Electricity Distribution (2012)	Regulations for independent electricity distribution outside of the national grid	Released in 2012
SE4All Action Agenda (2016)	Action agenda that captures Nigeria's specific goals as part of the broader SE4All global framework. It places a larger emphasis on off-grid solutions that other policy instruments, calling for 8 GW of off-grid generation capacity by 2030.[104] It is a living document that will be adapted and updated as progress is monitored and reported, new actions become more relevant, and others are completed or no longer relevant	Approved and released in July 2016

[103] Ley, K., Gaines, J. and Ghatikar, A. 2015

[104] Note: this differs slightly from the ~5 GW of off-grid RE capacity proposed in the NREAP

FIGURE 10: OVERVIEW OF CURRENT POLICIES RELATED TO DRE IN NIGERIA[105]

Policy area	Current policies	Gaps and challenges
High-level strategy and targets		
Energy mix	• National policies recognise the role of renewable energy sources in on-grid and off-grid electricity generation	• Previous RE policies have lacked substance and did not hold actors accountable for implementation • Actors in the energy sector have developed over 30 draft policy documents; few have been implemented successfully [106]
On-grid electricity	• Top government priority is to improve the transmission capacity of the existing grid; expansion of the grid is a secondary priority. Many interviewees consider expansion unlikely in the near-term – unless the financing landscape changes considerably • SE4All Action Agenda calls for strengthening of grid infrastructure	• Top government priority is to improve the transmission capacity of the existing grid; expansion of the grid is a secondary priority. Many interviewees consider expansion unlikely in the near-term – unless the financing landscape changes considerably • SE4All Action Agenda calls for strengthening of grid infrastructure
Off-grid electricity	• NREEEP emphasises the need for "exploitation and establishment" of additional sources of energy to complement the national grid • NREAP and SE4All Action Agenda set forward detailed targets for off-grid electricity • NERC Mini-Grid Regulations were released and approved in 2016, providing more certainty regarding registration and permits, operations, and grid interactivity (see below) for mini-grids. They have not yet been put into action. The regulations differ for isolated mini-grids (in areas unserved by national grid and Discos) vs. interconnected mini-grids (in areas underserved by Discos)	• Lack of specific policies and regulations for off-grid electricity (e.g., mini-grids) creates uncertainty amongst investors and other stakeholders. If implemented effectively, NERC Mini-Grid Regulations (2016) could help address this challenge • Grid extension projects remain attractive to project promoters and influencers within the sector, despite challenging economics in many rural areas
Grid interactivity	• **Isolated mini-grids (with permit):** When a distribution licensee (i.e., Disco) extends its network to an isolated mini-grid, the mini-grid permit holder must: a) convert to an interconnected mini-grid operator (see below) or b) transfer all assets the mini-grid operator does not want to remove from the mini-grid system to the distribution licensee in return for compensation	• Mini-Grid Regulations (2016) put forward policy on how off-grid systems interact with the national grid – especially as Discos expand their networks. Implementation and impact remain uncertain

[105] Sources for information in Figure 10: Ley, K., Gaines, J. and Ghatikar, A. 2015; Federal Ministry of Power 2015; Nigerian Electricity Regulatory Commission 2015, Regulations for Feed-in Tariff for Renewable Energy Sourced Electricity in Nigeria, Nigerian Electricity Regulatory Commission; ODI 2016, Accelerating access to electricity in Africa with off-grid solar, ODI; Usman, H.S. 2014, "The Benefits and Challenges Involved in Climate-friendly Technology Transfer: A Case for Solar Energy Technology in Nigeria;" Stakeholder interviews, 2016

[106] SE4All 2016, Action Agenda

	• **Interconnected mini-grids (with permit):** After the expiration and non-renewal of a tripartite contract of an interconnected mini-grid (between mini-grid operator, distribution licensee, and the community), the distribution licensee may re-integrate the mini-grid into its network with written endorsement from the community and notification of NERC. The same compensation policy as isolated mini-grids (see above) applies in this situation, unless otherwise specified in the tripartite contract • **Registered mini-grids (under 100kW, without permit):** When a distribution licensee (i.e., Disco) extends its network to a registered mini-grid, the operator must de-commission and remove all assets and equipment within two months after the distribution licensee has started supplying electricity to the area; there is no refund or compensation for the mini-grid operator	
Electricity regulations and incentives		
Economic/ fiscal	• **Import duties:** Exact taxes vary across DRE inputs, from 0% for solar panels to >20% for various types of batteries.[107] However, when PV solar panels are imported as part of a complete solar device (including battery storage), they incur a minimum of 21% import duty and a maximum of 35%.[108] Import duties for solar lanterns and charging systems can reach 30%.[109] The NREEEP recommends the formation of Special Task Force within the Nigerian Custom Services to mitigate potential difficulties in customs clearance • **Other taxation:** Imports are subject to a 5% VAT. Several industries related to DRE, including solar, are "pioneer" industries that receive a 5-7 year corporate tax holiday.[110] According to the media, the Renewable Energy Association of Nigeria (REAN) is advocating a zero percent VAT on all distributed renewable energy products[111]	• High import duties for certain inputs, such as batteries, dramatically increase project costs (see additional detail on import-related barriers in the 'Customer protection, environmental and technical standards' section below)
Tariffs	• **On-grid:** NERC sets tariffs through the Multi-Year Tariff Order (MYTO); NBET purchases power from Gencos through power purchase agreements. Discos purchase power from NBET through vesting contracts • **Feed-in tariff:** A renewable energy feed-in tariff (REFIT) was approved in November 2015 and went into action in February 2016; it sets the methodology to calculate and update tariffs for electricity from solar, biomass, wind, and small hydropower sources within the qualifying capacity ranges[112] • **Net metering:** RE generation with capacity less than 1 MW must be procured through net-metering, not the REFIT • **Off-grid:** Per the Mini-Grid Regulations (2016), tariffs for permitted mini-grids will be calculated following the MYTO methodology. Tariffs are intended to be cost-reflective and expected to be higher than those offered by Discos	• REFIT has not yet been implemented in practice; interviewees noted that no PPAs have been signed between RE power generators and Discos/ NBET as of mid-2016 • End-user tariffs for electricity from mini-grids with capacity <1 MW are supposed to be 'cost-reflective.' Meanwhile, end-user tariffs for electricity from the national grid are subsidised, which risks creating considerable inequality in electricity prices for urban vs. rural customers • The NERC has determined MYTO methodology to calculate end-user tariffs for off-grid electricity, but this has not yet been implementedgiven recent approval of the Mini-Grid Regulations (2016) • Net metering policy does not yet exist

[107] The Nigeria Customs Service website cites a 20% import duties for batteries, but several interviewees mentioned values closer to 30-35%.

[108] ODI cites a minimum of 21% and a maximum of 35%, the latter based on data from Lighting Africa

[109] ODI cites 30%

[110] These industries include: "companies that manufacture transformers, meters, control panels, switchgears, cable and other electrical related equipment, which are considered pioneer products/industries and manufacturers of solar-energy-powered equipment and appliances biomass, large scale mechanised farming (wheat, maize, rice and sorghum) energy efficiency schemes, for manufacturers of oven, cookers, cold rooms, refrigerators, fridges, freezers, air conditioner utility services (independent power generation utilising gas, coal and renewable energy sources)." Source: Ley, K., Gaines, J. and Ghatikar, A. 2015

[111] See http://www.businessdayonline.com/association-seeks-zero-per-cent-vat-renewable-energy-products/ for more information

[112] Wind and biomass: 1-10 MW; Small hydro: 1-30 MW; Solar PV: 1-5 MW

Licensing and contracts	• **Generation:** An electricity generation license from NERC is required for power generation above 1 MW. Above 5 MW, the generator can evacuate power to an IEDN. Above 20 MW, the generator must evacuate power through TCN (the national grid). Per the Mini-Grid Regulations (2016), mini-grids with 0-100kW of capacity must register with NERC, but the permit is optional. Mini-grids within the range of 100kW-1MW must secure a permit • **Distribution:** An IEDN license from NERC is required for distribution above 100 kW • **Power purchase agreements:** As of February 2015, all power trading arrangements must be bound by contracts (PPAs or vesting contracts). PPAs from RE sources within the REFIT qualifying capacity limits are must-take contracts for the Discos. Larger RE projects must pass through a competitive bid process[113] • **Power purchase obligations:** The REFIT mandates the national grid to procure 2000 MW of renewably-sourced energy by 2020; the 11 Discos are obligated to procure 1000 MW (50%) and the NBET (or its successor) is obligated to procure the remaining 50%	• In the absence of dedicated mini-grid regulations, off-grid developers have taken an ad hoc approach that relies on verbal agreements with key partners (e.g., local government and the REA). One interviewee noted: "you want to be double sure that you're covered." NERC has released and approved Mini-Grid Regulations (2016) – but efficacy of the regulations is not yet known given early implementation • REFIT has not yet been implemented in practice; as of mid-2016, no PPAs have been signed between RE power generators and Discos/NBET
Customer protection, environmental, and technical standards	• **Technical regulation:** The National Grid Code, Distribution Code and Metering Code govern the electricity networks; all three stem from the Electricity Power Sector Reform Act (EPSRA) of 2005 • **Quality assurance standards:** The SON does not recognise international solar standards (e.g., IEC/ISO) and instead imposes an arduous quality assurance process for imported solar products (e.g., case-by-case application for certification and a physical inspection/sampling for each shipment of products). SE4All Action Agenda calls for development of minimum national and regional performance standards for energy products, based on government testing, labelling, and certification • **Quality of service regulation:** NERC has the mandate to oversee and enforce service quality delivery. Service complaints are supposed to go to Customer Care Units (CCUs) within the Discos, but if not addressed, customers can elevate complaints to the 'Consumer Forum' and then to NERC itself. Other consumer protection considerations are included in other policies, such as the Mini-Grid Regulations (2016) and the IEDN regulations (2012)[114] • **Environmental policy:** An Environmental and Social Impact Assessment (ESIA) is mandatory for development projects, per the Nigerian EIA Act No. 86 (1992), but can be waived for projects with minimal expected environmental impact. ESIAs are not currently required for mini-grid projects.	• Standards, quality control and certification programmes exist – but are not always enforced, which results in market spoilage issues and negative consumer perceptions of DRE (with emphasis on solar) • Process to import solar products involves many hurdles that cause delays and increase costs for providers: national standards certification processes are unnecessarily onerous and not fully aligned with global standards (e.g., IEC/ISO) • Lack of alignment on key KPIs for solar off-grid projects and lack of transparency regarding key performance dimensions (e.g., NPLs/defaults) from current ecosystem of market participants • Several interviewees noted that consumer protection remains weak

[113] Wind and biomass: 1-10 MW; Small hydro: 1-30 MW; Solar PV: 1-5 MW

[114] For example, IEDN licensees are required to – "give users at least 10 business days' prior notice of any planned maintenance, testing or repair that will require interruption to or curtailment of the transfer of electricity"

Financial support/ subsidies	• **Off-grid grants and subsidies:** NREEEP specifies the need to provide subsidies to alleviate upfront costs for RE projects, but provides minimal detail. The now-superseded Renewable Energy Master Plan (2005, revised 2012) provided greater detail on financial and fiscal incentives. The Rural Electrification Agency (REA) is supposed to support projects through the Rural Electrification Fund (REF). The SE4All Action Agenda calls for mobilisation of financing for mini-grids to supply electricity to rural areas remotely far from the grid • **Loan support and risk mitigation:** NREEEP specifies the government will provide "guarantees and financial frameworks" to grow the RE market, but provides no additional detail. Some financial institutions are accessing the Central Bank preferential financing window for SMEs [115] and using it to lend to off-grid energy providers	• Financing policies are high-level and lack specificity required by project developers and investors • Financing policies from the NREEEP have not been implemented, and the corresponding Independent Resource Plan (IRP) has not been released • REF has not been operationalised because a) RESIP has not been approved, b) REA lacks capacity to drive progress due to vacancies in leadership positions, and c) lack of political alignment and support for grid projects[116] • High fossil fuel subsidies (e.g., for kerosene) remain a disincentive for Nigerians to choose DRE • The SE4All Action Agenda notes the absence of a clear legal and regulatory framework for energy financing in Nigeria
Procurement	• Discos purchase electricity from the National Electricity Bulk Trader (NBET) • Consumers purchase electricity from Discos or off-grid providers. Captive generation is also very common.	

[115] See Development Finance Department Central Bank of Nigeria 2014, Micro, Small and Medium Enterprises Development Fund (MSMEDF) Guidelines

[116] The criteria for accessing the REF are meant to be stringent and transparent to prevent corruption. There is some resistance to this, which stakeholders attribute at least partially to the loss of rent seeking opportunities

Enabling policies		
Mobile regulations	• Mobile regulations allow for pay-as-you-go energy plans via several currencies: mobile money, airtime, premium SMS, and cash [117] • Only banks can provide mobile money	• Mobile money ecosystem is nascent with low utilisation rates (<1% usage in adults [118]), leading to substantial obstacles for PAYG energy models
Technology transfer	• National Office for Technology Acquisition and Promotion (NOTAP) regulates and promotes technology transfer (TT); NOTAP policies do not explicitly address RE but several programmes exist to support TT in this sub-sector	• Transfer of solar energy technology is limited by poor coordination between government institutions and limited technical capacity within Nigeria to use TT opportunities
Human capital and local expertise	• NAPTIN was tasked with developing a National Power Training Policy, but current status is unclear. GIZ is working with NAPTIN to develop training modules for power sector professionals [119] • Some state governments are taking action: for example, the Lagos State Electricity Board launched the Lagos Energy Academy in 2014, which offers a course on solar energy	• Insufficient supply of solar and wind technicians capable of installing and maintaining systems; few enabling policies or government incentives to address the talent gap
Project development		
Site identification and permissions	• NREEEP states the FMPWH is responsible for helping RE project developers to secure land for project development in states – but developers are responsible for providing the financing	• Off-grid developers did not cite difficulties in acquiring land from communities, [120] but this could be more difficult in areas already serviced by the 11 Discos
Resource assessment	• Most resource assessment is done at a national level, but some states play a more active role	
Land procurement	• Land agreements are often signed at the local/community level	• See above

[117] See GMSA for additional detail: Smertnik, H. 2016, Mobile for Development Utilities: Assessing the opportunity for pay-as-you-go solar in Nigeria, GSMA and UKAid. The GSMA Utilities team is currently looking into regulatory issues around the use of airtime as currency for PAYG energy

[118] EFInA 2014, EFInA Access to Financial Services in Nigeria 2014 Survey

[119] SE4All 2016, Action Agenda

[120] Regarding its mini-grid development pilot projects, BOI noted: "The communities were more than happy to give up land space." A Dalberg February 2016 site visit to an Arnergy mini-grid in Osun State confirmed this

KEY TRENDS

The Nigerian energy sector has gradually liberalised since 2001 when the government released the initial reform agenda through the National Electric Power Policy (NEPP). Throughout the early 2000s, many other policies and regulations, such as the Electricity Power Sector Reform Act of 2005, guided Nigeria through a slow privatisation and deregulation process. Following the official privatisation of the sector in 2013, the government has narrowed its focus to policymaking, regulation, coordination, and transmission. Notably, the NREEEP identifies the need for a shift from public to private financing: "the Nigerian Government alone cannot continue to provide the major finance for developing the renewable energy sub-sector. Hence private sector participation is necessary and imperative."[121] This necessitates a departure from centrally-managed, government-funded projects to a demand-driven, market-based approach.[122] However, given that these changes are relatively recent, the private DRE market remains nascent.

Many states are taking a more active role in exploring new models to generate and distribute electricity to their populations. Unlike other resources (mines, minerals, natural gas, and water resources) that exclusively fall within the purview of the federal government of Nigeria (FGN), power is a "concurrent competency"[123] shared by federal and state governments. However, the delineation of power is not well-defined. While the FGN is responsible for regulation and power transmission, federal, state, and local actors all play a role in generation and distribution.[124] Some states – such as Lagos and Rivers – are exploring new models to generate and distribute electricity, with the goals of reducing dependency on the national grid and increasing state revenues.[125] States are also seeking shares in the privatised Discos in order to play a more influential role in the expansion of distribution networks.[126,127] The draft RESIP also aims to strengthen the role of the states.[128]

Looking forward, there is potential for DRE to gain traction and increase its importance in the electricity landscape. Since February 2016, frequent vandalism of gas pipelines has underscored concerns about Nigeria's energy security and served as a constant reminder of the need to diversify the country's energy mix. Minister Fashola of the FMPWH recently noted that gas disruptions have "challenged us to develop options and alternatives like solar in particular and, of course, hydro power plants... So, we will be accelerating work on projects...this is a journey of diversification."[129] The Minister also recognised that changing Nigeria's electricity sources requires "less talk and more action."[130] Similarly, the NREEEP recognises that previous renewable energy policies in Nigeria lacked 'substance' and did not hold key actors accountable for implementation. Therefore, the government seeks to address this historical lack of progress through two actions plans (NREAP, NEEAP) and an independent resource plan (IRP) to drive the implementation of RE policy – and ultimately, the growth of the DRE sub-sector. Overall, this trend suggests that the next 6-12 months are a particularly important – and fortuitous – time to help shape the policy agenda.

Since February 2016, frequent vandalism of gas pipelines has underscored concerns about Nigeria's energy security and served as a constant reminder of the need to diversify the country's energy mix

[121] Federal Ministry of Power 2015

[122] Ley, K., Gaines, J. and Ghatikar, A. 2015

[123] Ley, K., Gaines, J. and Ghatikar, A. 2015

[124] The mandate for distribution is particularly unclear. The Federal government has a mandate to regulate power generation and transmission of the national grid. Meanwhile, states have a mandate for power generation, but their mandates for transmission and distribution are confined to off-grid areas (according to the SE4All Action Agenda). Therefore, the mandate for distribution within the national grid is unclear

[125] Ley, K., Gaines, J. and Ghatikar, A. 2015

[126] Ley, K., Gaines, J. and Ghatikar, A. 2015

[127] Stakeholder interviews, 2016

[128] SE4All 2016, Action Agenda

[129] Okafor, C. 2016, 28 June 2016 - last update, Nigeria: As Pipeline Breaks Threaten Nigeria's Energy Security

[130] Okafor, C. 2016, 28 June 2016 - last update, Nigeria: As Pipeline Breaks Threaten Nigeria's Energy Security

IV. EMERGENT POLICY QUESTIONS

Within the DRE policy landscape, policy-makers and influencers cite a number of information and data gaps that, if filled, could help move the sector forward. The table below summarises the key policy questions that emerged through desk research and interviews with key stakeholders in Nigeria.

FIGURE 11: SUMMARY OF KEY QUESTIONS FOR POLICY-MAKERS AND INFLUENCERS IN NIGERIA

Stakeholder	Key questions
Policy-makers	• **Baseline electrification:** What is the extent and quality of electrification across Nigeria? What are the present-day baseline conditions? • **Government prioritisation:** Where and on what should the government focus its efforts given its limited resources for DRE (geography, type of technology, embedded generation vs. off-grid)? • **Financing:** How can the government best unlock private sector financing and reach renewable energy targets/grow the sector? What should the criteria be to access the proposed Rural Electrification Fund? • **DRE regulations:** What 'light-handed' regulations are required for the DRE sub-sector? • **End user tariffs:** What tariffs should end users pay to access off-grid vs. on-grid electricity? [131] • **Import duties and taxes:** Is there a clear case for tariff/tax reduction on solar components (i.e., what is the likely fiscal loss for the government in the short run relative to medium- and long-term benefits of making solar components cheaper and helping to achieve electrification goals)? • **Rural electrification:** What is Nigeria's plan for rural electrification? • **On-grid vs. off grid:** Where should the grid be expanded vs. where could mini-grids be a less costly and more efficient way of achieving electrification goals? • **Best practices and lessons learned:** How have other countries handled the challenges faced in the DRE sector, such as lack of financing and grid interactivity? • **Role of the states:** What are concrete actions state governments can take to drive the DRE sub-sector forward? • **Consumer experience:** What is the experience of consumers with DRE relative to the national grid?
Policy influencers (private sector companies, NGOs, donors)	• **Clarity of policies:** What policies currently apply to mini-grids? • **Financing:** How do we access financing/subsidies for DRE projects? • **Import duties and taxes:** How can we make a compelling case for tariff/tax reduction for DRE solutions given the need to import key components/systems/low-wattage appliances? • **Project opportunities:** Where are the best project opportunities at a national level? What is the opportunity to expand solar energy in southern Nigeria (the current perception is that it rains a lot and is therefore not viable)? • **Standards:** What should the standards be around key performance indicators for DRE models (e.g., reliability, affordability, grid compatibility etc.) and how and by whom should they be monitored?

[131] Minister Fashola said in his inaugural speech: "By far the most complex challenge is the problem of tariff"

V. POLICY CHALLENGES AND OPPORTUNITIES

Assessment of current policies and expert interviews suggest that poor implementation of national policy, a weak enabling environment for DRE financing, lack of data to inform policy-maker decisions and scepticism of DRE are critical policy-related barriers.[132] Other notable barriers include limited capacity and knowledge of DRE amongst stakeholders and lack of stakeholder coordination and collaboration. The sections below provide additional detail on each of the top four barriers, current efforts to address them, and remaining opportunities.

POOR IMPLEMENTATION OF NATIONAL POLICY

Description: While the NREEEP represents a notable step forward, many policies are not actionable in their current high-level form. For example, the NREEEP lists "implementing a framework for the use of Sovereign Guarantees to support appropriate renewable electricity projects" as a key strategy – but provides no additional detail on how this financing mechanism could work. In certain cases, the policy specifies the need for another agency or parastatal – such as NERC – to develop specific regulations. Therefore, many specific policies and regulations remain "to be determined." Further, the NREEEP and other energy policies lack considerations specific to decentralised renewables (e.g., mini-grids).

The NREAP approved by NACOP and adopted by ICREEE in July 2016 partially addresses these challenges but lacks specificity and actionable recommendations. It provides detailed targets for renewable energy leading up to 2030 and responses to questions (based on Section 4 of the EREP) that assess the status of measures to achieve these targets in Nigeria. However, the action plan alone cannot resolve all key implementation challenges, such as the operationalisation of the REF. The SE4All Action Agenda recommends that the government should review "existing renewable energy and energy efficiency actions plans and develop more comprehensive plans with clear targets and timelines."

Lastly, institutional challenges stemming from the transition between the presidential administrations are exacerbating policy implementation challenges. Key government positions (e.g., head of the REA) have been filled slowly and forward progress with a number of policies and regulations (e.g., the RESIP and the REF) has stalled. Together, the lack of detail in policy formulation and delays in policy implementation create uncertainty for developers, investors, and other stakeholders in the sector. As one interviewee noted, "policy must be clear in order for the opportunities to unfold." [133]

Efforts to address the barrier: NERC, with the support of GIZ, developed and approved Mini-Grid Regulations in the fall of 2016, but they are not yet in force. As discussed above, the NACOP approved two action plans (NREAP and NEEAP) to help implement the NREEEP, but the IRP has not been released.

Opportunities:

- **Help the government and/or other Nigerian intermediaries develop clear, actionable, and effective policies** by transferring best practices from other countries with more developed DRE sub-sectors. As one example, Nigeria could immediately benefit from best practice transfer related to the issue of grid interactivity: how off-grid and on-grid systems can connect to, strengthen, and/or reinforce each other in both the short- and long-term.
- **Conduct research on the economic and/or social impact of specific policies** in order to spur urgent and effective implementation of the policies the government has developed, for example, the impact of import duties on DRE inputs on sector growth.

[132] We consider two types of challenges within scope of "policy-related barriers." (i) A challenge related to the formulation, implementation, or efficacy of government policy (e.g., lack of policies dedicated specifically to mini-grids), and (ii) A challenge that does not directly relate to government policy but can be addressed through a policy lever (e.g., lack of data)

[133] Stakeholder interviews, 2016

WEAK ENABLING ENVIRONMENT FOR DRE FINANCING

Description: Given its own resource constraints, the FGN has explicitly stated it expects the private sector to finance the majority of renewable energy projects going forward.[134] During interviews, a non-government stakeholder stated that the FGN has limited money to invest in solar energy.[135] However, the private sector remains wary of investment in DRE – in part due to policy uncertainty, lack of knowledge about the sector, and concerns around financial viability of DRE. It has not yet stepped up to play the role of primary financier. Therefore, overall levels of public and private investment in the sector remain low.[136] In addition to insufficient financing volumes, there is a scarcity of financial products tailored to the DRE sector. Patient capital needed to support 20-year DRE projects and risk mitigation instruments (e.g., guarantees) are limited. Lastly, the government does not know how to most effectively use its limited resources in a catalytic way. An interviewee pointed to the need to help the government navigate these budget issues.[137]

Without prompt, several interviewees mentioned finance as a leading barrier preventing the growth of the sector. After completing several pilot projects, one bank is unlikely to scale its work in mini-grid development without a guarantee. Moreover, the government has not yet released the integrated resource plan (IRP) to accompany the NREEEP – and progress on the Rural Electrification Fund (REF) has stalled.

Efforts to address the barrier: The FMPWH is developing an investment prospectus that provides guidelines on investing in the Nigerian energy sector. Given the document has not been released, the amount of attention given to DRE within this prospectus is unknown. The SE4All Action Agenda recommends a section dedicated to RE investment, but does not specify DRE. FMPWH is also responsible for developing an IRP to support implementation of the NREEEP, but the IRP has not been released and its exact status is unclear. Lastly, the Rural Electrification Agency (REA) is responsible for designing and launching the REF to support off-grid projects across the country. Although the REF has been under discussion for approximately ten years, it does not yet exist – and recent progress has stalled due to lack of capacity at the REA.

Opportunities:

- **Support the government and other actors in understanding, developing, and deploying innovative financing mechanisms** to unlock private sector investment in DRE. Support could take various forms, but should likely have both policy and information components.
- **Publish a report on innovative financing mechanisms for DRE** in Nigeria and convene public and private sector stakeholders to discuss the findings and make commitments (e.g., the Clinton Global Initiative model).

> *"Finance, finance, finance"*
>
> – Solar solution provider, responding to an open question about key policy-related barriers

[134] Federal Ministry of Power 2015
[135] Stakeholder interviews, 2016
[136] Financing data is scarce
[137] Stakeholder interviews, 2016

LACK OF DATA

Description: Public and private stakeholders lack nationwide data resources related to the electricity sector, including decentralised renewables. This includes data on current energy resources and access, grid expansion plans, high-potential locations for future projects, and consumer needs and preferences across regions and states. This lack of data impedes informed decision-making related to RE strategy (for the government) and market development (for the private sector). One government official noted: "We have no idea of how much renewable energy we have."[138]

Without any prompt, several interviewees cited lack of data as a key barrier to the growth of DRE. In fact, one solar solutions provider recently reached out to Facebook's internet.org in hopes of accessing data resources to identify future project opportunities and inform scale-up decisions. Moreover, the NREEEP also identifies the need for web-based prospecting tools to encourage implementation of RE projects, assess the feasibility of select opportunities, and prepare bankable projects.

> *"The lack of access to comprehensive, accurate, and reliable information on the energy sector and regulatory landscape in Nigeria is a significant barrier to both public, private, and other stakeholder group participation"*
>
> – SE4All Action Agenda

Efforts to address the barrier: GIZ is working to strengthen data management in five states it supports through NESP.[138] At the federal level, a handful of MDAs – including FMPWH, NERC, ECN, and REA – collect electricity-related data, but no actor has built comprehensive, integrated, nationwide datasets. More recently, the newly-released SE4All Action Agenda and the NREAP both recognise the lack of data and propose immediate action. For example, the Action Agenda calls for "building and investing in a robust national energy data management toolkit" to develop future plans and scenarios for the energy sector.[140]

Opportunities:

- **Generate, compile, and analyse nationwide datasets to inform government policy and planning decisions.** Investment into dataset collection and analysis should ultimately drive the uptake of DRE across the country. Although not explicitly related to policy, this data could have the secondary benefit of supporting private sector actors (e.g., mini-grid developers) in further developing the DRE market by reducing information gaps and building developer and investor confidence.
- **Support on the ground surveys and data collection.** Due to resource constraints and bureaucratic inertia, there is minimal quantitative survey work being conducted in Nigeria to measure household energy use. Co-funding and supporting low cost (e.g., SMS/IVR) household surveys with in-country partners could fill essential information gaps for government stakeholders and enable better planning. It could also provide vital ground-truth.
- **Conduct demand assessments for different regions of the country** to help policy-makers plan energy access efforts.
- **Help monitor projects and progress toward DRE goals across the country**, potentially via a new type of technology/system.

[138] Stakeholder interviews, 2016

[139] Programme implemented by GIZ to improve conditions for the application of and investment in renewable energy and energy efficiency -- as well as the promotion of rural electrification

[140] SE4All 2016, Action Agenda

SCEPTICISM OF DRE TECHNOLOGIES AND PROJECTS

Description: Many stakeholders – including donors, the government, and consumers – are sceptical of DRE technologies and projects due to market spoilage issues and failed efforts in the past. Multiple issues underlie this scepticism, including: market spoilage, poor maintenance of products (e.g., solar street lamps in a community), and questionable economic viability of projects. Related to market spoilage, the market is flooded with low-quality products that are not well-regulated by Nigerian authorities. Standards for imported products exist, but they are not always enforced. The government does not adhere to internationally-recognised quality standards for solar products. Domestically, the government has a solar inputs manufacturing parastatal that "they want everyone to use,"[141] but the solar panels are expensive and not competitive relative to most imports. At the project-level, people point to solar street lamps – amongst other examples – that do not work as a source of their negative perceptions of DRE.[142] Lastly, financial institutions and other investors are not convinced – or simply unaware – of the business case.

Without any prompt, several interviewees cited scepticism of DRE as a key barrier to the growth of the sub-sector. One solar solutions provider expects this issue to continue at the household-level for the next five years until consumers are better able to afford high-quality products

Efforts to address the barrier: The Standards Organisation of Nigeria (SON) oversees the quality of DRE products, but efforts to address market spoilage issues have been challenging.[143] The SE4All Action Agenda recommends developing "minimum national and regional performance standards for energy products, based on government testing, labeling, and certification" – but does not provide additional detail.[144] Outside the government, Power for All is trying to change the narrative around DRE to convince potential consumers of the efficacy and impact of mini-grids and other standalone solutions.

Opportunities:

- **Develop appropriate key performance indicators (KPIs) to assess – and ultimately improve – off-grid systems.** KPIs could measure the reliability, quality of solution, and cost to consumers for each DRE model.
- **Develop clean technical standards for DRE products** that align with international standards. This could be done in partnership with SON and GOGLA.

[141] Stakeholder interviews, 2016
[142] Stakeholder interviews, 2016
[143] Stakeholder interviews, 2016
[144] SE4All 2016, Action Agenda

ANNEX 3.1: OVERVIEW OF KEY STAKEHOLDERS

KEY STAKEHOLDERS

Name of institution	Function
National government	
Federal Ministry of Power, Works, and Housing (FMPWH)	The newly-combined FMPWH is the primary policymaking arm for the power sector. Minister Fashola oversees the Ministry, supported by Mustapha Baba Shehuri, the Minister of State. Currently, FMPWH's key priority in the power sector is improving the transmission capacity of the existing grid. The Renewable and Rural Power Access department was created during a restructuring of the Federal Ministry of Power[145] following privatisation in 2013.
Rural Electrification Agency (REA)	A public entity under the FMPWH that coordinates rural electrification efforts and is responsible for overseeing the Rural Electrification Fund (REF), which is not yet operational. REA has worked on nearly 3000 rural electrification projects, including some solar and mini-grid projects.[146] Since 2013, REA has started to transition to a more demand-driven, market-based approach (e.g., away from centrally managed and government-funded projects)[147]
National Electricity Regulatory Commission (NERC)	The independent regulatory agency established by the EPSRA in 2005. Its mandate is to monitor and regulate the electricity industry; issue licenses to market participants, and ensure compliance with market rules and operating guidelines.[148] It sets generation and consumer off-take prices through the Multi-Year Tariff Order (MYTO) and is currently developing regulations specific to mini-grids. [149]
Nigerian Bulk Electricity Trader (NBET)	Entity that buys electricity from Gencos and sells it to Discos and other eligible customers
Standards Organisation of Nigeria (SON)	A federal entity with the Ministry of Industry, Trade, and Investment (FMITI) that ensures product quality through standards and certification. SON oversees the importation of off-grid products and is relevant to market spoilage issues, among other standards challenges.
National Power Training Institute of Nigeria (NAPTIN)	A federal government institution that reports to the FMPWH and operates nearly ten regional training centres across the country. NAPTIN also has the responsibility to help the FMPWH develop policy to build capacity in the power sector.[150] NAPTIN increasingly seeks to take a private sector-driven approach to its training and operations in order to best meet the demand of the privatised power sector.[151]

[145] Before the merger of Power, Works , and Housing

[146] The exact number of projects is not readily available, but data on the REA website mentions ~75 projects that involve solar.

[147] Ley, K., Gaines, J. and Ghatikar, A. 2015

[148] NERC: About Us 2016, Available: http://www.nercng.org/index.php/about-us

[149] Ley, K., Gaines, J. and Ghatikar, A. 2015

[150] The 2016 training schedule includes a 15-day course focused on renewable energy (operation and maintenance of solar, wind, and hybrid systems)

[151] Ley, K., Gaines, J. and Ghatikar, A. 2015

Energy Commission of Nigeria (ECN)	Government entity under the Federal Ministry of Science and Technology that coordinates the National Energy Policy (NEP) and related strategic planning. ECN is a leading actor in energy statistics and research, including management of the National Center for Energy Efficiency and Conservation and five other research centers.
Key civil society organisations and academic institutions*	
Power for All	A UKaid/DfID-supported campaign to "advance renewable, decentralised electrification solutions as the fastest, most cost-effective and sustainable approach to universal energy access." In Nigeria, their work primarily focuses on market development.
Nigerian Alternative Energy Expo (NAEE)	A global consortium focused on increasing the capacity for renewable energy in Nigeria, primarily via knowledge sharing. NAEE provides coverage of alternative energy, climate change, rural electrification, grants, and greenhouse gas emissions in Nigeria.
Manufacturers Association of Nigeria (MAN)	MAN brings together 2000+ companies in Nigeria to present their interests to politicians, other sectors of the economy, and broader society. Notably, MAN also develops policy suggestions to promote the enabling environment for manufacturing.[152] A key component of this enabling environment is power, and one high-potential use of off-grid energy is to grow industrial clusters and cottage industries. Therefore, MAN has identified about 28 clusters to co-develop mini-grids (ranging from 5 to 50 MW) with NERC. [153]
Key off-grid private sector actors*	
Solar mini-grids and SHS	• Arnergy is a solar solutions provider focused on mini-grids and SHS (PAYG and lease-to-own) and is a recipient of Bank of Industry funding • Nova-Lumos is a leading provider of PAYG energy via solar home systems (SHS) • Green Village Electricity is also a leading off-grid developer and recipient of Bank of Industry funding • Schneider Electric provides "integrated" energy solutions that combine technology, products and services [154]
On-grid	• Over 6 Gencos and 11 Discos are now privatised and operate on a regional basis. [155]
Bank of Industry (BOI)	• Nigerian DFI that has worked with UNDP through the Access to Renewable Energy Programme to build capacity in the renewable energy sector, and more recently, invested in six pilot SHS and mini-grid development projects. A sampling of results achieved to date includes development of state-level RE strategies, creation of RE desks at financial institutions, and establishment of the National Association for Renewable Energy Entrepreneurs and Professionals (NAREEP). [156]

[152] Ley, K., Gaines, J. and Ghatikar, A. 2015

[153] Ikyaa, Y. 2015, Manufacturers identify 28 clusters for proposed micro grid, Business Day

[154] Schneider Electric 2016, Nigeria: Energy Infrastructure

[155] There are now more than six Gencos, but six were created in the privatisation of state assets.

[156] UNDP 2016, Access to Renewable Energy

Ecobank	The most active commercial bank in residential off-grid energy financing. Ecobank has received partial credit guarantees from the USAID Development Credit Authority (DCA) to promote lending in the energy sector.[157]
International donors and actors	
Power Africa	A $7 billion US government effort launched by President Obama in 2013 to enable 60 million new connections and 30,000 MW of new and cleaner generation. In Nigeria, Power Africa focuses on financing and transaction advisory. It seeks to mobilise long-term financing through credit enhancement, grants, technical assistance, and investment promotion efforts. USAID is the coordinating agency in country.
GIZ	Leading energy donor implementing the Nigerian Energy Support Programme (NESP), which seeks to improve conditions for the application of and investment in renewable energy and energy efficiency – and to promote rural electrification.
African Development Bank (AfDB)	AfDB has selected energy access as one of its "High Five Priority Areas." It recently released the New Deal on Energy for Africa, a transformative partnership to reach universal access by 2025. The AfDB president, Akin Adesina, is from Nigeria and previously served as the Minister of Agriculture.

[157] Rapp, M. 2015, 25 March 2016 - last update, Ecobank and USAID's Development Credit Authority: A Pan-African Approach to Unlocking Private Capital

4

SENEGAL COUNTRY REPORT

EXECUTIVE SUMMARY

Despite two decades of power sector reforms, approximately 40% of Senegal's population still lacks access to electricity, with vast rural and urban disparities. Over six million people are not connected, including three out of five in rural areas.[158] Moreover, Senegal boasts one of the most expensive electricity tariffs in Africa: over $0.26/kWh.[159] Against this backdrop, the government sees renewable energy (RE) as a potential solution to both low levels of access and high costs – but less than 1% of installed generation capacity came from RE sources in 2012.[160] Since the early 2000s, decentralised renewable energy (DRE) has grown to include hundreds of projects and over 3 MW of solar generation capacity.[161]

The national regulatory framework encourages DRE as a key component to improving rural electrification, but more specific regulations and incentives are needed to grow the sector. In 2008, the updated national energy policy – known as the Letter of Policy Development of the Energy Sector (LPDSE) – explicitly acknowledged the importance of renewable energy. The LPDSE laid the groundwork for the passage of the Renewable Energy Law (2010), which regulates the on-grid and off-grid RE sector. However, the law is relatively high-level, and implementing decrees are required to determine the specific incentives and regulations (e.g., feed-in tariffs, tax exemptions). Senegal also has a Rural Electrification Plan of Action that relates more directly to DRE, but many components have faced implementation challenges. Lastly, the Ministry of Energy and the Development of Renewable Energy (MEDER) has not yet approved the National Renewable Energy Strategy (2016-2020) because the draft did not fully capture the government's aspirations in the RE sector; therefore, the draft is now being reworked. As a result, despite political commitment, there are gaps in policies and regulations needed to drive the uptake of DRE.

Key policy-related barriers include limited understanding of the ecosystem of government actors and their roles; the need for stronger subsidies and incentives to drive DRE; a tariff policy that could better encourage DRE; fragmented and inadequate data; and grid interactivity. Despite much recent progress, government entities working on DRE via rural electrification often encounter challenges in carrying out their mandates due to capacity that could benefit from further reinforcement; limited financing; and limited empowerment. When asked about information gaps, stakeholders often cited weak information systems and limited flow of information between policy-makers rather than specific knowledge or research needs. Key questions emerged regarding how to help government entities better collaborate (via improved exchange of information and data) and how to empower them to drive the growth of DRE (via financing and capacity). Questions also emerged around specific DRE policy issues: subsidies and incentives, end user tariffs, feed-in tariffs, and grid interactivity regulations.

Approximately 40% of Senegal's population lacks access to electricity. Moreover, Senegal boasts one of the most expensive electricity tariffs in Africa. Against this backdrop, the government sees renewable energy as a potential solution to both low levels of access and high costs

[158] IEA 2015, World Energy Outlook [Homepage of International Energy Outlook], [Online]

[159] USAID 2016, 2 June - last update, Senegal: Power Africa Fact Sheet [Homepage of USAID], [Online]

[160] IRENA 2012, Senegal: Renewables Readiness Assessment, International Renewable Energy Agency. RE accounted for 2 MW out of a total of 548 MW in 2012. This excludes 64 MW of capacity Senegal receives from the Manantali Dam in Mali

[161] Stakeholder interviews, 2016

I. INTRODUCTION

This report presents a policy analysis of the decentralised renewable energy (DRE) landscape in Senegal. It details current policies impacting DRE, identifies key stakeholders, and analyses challenges that inhibit the growth of the sub-sector in Senegal. It also identifies key questions on the minds of policy-makers and policy influencers and proposes solutions to help answer them. We derived the findings presented in this document through desk research and nine qualitative interviews with key stakeholders from government, civil society, donor agencies, and the private sector.

The report is structured as follows: Section II sets the stage for the analysis by outlining the current state of Senegal's power sector – including electricity access, shortfalls between supply and demand, and renewable energy targets. Section III describes the current DRE policy landscape, the key stakeholders active within it, and important emerging policy trends. Within this policy landscape and the state of the sector, Section IV presents the key questions posed by policy-makers and policy influencers that, if answered, could move the sector forward. Section V concludes by summarising the key policy challenges in Senegal and highlights opportunities for action at a macro-level.

II. OVERVIEW OF THE ENERGY SECTOR

Since 1996, Senegal has attempted to privatise and liberalise its electricity sector in order to deliver improved access and quality to its population. In 1998, the government set forward institutional reforms to help privatise the market.[162] This included dividing the sector into three separate public entities;[163] transforming the national utility – SENELEC – into a stock company; opening power generation to independent power producers (IPPs); and allowing private investment in the electricity market.[164] In 1999, the government sold 34% of SENELEC's shares to a private consortium. However, after 18 months of challenges related to pricing and securing investments, the new government re-purchased these shares in September 2000. Under a new model, the government tried to re-privatise SENELEC in 2001 – but was unable to reach a deal with either of the two bidders. As a result, SENELEC maintains its monopoly over wholesale power purchase, transmission, and distribution – and the electricity sector remains predominantly under public control.

Despite two decades of reforms, access to energy remains a fundamental challenge. In 2014, only 61% of the population had access to electricity – with a vast disparity of 40% in rural areas compared to 88% in urban areas. [165,166] What's more, people who do have access face insufficient and unreliable supply and high electricity costs. Senegal's primary source of electricity is oil, which results in some of the most expensive electricity tariffs in SSA: over $0.26/kWh.[167] As a result, over six million people – as well as communities, businesses, and public institutions – cannot access the electricity they need.[168]

[162] See Law n° 98-29 of 14 April 1998 in Figure 3

[163] A national utility, SENELEC, a rural electrification agency, ASER, and a regulator, CRSE

[164] ECOFYS Germany GmbH 2009, Energy-policy Framework Conditions for Electricity Markets and Renewable Energies, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, Eschborn, Germany

[165] IEA 2015, World Energy Outlook [Homepage of International Energy Outlook], [Online]

[166] One stakeholder expressed doubt about the veracity of the ~30-40% rural electrification estimate, which depends on data from ASER

[167] USAID 2016, 2 June - last update, Senegal: Power Africa Fact Sheet

[168] IEA 2015, World Energy Outlook [Homepage of International Energy Outlook], [Online]

Against this backdrop, the government sees renewable energy (RE) as a potential solution to both high costs and low levels of access.[169] Given the high costs of generating electricity from imported oil, the government is determined to increase its use of biofuels and other renewable energy sources.[170] By reducing dependence on oil imports, renewable energy also increases Senegal's energy security – a key priority for the government. Moreover, the government sees renewables as one way to reach rural populations who live beyond the national grid. Solar has potential for 1,800 kWh/m2/year for direct normal irradiation and 2,000 kWh/m2/year for global horizontal irradiation. Wind has potential along the coast between Dakar and Saint Louis, with speeds of 4-6 m/s.[171] Overall, renewable sources of energy could be a much-needed complement to Senegal's existed 600+ MW of installed generation capacity.[172]

Given these potential benefits, political support for renewable energy is high. In 2012, the government participated in the International Renewable Energy Agency's (IRENA) first-ever Renewable Readiness Assessment (RRA). The purpose of the RRA was to help assess Senegal's current situation, identify gaps, and develop concrete actions to accelerate the growth of RE. The RRA recommended eight concrete actions, several of which related to strengthening the regulatory environment and market conditions for off-grid energy.[173] More recently, Senegal developed the Senergy 2 utility-scale solar PV plant. The plant has 20 MWp of installed capacity and is the first Independent Power Producer (IPP) to be connected to the grid in West Africa.[174] Therefore, Senegal has demonstrated that it can attract investment in renewable energy – and there will be more opportunities to do so in the future. President Macky Sall also appointed a 'reformer' [175] to lead SENELEC, and Minister Thierno Alassane Sall of the Ministry of Energy and the Development of Renewable Energy (*Ministre de l'Energie et du Développement des Energies Renouvelables*, MEDER) has expressed his support for alternative sources of energy.[176] Yet according to interviewees, SENELEC has retained its monopoly and powerful union. The government recognises the hard reality that Senegal needs to pursue the most affordable electricity options – regardless of whether or not they are renewable.[177]

Within the RE landscape, the government and international donors have prioritised development of decentralised renewable energy (DRE) in rural areas since the early 2000s. Given low levels of access, the government promotes electrification of remote areas the grid does not serve through Local Rural Electrification Initiatives (*Electrification Rurale d'Initiatives Locale,* ERILs). ERILs can include solar home systems (SHS), mini-grids, and other DRE solutions. A range of actors – including NGOs, private sector, or community groups – can implement ERILS, if approved by the Senegalese Agency for Rural Electrification (*Agence Sénégalaise pour l'Électrification Rurale*, ASER).[178] In 2014, ENERSA, a private company, signed the first concession contract with the Senegalese government for the village of Sine Moussa Abdou.[179] Since then, however, no other concessions have been fully formalised, which is an obstacle for operators seeking to maintain or invest in new mini-grids. As of 2014, ASER had also installed 107 mini-grids, totalling 1 MW of installed PV capacity – and ASER now estimates off-grid capacity is over 3 MW.[180,181] The key off-grid initiative at present is the Renewable Energy for Senegal (ERSEN) off-grid Solar Energy Programme. It is co-implemented by ASER and GIZ's Programme for the Promotion of Renewable Energy, Rural Electrification, and Sustainable Supply of Household Fuels (PERACOD).[182] ERSEN is the Senegalese project of EnDev, a multi-donor partnership in more than 25 countries that has supported solar mini-grids and SHS in over 270 villages in Senegal.[183] Six private operators oversee these ERSEN projects. Also in the private sector, Oolu Solar has deployed a PAYG solution at small scale in partnership with Orange Money. Although international donors and the government have been involved in the majority of off-grid projects to date via investment subsidies, price controls, and technical assistance, the scale of DRE ultimately hinges on increased private sector participation.

[169] IRENA 2012, Senegal: Renewables Readiness Assessment, International Renewable Energy Agency

[170] Beyond renewables, the government is also moving toward coal-powered electricity

[171] IRENA 2012, Senegal: Renewables Readiness Assessment, International Renewable Energy Agency

[172] USAID 2016, 2 June - last update, Senegal: Power Africa Fact Sheet. At time of publication, this updated web page lists 731 MW of installed generation capacity

[173] Two recommendations related to DRE were to a.) adapt the rules of intervention for the regulator (CRSE) in the specific case of small electricity producers (ERILs) and b.) identify conditions needed for operation and maintenance of off-grid motive and thermal power

[174] Senergy 2 – Senegal – Operational, GreenWish Partners, http://www.greenwishpartners.com/portfolio/senergy-2-solar-pv-farm/

[175] Stakeholder interviews, 2016

[176] Stakeholder interviews, 2016

[177] Stakeholder interviews, 2016

[178] Mini-Grid Policy Toolkit-Case Study: ERSEN Off-grid Solar Energy Programme 2014, EU Energy Initiative Partnership Dialogue Facility (EUEI PDF)

[179] Electrifying the village of Sine Moussa Abdou 2014, http://www.matforce.com/MATFROID/blog-actu/2-electrification-du-village-de-sine-moussa-abdou edn, Matfroid, Matfroid

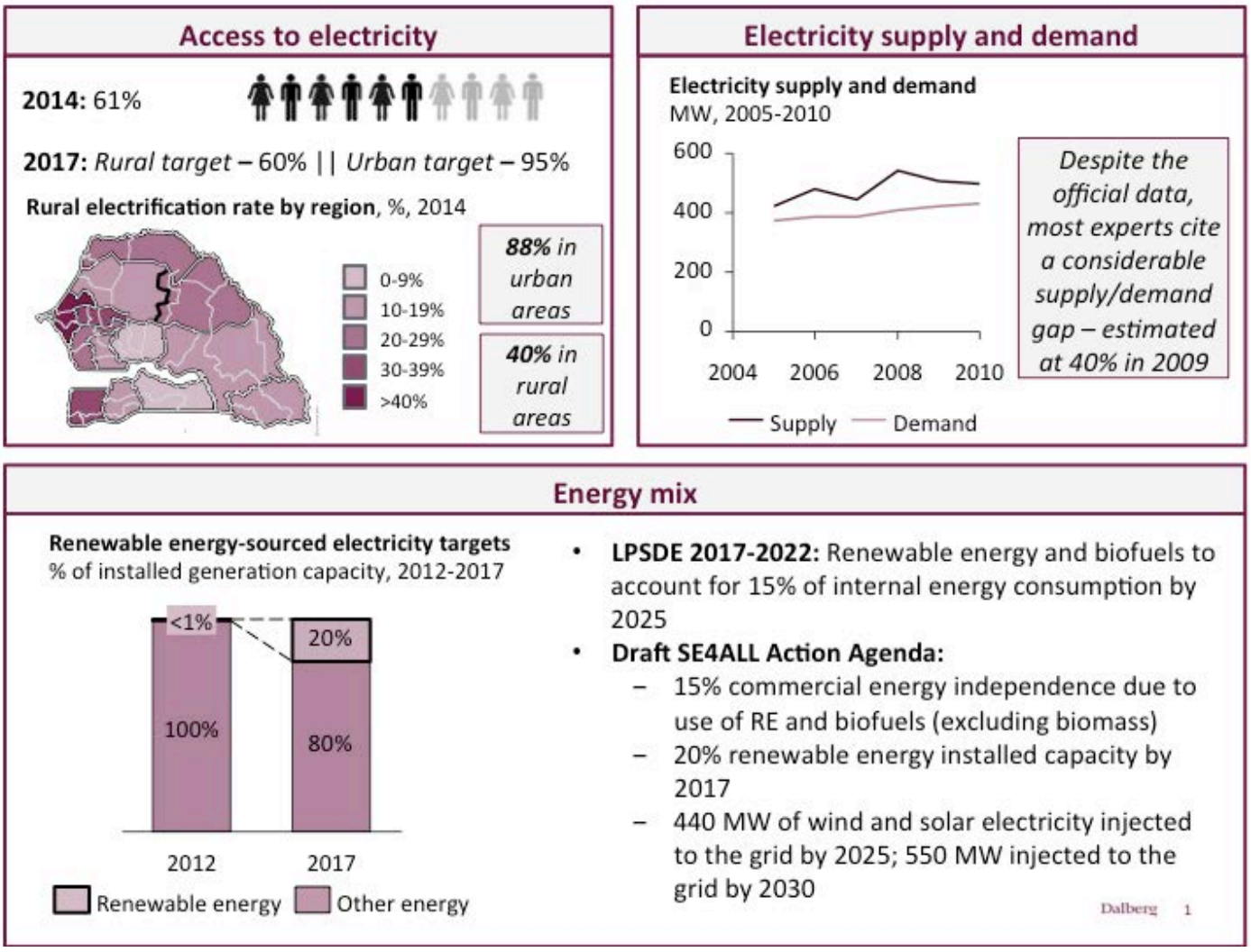
[180] Stakeholders interviews, 2016

[181] REN21 2014, ECOWAS Renewable Energy and Energy Efficiency Status Report, Ren21, Paris: Ren21 Secretariat

[182] ERSEN/PERACOD mini-grids deploy a hybrid utility private model: the government owns the land and equipment but gives a concession to a private firm for operation, maintenance, and repair

[183] Stakeholder interviews, 2016

FIGURE 12: OVERVIEW OF THE POWER SECTOR IN SENEGAL [184]



[184] Sources for Figure 12: Sources for Figure 12: Access to electricity: World Energy Outlook (2016), Electricity Access DatabaseIEA 2015, World Energy Outlook; Niane, I. 2015, Energie Durable pour Tous (SE4ALL) Agenda d'Actions Sénégal, ECOWAS Centre for Renewable Energy and Energy Efficiency; MEDER 2014, SIE. Electricity supply and demand: African Development Bank 2011, Étude D'interconnexion des Réseaux Electriques Sénégal, Mauritanie, Maroc, Espagne, African Development Bank; Stakeholder interviews, 2016. Energy mix: Niane, I. 2015, Energie Durable pour Tous (SE4ALL) Agenda d'Actions Sénégal, ECOWAS Centre for Renewable Energy and Energy Efficiency; Lettre de Politique de Développement du Secteur de L'Energie 2012, Ministère de L'Energie et des Mines, Dakar, Senegal. Notes for Figure 12: Access to electricity: Targets for 2017 are from the draft SE4ALL Action Agenda. Electricity supply and demand: Peak demand estimate comes from the AfDB – but this is difficult to measure given lack of access and use of biomass. Energy mix: current % of RE installed generation capacity varies by source. RRA cited 2 MW out of 548 MW in 2012, which excludes 64 MW from the Manantali Dam in Mali (Senegal receives 32% of 200 MW capacity). One interviewee said that proportion of electricity from RE sources is currently 8%. Target of 20% renewable energy installed capacity comes from SE4ALL, and is supported by statements in the media. However, there is no clear MW target for total installed generation capacity by 2017

III. POLICY LANDSCAPE

KEY STAKEHOLDERS AND ROLES

Government and international donors play a critical role in the DRE sub-sector, but other actors are becoming increasingly involved. Many stakeholders noted that "new players" in the sector – including RE IPPs and off-grid developers and operators – play a critical role and government and donors need to include them.[185] Key stakeholder segments include:

- **Public sector:** MEDER sets the overarching policy for the energy sector, including the work-in-progress National Renewable Energy Strategy (see Figure 13). Several agencies related to DRE sit under MEDER: the National Agency for Renewable Energy (ANER) and ASER. The Regulatory Commission of the Electricity Sector (CRSE) oversees licensing, operation, and sales of electricity – including approving tariffs for off-grid projects. SENELEC is the national utility and has a monopoly over on-grid transmission and distribution; it is also the largest generator.[186]
- **Private sector:** Private companies play an important role in the sub-sector through development and operation of DRE solutions, such as mini-grids. Private sector actors can implement ERILs, with approval from ASER. In the ERSEN project, private sector companies have received concessions to operate, maintain, and repair solar PV mini-grids. Since 2008, private renewable energy IPPs can also connect to the national grid.[187]
- **Civil society & academia:** Civil society and community-level actors can implement off-grid ERILs, with approval from ASER. Currently, these actors primarily provide technical support to the government, conduct research, and help coordinate various stakeholders related to the DRE sub-sector. One key actor in this category is University Cheikh Anta Diop of Dakar's Centre for the Study and Research of Renewable Energy (CERER).
- **Donors:** The World Bank/IFC, Germany/GIZ, AFD, the EU, the Netherlands (via Energising Development, originally a Dutch-German partnership that has since expanded) are leading DRE donors in Senegal, particularly in the solar sector.[188] USAID is becoming increasingly involved in energy via Power Africa, and African Development Bank (AfDB) efforts are likely to expand as a part of its New Deal on Energy Access. However, both USAID and AfDB focus a large portion of their efforts on non-renewable and grid-connected activities. Exact levels of investment are unknown, but the energy sector as a whole depends highly on international donors.[189]

CURRENT POLICIES

Senegal has developed several policies and laws related to DRE since it prioritised RE at the national level in 2008. The governing policy for the energy sector is the Letter of Policy Development of the Energy Sector (*Lettre de Politique de Developpement du Secteur de l'Energie,* LPDSE), which was first released in 1997 and subsequently updated in 2002, 2008, and 2012. In 2008, the LPDSE explicitly acknowledged the importance of renewable energy and laid the groundwork for the passage of the Renewable Energy Law (2010), which regulates the RE sector. The Law covers tax relief, grid access, certificate of origin (to help RE producers to unlock incentives), and feed-in tariffs.[190] However, the law is relatively high-level, and implementing decrees are required to determine the specific incentives and regulations. Two such decrees, discussed in Figure 13 below, have been released. Most recently, the 2012-2017 LPDSE called for the creation of ANER, the operationalisation of incentive schemes, investment opportunity identification and planning, and a study on the implementation of a feed-in tariff. [191] Although still in its early stages, the RE policy environment is advancing.

[185] Stakeholder interviews, 2016

[186] IRENA 2012, Senegal: Renewables Readiness Assessment, International Renewable Energy Agency

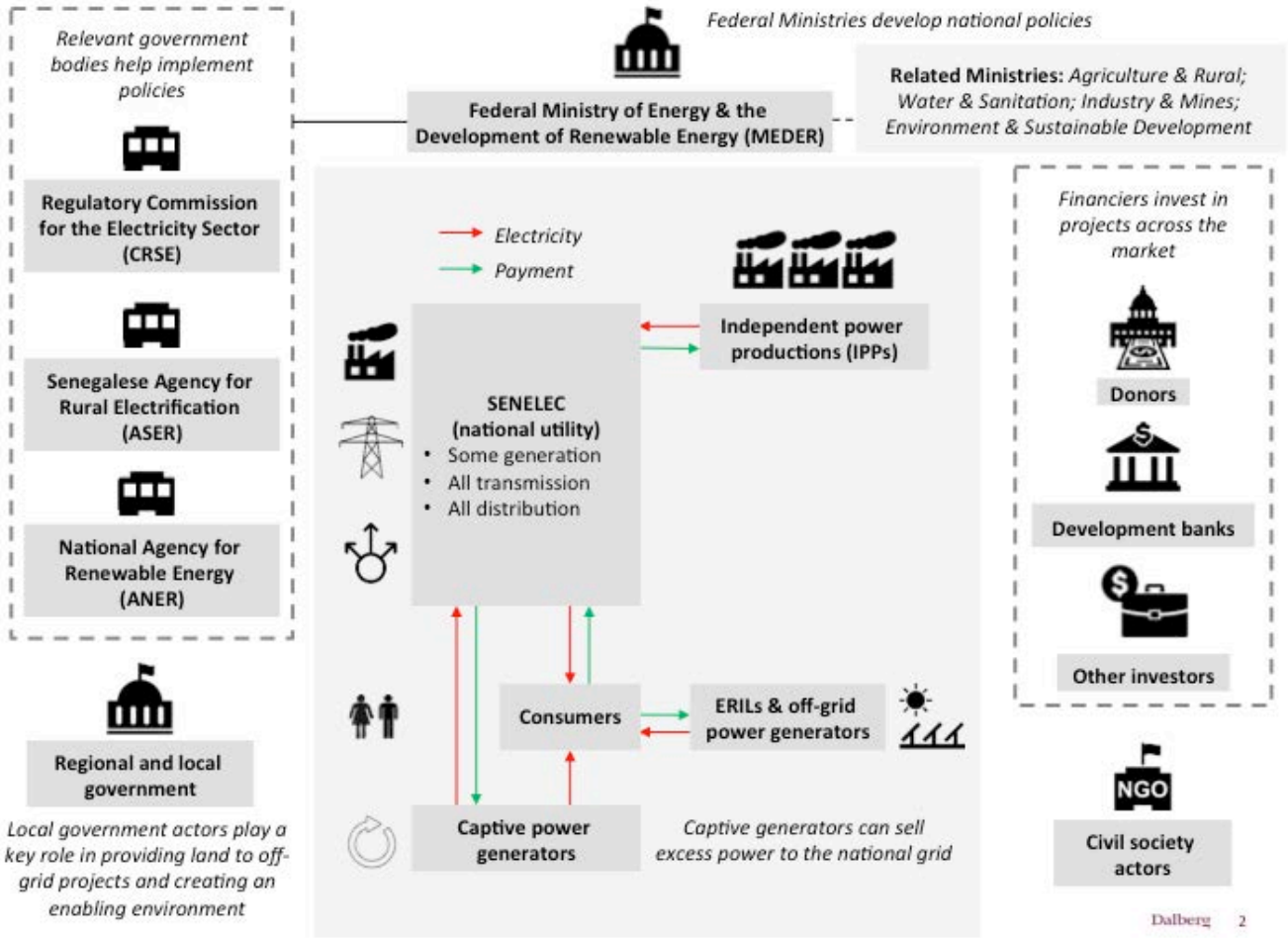
[187] IRENA 2012, Senegal: Renewables Readiness Assessment, International Renewable Energy Agency

[188] ECOFYS Germany GmbH 2009, Energy-policy Framework Conditions for Electricity Markets and Renewable Energies, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, Eschborn, Germany[189] IRENA 2012, Senegal: Renewables Readiness Assessment, International Renewable Energy Agency

[190] IEA 2013, 18 July - last update, Renewable Energy Law [Homepage of International Energy Agency], [Online]

[191] Lettre de Politique de Développement du Secteur de L'Energie 2012, Ministère de L'Energie et des Mines, Dakar, Senegal

FIGURE 13: KEY STAKEHOLDERS, THEIR ROLES AND RELATIONSHIPS IN SENEGAL



However, there is still a need for more specific policies dedicated to DRE. In late 2015, ANER announced a draft of the National Renewable Energy Strategy 2016-2020 (1), which targeted 20% renewable energy – as measured by installed generation capacity – by 2017.[192] MEDER recently did not approve the draft strategy because it was not ambitious enough; therefore, it is now being reworked.[193]

This demonstrates the government's commitment to the DRE sector. Further, the two implementing decrees of the Renewable Energy Law relate to how RE IPPs and self-producers[194] can connect to the national grid, but lack specificity on key off-grid issues (e.g., feed-in tariffs). As a result, there are gaps in national policies and regulations needed to promote DRE.

Lastly, the government has a twenty-year rural electrification plan but many components have faced implementation challenges. The plan includes multiple components related to emergency action and universal access. Created in 2002, the Senegalese Rural Electrification Plan of Action (*Plan d'Action Senegalais d'Electrification Rurale*, or PASER) targeted 62% rural electrification by 2022. Yet to date, few concrete actions have materialised due to competing programmes, recurrent shifts in leadership, institutional capacity that could benefit from strengthening, and lack of open and up-to-date data on PASER progress.[195] The government also promotes rural electrification through the Emergency Programme for Community Development (*Programme d'Urgence de Développement Communautaire*, PUDC). PUDC seeks to electrify 479 villages by 2016, 150 with solar energy.[196]

[192] Media Terre, Renewable energy: The Government of Senegal is to meet 20% of the installed capacity [Homepage of Media Terre], [Online]

[193] Stakeholder interviews, 2016

[194] i.e., captive generation for self-use. IPPs produce power for many end users.

[195] Stakeholder interviews, 2016

[196] Government of Senegal, The Community Development Emergency Program aims to contribute to improving rural access to basic social services through the implementation of socio-economic infrastructure. [Homepage of Government of Senegal], [Online]

Photo credit for Senegal report cover page: Barb Dybwad https://www.flickr.com/photos/barb/267632615/in/gallery-49143349@N05-72157623714817605/

FIGURE 14: KEY POLICIES RELATED TO DECENTRALISED RENEWABLE ENERGY IN SENEGAL [197]

Policy	Description	Status
La loi n° 98-29 du 14 avril 1998	Law that initiated the institutional reforms of the electricity sector, with the goal of privatising and liberalising the market. The law split the electricity market into three entities: SENELEC, CRSE, and ASER.	Effective as of April 1998
National Bioenergy Strategy	Strategy to use jatropha to generate biodiesel and sugarcane to produce ethanol; the strategy was followed by the launch of National Committee on Biofuels (CNB) to coordinate action.	Adopted in 2006
Letter of Policy Development of the Energy Sector (*Lettre de Politique de Developpement du Secteur de l'Energie*)	The LPDSE is the government's overarching strategy for the energy sector, first released in 1997 and subsequently updated in 2002, 2008, and 2012. The 2008 update opened the national grid and the power-generating sector to renewable sources. It also set the goal for renewable energy and biofuels to account for at least 15% of internal energy consumption by 2020.	First developed in 1997; subsequent updates released in 2002, 2008, and 2012
Letter of Policy Development of the Energy Sector (2012-2017)	The most recent LPDSE called for the creation of ANER; the operationalisation of incentive schemes; investment opportunity identification and planning; and a study on the implementation of a feed-in tariff.	Update released in 2012
Senegalese Rural Electrification Plan of Action (*Plan d'Action Senegalais d'Electrification Rurale*)	This 20-year rural electrification programme seeks to increase rural electrification from 8% in 2000 to 62 % in 2022. According to stakeholders, implementation has encountered challenges.	Effective as of 2002, but implementation has encountered challenges.
Renewable Energy Law (*La Loi d'Orientation sur les Energies Renouvelables*)	Law that regulates the renewable energy sector in Senegal. Covers tax relief, grid access, certificate of origin (for RE producers to unlock incentives), and feed-in tariffs. Implementing decrees determine the specific incentives to promote RE.	Effective as of December 2010
Decree No. 2011-2013	An implementing decree of the Renewable Energy Law that details the power purchase conditions for RE power plants, as well as the conditions to connect RE sources to the grid. It also touches on power purchase obligations and feed-in tariffs, but does not provide specifics.	Effective as of December 2011

[197] This is not an exhaustive list of all policies in the electricity sector, but rather a synthesis of those that relate to DRE

Decree No. 2011-2014	An implementing decree of the Renewable Energy Law that details the power purchase conditions for RE from self-producers (captive generation). This includes fixed maximum intake, purchase price, conditions of purchase, and connection to the grid.	Effective as of December 2011
National Renewable Energy Strategy (*Stratégie nationale de développement des énergies renouvelables*) 2016-2020	Strategy to promote the growth of RE across the country. The draft was announced by the media in December 2015, and supposedly targeted 20% of total installed capacity to be renewable energy by 2017. However, according to stakeholders, the MEDER did not approve the strategy; therefore, it is now being redone	Draft not approved by MEDER; currently being reworked
Emergency Programme for Community Development (*Programme d'Urgence de Développement Communautaire*)	The LPDSE is the government's overarching strategy for the energy sector, first released in 1997 and subsequently updated in 2002, 2008, and 2012. The 2008 update opened the national grid and the power-generating sector to renewable sources. It also set the goal for renewable energy and biofuels to account for at least 15% of internal energy consumption by 2020.	First developed in 1997; subsequent updates released in 2002, 2008, and 2012
Decree No. 2011-2013	Community development strategy that includes a component on rural electrification—with a target to provide electricity to 479 villages, including 150 with solar energy.	To be implemented 2012-2016

FIGURE 15: OVERVIEW OF CURRENT POLICIES RELATED TO DRE IN SENEGAL[198]

Policy area	Current policies	Gaps and challenges
High-level strategy and targets		
Energy mix	• The Renewable Energy Law (2010) and other policies recognise the role of RE sources in on-grid and off-grid electricity generation • Political commitment to RE is high	• Policies are relatively high-level and often lack mechanisms to encourage implementation, e.g., action plans or 'decrees' that provide additional detail on subsidies, incentives, and other concrete regulations outlined in the high-level policies • Previous policies (e.g., PASER) have not been implemented successfully due to capacity that could benefit from strengthening, a disconnect between policy-makers and what was happening 'on the ground' and lack of information & data
On-grid electricity	• Government supports private sector-led electrification of rural areas through ten large-scale concession schemes • The government has divided the country into ten Priority Rural Electrification Programmes (Programmes Prioritaires d'Électrification Rurale - PPER); each PPER is allocated to a national or international company via tender for 25 years	• Many barriers – including financing, generation capacity, and the SENELEC monopoly – are not covered here in detail • To date, only 6 of 10 PPER concessions have been sold – and only 1 or 2 have started work [199]
Off-grid electricity	• Government has recognised that large-scale expansion of the national grid will not meet the needs of rural areas • Therefore, the regulatory framework promotes electrification of remote areas through PPERs and off-grid Local Rural Electrification Initiatives (ERILs)	• Lack of specific policies and regulations for off-grid electricity impedes growth of the sector • Many DRE-related policies and strategies have encountered implementation challenges (e.g., PASER) • The Ministry did not approve the National Renewable Energy Strategy because it was not ambitious enough. Although this demonstrates commitment, it also exacerbates policy gaps • One stakeholder noted that the government's two rural electrification instruments – PPERs and ERILs – sometimes compete with each other: "ERILs have been the major channel to increase access to electricity in rural areas, but investing in ERILs is riskier. In case of geographic conflict, the law favors concessionaires over ERIL operators" • To date, only one ERIL has successfully launched: Sine Moussa Abdou[200]

[198] Sources for information in Figure 15: Stakeholder interviews, 2016; IRENA 2012, Senegal: Renewables Readiness Assessment, International Renewable Energy Agency; ECOFYS Germany GmbH 2009, Energy-policy Framework Conditions for Electricity Markets and Renewable Energies, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, Eschborn, GermanyGTZ 2009, Renewable Energies in West Africa, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, Eschborn, Germany; REN21 2014, ECOWAS Renewable Energy and Energy Efficiency Status Report, Ren21, Paris: Ren21 Secretariat; IEA 2016, Program for the promotion of Renewable Energies, Rural Electrification and Sustainable Supply in Domestic Fuel (PERACOD) [Homepage of International Energy Agency], [Online]; Electrifying the village of Sine Moussa Abdou 2014; relevant policy documents.

[199] Stakeholder interviews, 2016

[200] There is some debate over the number of ERILs that exist. Some people consider Sine Moussa Abdou to be the only one, but CRSE documents also refer to PERACOD/ERSEN mini-grids as ERILs. There are many other mini-grid projects that are not recognised/contracted by the government

Grid interactivity	• There is no policy that deals with issues related to grid interactivity (e.g., what happens when the national grid arrives) • In an effort to prevent on-grid and off-grid competition, ASER only approves ERILs in areas that will not be electrified in the next three years, according to the electrification plan of the PPER concession holder	• No clear policy on how off-grid systems interact with the national grid, resulting in uncertainty for off-grid projects
Electricity regulations and incentives		
Economic/ fiscal	• **Import duties:** The 2010 Renewable Energy Law specifies that materials and equipment needed to exploit RE shall "benefit from fiscal incentives," but does not provide additional detail. International donors often negotiate tax exemption on a case-by-case basis. Exemptions only automatically kick in if the government contracts developers/operators (e.g., the one existing ERIL example: Sine Moussa Abdou). • **Other taxation:** The RE Law (2010) calls for full tax exemption for the purchase of materials or equipment for self-consumption of renewable energy. [201]	• RE Law mentions a tax exemption scheme on imports of and VAT on renewables equipment, but an enforcement decree has not yet been adopted • According to interviews, the Ministry of Finance argues the tax exemption scheme conflicts with the ECOWAS common external tariffs – and is therefore not likely to be enforced • According to interviews, there are concerns about loopholes for tax fraud given some renewables equipment – cables, batteries – could be imported for a different purpose • Exemptions from import duties and VAT for DRE components only apply if the government contracts the developer/operator • Other exemptions are determined on a case-by-case basis without a streamlined process
Tariffs	• On-grid: CRSE approves tariffs for all electricity, regardless of the size of the project. This includes off-grid ERILs • Feed-in tariff: The National Renewable Energy Law sets the basis for a renewable energy feed-in tariff (REFIT), which is currently under development. The draft FIT policy covers solar PV, solar thermal, wind, hydropower, biomass, and biogas installations. However, to date, no REFIT has been implemented • Net metering: While not officially recognised as a net metering policy, the 2010 Renewable Energy Law and Decree No. 2011-2014 set the conditions for purchase of excess electricity from self-producers—by the national grid or by decentralised distribution networks. • Off-grid: Tariffs set by CRSE are cost-reflective and therefore seek to encourage mini-grid development. There are four consumer tariff levels, but tariffs are set individually for each mini-grid, depending on the cost of the project. For ERSEN projects, each tariff is set in negotiation with CRSE to predict an IRR of 12%. Off-grid tariffs are typically higher than on-grid tariffs due to lack of government subsidy.	• CRSE must set the tariff for all projects - regardless of size - which can be cumbersome for mini-grids • On-grid end user tariffs are subsidised (the government covers SENELEC's losses), while off-grid tariffs are supposed to be cost-reflective. High off-grid tariffs prevent solar and other DRE solutions from competing with on-grid prices. • Although off-grid tariffs are supposed to be cost-reflective, stakeholders suggest that in reality they are not • Differential tariffs also leads to constant comparison among customers; experience from ERSEN projects suggests that some customers would prefer to remain disconnected than to pay more for off-grid electricity • Flat rate tariffs (as opposed to metered) can be problematic for mini-grids as it can result in several customers using up/wasting all of the electricity • Feed-in tariff mechanism has not yet been determined/implemented; a risk for potential investors

[201] REN21 2014, ECOWAS Renewable Energy and Energy Efficiency Status Report, Ren21, Paris: Ren21 Secretariat

Licensing and contracts	• **Generation:** IPPs require a license from CRSE and ERILs require approval from ASER (with tariff approved by CRSE) • **Distribution:** SENELEC is the sole on-grid distributor • **Concessions:** As part of PASER, the government has divided the country into 10 Priority Rural Electrification Programmes (Programmes Prioritaires d'Électrification Rurale, PPER). Each concession is allocated to the winning bidder via tender for a period of 25 years • **Power purchase agreements:** CRSE sets the purchase price for electricity, but no mechanism exists yet for PPAs for electricity from RE sources • **Power purchase obligations:** Each PPER concession must source electricity from RE sources, but exact targets are not specified	• Mini-grid licensing process is burdensome given required approval from ASER on a case-by-case basis and tariff-setting by CRSE • IPP process is cumbersome; the time from signing the contract to implementation is often 7-8 years, according to interviews [202] • SENELEC monopoly creates uncertainty around off-grid projects • Only 6 of 10 PPER concessions have been sold to national and international companies
Customer protection, environmental, and technical standards	• **Quality assurance standards:** Two labs have been set up under the Senegalese Association for Standardisation (ASN) to ensure national standards for solar PV components are adopted. • **Quality of service regulation:** For many off-grid projects, quality is monitored at the local level. • **Environmental policy:** According to the 2010 Renewable Energy Law, production and distribution of RE must follow the conditions set by Senegal's Environmental Code	• Even though standards exists, there is limited testing of equipment. Some research institutes do work in this area, but they do not always share the results.
Financial support/ subsidies	• **Off-grid grants and subsidies:** Previously, the government provided large upfront subsidies for several ERILs. Currently, no dedicated financing mechanism(s) exists to promote DRE. • **Loan support and risk mitigation:** The Rural Electrification Fund (FER) is supposed to provide subsidies to operators and lines of credit & guarantees to banks and microfinance institutions • **Subsidies for other products:** Senegal has subsidised liquefied petroleum gas (LPG) for over two decades in order to reduce traditional biomass consumption and stem deforestation. Senegal has gradually phased out its kerosene subsidy.	• Government could benefit from a more coherent subsidy policy for the DRE sub-sector. Large upfront subsidies provided to ERSEN mini-grid projects were unsustainable, but no other model has been developed. • Limited financing is available for smaller RE projects (e.g., DRE) • FER is not operational, and as a result, rural projects are not benefitting from government subsidies • Mini-grid operators often cannot secure loans from commercial banks because they are not contracted by the government and otherwise lack collateral

[202] This is mostly relevant to on-grid electricity

Enabling policies		
Mobile regulations	• Mobile regulations allow for PAYG energy plans	
Technology transfer	• No clear policy on technology transfer	
Human capital and local expertise	• No clear policy on training or human capital development	• Government capacity could benefit from strengthening (particularly at agencies working on renewables) • Limited technical expertise to operate and maintain off-grid systems, and few enabling policies or government incentives to address the talent gap
Project development		
Site identification and permissions	• Developers usually find land on their own and must negotiate directly with local authorities and communities	
Resource assessment	• MEDER plays the leading role in resource assessment at the national level	
Land procurement	• Local communities own most land; local authorities have a high degree of autonomy over land use	• To be viable, RE projects must negotiate a land agreement for the duration of the project cycle (20+ years) • Complex system of land ownership and lack of agro-ecological zoning assessments for feedstock production impede growth of biofuels

KEY TRENDS

In the past decade, renewable energy has gained traction due to the government's goal to increase Senegal's energy security and independence. High oil prices from 2008 to 2014 exposed the vulnerability of the electricity sector due to its dependence on imported fossil fuels, pushing the government to consider other renewable and non-renewable options (e.g., coal). Senegal opened the grid to renewable IPPs in 2008 and has supported IRENA and the ECOWAS Regional Centre for Renewable Energy and Energy Efficiency (ECREEE). In early 2016, Senegal became the second country to sign on to IFC's Scaling Solar programme. It plans to add up to 200 MW in solar through the programme, with half of the capacity operational within two years.[203] However, President Sall has argued that Senegal cannot only focus on renewable energy sources. In July 2016, he said, "It is necessary to have a balanced energy mix" and called for the creation of a continent-wide fund to support electrification efforts, hosted by the AfDB. [204] Despite the discovery of offshore oil in early 2016, [205] President Sall has recently reaffirmed the government's commitment to reaching 20% renewable energy installed capacity by 2017.[206] This is promising for the DRE sector.

Senegal opened the grid to renewable IPPs in 2008 and has supported IRENA and the ECOWAS Regional Centre for Renewable Energy and Energy Efficiency (ECREEE). In early 2016, Senegal became the second country to sign on to IFC's Scaling Solar programme. It plans to add up to 200 MW in solar through the programme, with half of the capacity operational within two years

Under the umbrella of rural electrification, the number of DRE projects in Senegal has also grown over the past ten years – but sustainability is a key challenge. Although ASER estimates Senegal has over 3 MW of installed off-grid capacity, only a portion is operational. [207] In July 2016, an energy access partnership conducted an evaluation of mini-grids it has supported over the past 10 years. It found that only 2 of 10 mini-grids from the first phase of the programme in two regions were still operational. The projects require new inverters, which is a large expense for operators who are seeing recovery rates of 30-40%. Moreover, the few operators who are still running mini-grids are often compromising quality to make the economics work. Going forward, this partnership is unlikely to invest in new mini-grids until they resolve these sustainability issues.

[203] Eckhouse, B. 2016, 10 February - last update, Senegal to Add 200 Megawatts of Solar through IFC Program [Homepage of Bloomberg], [Online].
[204] Ibrahima, O. 2016, 18 July - last update, Pour un Fonds de soutien à l'électrification de l'Afrique [Homepage of Le Soleil Online], [Online].
[205] Stemler, D. 2016, 18 March - last update, Big Energy Discoveries Hold Huge Potential for Senegal [Homepage of Oil Price], [Online].
[206] Media Terre, Renewable energy: The Government of Senegal is to meet 20% of the installed capacity [Homepage of Media Terre], [Online].
[207] Stakeholder interviews, 2016
[208] Stakeholder interviews, 2016

IV. EMERGENT POLICY QUESTIONS

Within the DRE policy landscape, policy-makers cite a number of information and data gaps that, if filled, could help move the sector forward. The table below summarises the key policy questions we found through desk research and interviews with key stakeholders in Senegal.

FIGURE 16: SUMMARY OF KEY QUESTIONS FOR POLICY-MAKERS AND INFLUENCERS IN SENEGAL

Stakeholder	Key questions
Policy-makers	• **Comprehensive picture of the state of RE:** What is the full picture of the status of renewable energy in Senegal? Data is currently scattered across different entities (ASER, ANER, SENELEC, and NGOs like Enda). • **Financing:** How do we (the government – ANER, ASER, CRSE, MEDER) secure enough money to do our jobs well? • **Government empowerment and capacity:** How do we empower ANER, ASER, and CRSE to fulfill their mandates – particularly in light of the SENELEC monopoly? • **Subsidies:** To what extent should the government subsidise rural electrification projects? How can it do so most effectively? • **Feed-in tariff:** At what price should mini-grids sell electricity to SENELEC, if/when the national grid arrives? How can we make off-grid projects attractive to businesses – but not too expensive for SENELEC? • **End user tariffs:** What is the optimal tariff policy for off-grid projects? How can we harmonise off-grid tariffs with on-grid prices? Should there be one national tariff for on-grid and off-grid projects? If so, should the government cover the losses of off-grid projects (as it does for SENELEC)? Where would money to do so come from? • **Questions about rural electrification progress/efficacy:** - What have rural electrification efforts achieved so far? - Why have some concessionaires failed to provide electricity in rural areas? • **Best practices and lessons learned:** What are success factors/lessons learned from previous DRE projects (e.g., PERACOD)? • **Effective implementation:** How do we translate policy into action?
Policy influencers (private sector companies, NGOs, donors)	• **Institutional set-up:** How can the government improve its inadequate institutional set-up for rural electrification? • **Conflicting policy:** How do we reconcile conflicting regulations? For example, the SENELEC monopoly within 3 km of the national grid vs. ASER's open call for implementation of rural electrification initiatives? At some point, when the national grid reaches previously 'off-grid' areas, these policies will contradict each other. • **National grid capacity and interconnection with RE sources:** What load can the national grid actually handle? Can the national grid successfully connect to renewable sources of energy? • **Off-grid capacity and performance:** How many mini-grids exist? What is their total capacity and performance, to date? • **Mapping of government projects and efforts:** What are the relevant government agencies – SENELEC, MEDER, ANER, and ASER – doing related to rural electrification? Where is MEDER expanding medium tension lines? Where is ASER developing mini-grid projects? • **Energy nexus:** Where are the opportunities to integrate DRE into other development projects (e.g., a bilateral donor's work in agriculture)?

V. POLICY CHALLENGES AND OPPORTUNITIES

Assessment of current policies and expert interviews suggest that there are clear gaps in DRE-specific policies, compounded by implementation challenges for the relevant policies that do exist. Specifically, government coordination that could be strengthened, the need for more appropriate subsidies and incentives to drive DRE, off-grid tariff policy, insufficient open data and grid interactivity are critical policy-related barriers. [209] Other notable barriers include limited government (e.g., agencies) and technical capacity (e.g., mini-grid service providers), the SENELEC monopoly, and a lengthy process to develop operational IPPs.[210] One stakeholder also noted that most rural electrification efforts in Senegal focus on electricity supply, but the key challenge is demand. Many rural consumers do not have enough money to pay electricity bills, which threatens the sustainability of DRE investments. The sections below provide additional detail on each of the top five aforementioned barriers, current efforts to address them, and remaining opportunities.

More broadly, it is important to note that successful implementation of national RE/DRE policy remains a key challenge. As one stakeholder noted, "There is a disconnect between policy intention and reality on the ground." This challenge stems from government capacity that could benefit from further reinforcement; competing RE/DRE programmes; and a lack of data to track progress. In order for the DRE sector to grow, it is critical to develop mechanisms that encourage (or force) the government to act on the policy it has developed.

[209] We consider two types of challenges within scope of "policy-related barriers." (i) A challenge related to the formulation, implementation, or efficacy of government policy (e.g., lack of policies dedicated specifically to mini-grids), and (ii) A challenge that does not directly relate to government policy but can be addressed through a policy lever (e.g., lack of data)

[210] The IPP process primarily relates to on-grid sources of renewable energy

Photo credit - Fratelli dell'Uomo Onlus https://commons.wikimedia.org/wiki/File:Energia_solare_a_Malika,_Dakar.JPG

LIMITED UNDERSTANDING OF THE ECOSYSTEM OF GOVERNMENT ACTORS AND THEIR ROLES

Description: Many government bodies influence the growth and success of the DRE sector, including: MEDER, SENELEC, ASER, ANER, and CRSE. Each has a unique mandate, but they often overlap with each other. For example: MEDER has extended the medium tension lines to remote areas that recently developed mini-grids;[211] SENELEC's monopoly and subsidies create challenges with rural electricity providers (e.g., ASER); ASER has supported mini-grids within 5-10km of the national grid; and non-SENELEC agencies sometimes feel disempowered. Moreover, SENELEC is not properly incentivised to connect mini-grid operators to the grid given the high price of DRE and the absence of a well-defined feed-in tariff. One interviewee commented: "Everyone has their mandate, but there is not a lot of flow of information across entities." Capacity needs within each organisation further exacerbate these coordination and communication challenges.

Without prompt, all non-government interviewees cited government institutional structure and collaboration obstacles as key challenges. One stressed the importance of better endowing the non-SENELEC agencies with the human capacity, financial resources, and authority to carry out their mandates. Another stakeholder even suggested that ASER and ANER could be merged for efficiency reasons. Lastly, stakeholders noted that energy policymaking and decision-making are highly centralised (e.g., taking place in Dakar). Given the nature of rural electrification efforts, local authorities should play a more active role.

Efforts to address the barrier: MEDER seeks to play the primary coordinating role across electricity-related agencies, yet the challenges discussed above still persist. Through the US Energy Association, USAID/Power Africa is running technical workshops that bring relevant government stakeholders together to discuss difficulties and challenges in Senegal and in other countries. The first workshop addressed how to add renewable sources of energy to the grid. The second and third will focus on dispatching – with the goal of reducing power outages for on-grid consumers. These efforts are nascent given Power Africa has to date only received one year of funding in Senegal.

Opportunities:

- **Launch a national government energy access coordination platform.** This could provide a clear mapping of each government entity's ongoing and future activities related to electricity access. The platform could map the national grid, grid extension plans, the location of IPPs and self-producers selling electricity to SENELEC, and current and future mini-grid projects. Such a platform would promote greater transparency in the sector and help policy-makers better plan their efforts (e.g., ASER choosing the location for a new ERIL) based on what other government actors are doing (e.g., MEDER expanding medium tension lines to certain areas). Stakeholders noted that donors, CSOs, and private sector actors should be a part of this coordination platform.[212] To ensure that the platform does not become merely consultative, it would be important to ensure that the platform has strong leadership and clear accountability mechanisms in place.

NEED FOR APPROPRIATE SUBSIDIES AND INCENTIVES TO DRIVE DRE UPTAKE

Description: The Renewable Energy Law (2010) broadly outlines the need for fiscal and financial incentives to support the growth of renewable energy. Yet to date, few subsidies and incentives have materialised. Unlike on-grid electricity, there are no subsidies for off-grid electrification projects. The FER was supposed to fill this gap, but it is not yet operational. The government experimented with large (up to 80%) subsidies for ERILs through the ERSEN project, but they were unsustainable.[213] Therefore, key actors (e.g., private sector developers) are not properly incentivised to help grow the DRE sector. As a whole, the energy sector is highly dependent on financing from international donors.

Where subsidies and incentives do exist, they are negotiated on a case-by-case basis. For example, one developer negotiated tax exemption with ASER for its off-grid projects. The developer noted: "We would not have done it if it were not tax exempt." However, none of the six private operators running these projects are benefitting from incentives or subsidies because they are not formally contracted by the government.

[211] Stakeholder interviews, 2016

[212] Stakeholder interviews, 2016

[213] Mini-Grid Policy Toolkit-Case Study: ERSEN Off-grid Solar Energy Programme 2014, EU Energy Initiative Partnership Dialogue Facility (EUEI PDF)

Efforts to address the barrier: Many donors are supporting DRE projects, but few actors are thinking proactively about innovative models to finance the sector in the long-term.

Opportunities:

- **Research the impact of the government's on-grid vs. off-grid electricity subsidy policies.** This could include an analysis of all mini-grids implemented from ~2004 to present, and it would inform the design of future government subsidy programmes.
- **Publish a report on innovative (and sustainable) financing mechanisms for the government** to use to support the growth of the DRE sub-sector in Senegal. In order to be additive to information that already exists on this topic, all solutions/ recommendations should be highly specific to the Senegalese context and outline a clear process or action plan for the government to implement each mechanism.

> *"The government is spending so much money on subsidies for on-grid electricity, it doesn't have the resources to incentivise renewable energy"*
>
> - Senegalese stakeholder

OFF-GRID TARIFF POLICY

Description: Off-grid tariff challenges relate to the high cost of electricity and the relatively onerous process to set these prices. First, Senegal has some of the highest electricity tariffs (over $0.26/kWh) in Africa due to its dependence on imported oil. Moreover, there is a stark disparity between on- and off-grid tariffs – the latter are three times as high in some parts of the country, according to interviewed stakeholders.[214] In 2012, the government covered 120 billion CFA (USD ~200 million) in SENELEC losses.[215] Consumers constantly compare on- vs. off-grid prices, and some people prefer to stay disconnected rather than pay higher prices for off-grid access.[216,217] Second, CRSE must approve the tariff for each project, regardless of the size of the project. This is a cumbersome process for mini-grids that could be streamlined through dedicated mini-grid regulations and/or decentralised decision-making.

Efforts to address the barrier: According to one interviewee, ASER commissioned a study to determine how to harmonise tariffs, and a report is due by 2017. Another interviewee noted the government recently completed this study – but they have not seen it. Lastly, The World Bank is currently working on tariff harmonisation via technical assistance.

Opportunities:

- **Conduct research on the impact of differential on-grid vs. off-grid electricity tariffs**. This could be done in partnership with the World Bank and/or civil society organisations and research institutions.
- **Conduct research on tariff cross-subsidisation schemes from other countries.** What examples exist of on-grid/off-grid cross-subsidies? How are these programmes structured and financed? Which actors (e.g., government, donors) are involved and what are their respective roles?

[214] Stakeholder interviews, 2016

[215] Lettre de Politique de Développement du Secteur de L'Energie 2012, Ministère de L'Energie et des Mines, Dakar, Senegal

[216] Stakeholder interviews, 2016

[217] Mini-Grid Policy Toolkit-Case Study: ERSEN Off-grid Solar Energy Programme 2014, EU Energy Initiative Partnership Dialogue Facility (EUEI PDF)

FRAGMENTED AND INADEQUATE DATA

Description: Policy-makers and policy influencers lack high-quality, comprehensive data resources related to the DRE sub-sector. This includes data on existing mini-grids, their capacity, their performance, end user access to DRE, and high-potential locations for future projects. This lack of data hinders the regular tracking and monitoring of DRE electrification efforts. However, it is important to note the government interviewees saw the lack of data as an institutional capacity gap that needs to be addressed – not an information gap to fill directly. They are seeking capacity building to increase their technical capabilities, not raw data or information delivered by another actor.[218]

Without any prompt, one interviewee cited the need for open data on DRE efforts – and partially attributed the implementation challenges of PASER to a lack of data needed to track progress. The interviewee cited the need for mapping of the energy access activities and efforts of each government agency. The majority of stakeholders interviewed were not able to answer questions regarding the number of operational mini-grids in Senegal, their capacity, and their location.

Lastly, the MEDER Statistics and Planning Unit confirmed demand for data on energy access is high. They frequently receive ad-hoc requests from donors and private sector actors for more granular information to guide their interventions and investments. In most cases, MEDER tries to help them secure information through their networks – but this an approach MEDER would like to strengthen.

Efforts to address the barrier: A handful of public and civil society actors are collecting DRE-related data, but there are no centralised, comprehensive resources. Notably, PERACOD helped the government launch the Energy Information System of Senegal (Système d'Information Energétique du Senegal, SIE) – a decision making tool that collects, analyses, and disseminates energy-related data (e.g., consumption, electrification rates). SIE collects data from ASER, ANER, SENELEC, and the national statistics agency (ANSD). However, the SIE website[219] has not functioned since 2012, and the last comprehensive report was released in 2014.

MEDER recognises that SIE is incomplete – and the data they do collect is not always high-quality.[220,221] For example, ASER collects self-reported data on rural electrification projects, but they openly admit they have few quality control mechanisms (as all staff are based at headquarters). Lastly, ANER seeks to create a knowledge base that brings together fragmented sources of information, but this would be an internal initiative.

Opportunities:

- **Conduct a 'grid diagnostic' that assesses the capacity of the current grid and the opportunity for interconnection with RE energy sources.** The diagnostic could assess the capacity of the current grid and assess to what extent it can handle interconnection with renewable energy power producers. This information could ease the concerns of stakeholders who worry about the national grid's ability to handle future interconnection to RE and DRE power generators (from a technical standpoint).
- **Map existing mini-grids and set up a monitoring system** to provide real-time information on location, size, performance, etc. This could also provide ground-truth data on current rural electrification efforts.
- **Support on the ground surveys and data collection.** Co-funding and supporting low-cost (e.g., SMS/IVR) household surveys with in-country partners could fill essential information gaps for government stakeholders and enable better planning. To date, MEDER has only collected one energy-specific survey on biomass.[222]
- **Support the re-design of SIE, particularly its electricity component** to (i) capture information from non-government actors in an efficient and effective way, and (ii) disaggregate data by district, region, and sector.[223] Although not directly related to policy, a revamped SIE could also provide much-needed market insights to the private sector.

[218] Stakeholder interviews, 2016

[219] Website link: http://www.sie-energie.gouv.sn/

[220] Stakeholder interviews, 2016

[221] Unlike MEDER, SENELEC said SIE is operating well and they do not see a gap in energy knowledge, data, or information

[222] Stakeholder interviews, 2016

[223] This opportunity was suggested by the MEDER Statistics and Information Unit

LACK OF CLARITY AROUND GRID INTERACTIVITY POLICY

Description: Senegal's current regulations and institutional setup attempt to create a strict divide between on-grid and off-grid electrification efforts. Within three kilometers of the national grid, SENELEC holds a monopoly over the distribution of electricity to consumers.[224] Meanwhile, ASER has oversight over all areas further than three kilometers from the grid. However, there are no clear regulations regarding what happens when the national grid – and thereby SENELEC's monopoly – arrives in previously 'off-grid' areas. Under the SENELEC monopoly, it is illegal to directly sell electricity to consumers. Yet a feed-in tariff for mini-grid operators to sell electricity to SENELEC has not yet been defined. Several interviewees cited the lack of an RE feed-in tariff as the key policy challenge in Senegal. Based on implementing decrees of the 2010 Renewable Energy Law, SENELEC can no longer sign private agreements with operators. All contracts must go through CRSE; the latter does not have the technical capacity to manage these public procurements. SENELEC has highlighted the importance of a feed-in tariff to enabling cooperation with operators.[225]

Overall, this uncertainty and lack of clarity around grid interactivity creates a large risk for potential mini-grid investors, as the recent experience of one developer demonstrated. MEDER has started to extend the national grid via medium tension lines, and the grid recently arrived in several communities where the developer supported mini-grid developments less than two years ago. Each mini-grid project requires a 10-15 year concession in order to reap a return on investment. In the absence of a clear grid interactivity policy, the developer will likely lose its entire investment in these DRE projects.

Efforts to address the barrier: Interviewees noted the government's primary focus is on maintaining a clear divide between SENELEC, the rural electrification concessions (PPERs), and off-grid projects – rather that exploring how these systems can interact and mutually reinforce each other. ASER only approves ERIL projects in areas (i) not already covered by the national grid, and (ii) not included in PPER expansion plans over the next three years. However, there is no provision regarding what will happen when the grid expands to areas with operational ERILs. A feed-in tariff is supposedly under development, but its exact status is unknown.

Opportunities:

- **Help the government and/or other Senegalese intermediaries develop clear, actionable, and effective grid interactivity policy** by transferring best practices from other countries with more developed DRE sub-sectors. This should include clear discussion of what happens to mini-grids when the national grid – and therefore the SENELEC monopoly – is extended to previously off-grid areas. This could also include a feed-in tariff.
- **Develop clear technical standards for grid compatibility,** allowing mini-grids to easily connect to the grid, when it arrives.
- **Conduct research on the economic and/or social impact of grid interactivity** in order to spur urgent and effective formulation and implementation of grid interactivity policies in Senegal (e.g., a feed-in tariff).

[224] Stakeholder interviews, 2016

[225] Stakeholder interviews, 2016

ANNEX 4.1: OVERVIEW OF KEY STAKEHOLDERS

Name of institution	Function
National government	
Ministre de l'Energie et du Développement des Energies Renouvelables (MEDER, Ministry of Energy and the Development of Renewable Energies)	Ministry that oversees the energy sector, including the renewable sub-sector. Within the Ministry, DRE relates to the Renewable Energy Development department (Direction du développement des energies renouvelables, DER) and the Electricity department (Direction de l'Electricité, DE).
Agence Sénégalaise pour l'Électrification Rurale (ASER, Senegalese Agency for Rural Electrification)	Government agency created in 2000 with the mandate to promote rural electrification by supporting local, national, and international initiatives. ASER is co-implementing the ERSEN project with GIZ.
Commission de Régulation du Secteur de l'Electricité (CRSE, Regulatory Commission of the Electricity Sector)	Regulator that oversees licensing, operation, and sales of electricity. This includes setting tariffs (regardless of the size of the project) and monitoring concession contracts.
Agence Nationale pour les Energies Renouvelables (ANER, National Agency for Renewable Energy)	Government agency established by the 2012-2017 LPDSE to promote and develop renewable energies in all forms: solar, wind, biomass, hydropower, and tidal. ANER has focused more on SHS and public areas electrification given ASER's focus on village-level mini-grids.
Standards Organisation of Nigeria (SON)	A federal entity with the Ministry of Industry, Trade, and Investment (FMITI) that ensures product quality through standards and certification. SON oversees the importation of off-grid products and is relevant to market spoilage issues, among other standards challenges.
SENELEC	SENELEC is the vertically-integrated national utility created in the 1998 power sector reforms. It is the largest electricity generator, and the only concessionaire for on-grid transmission and distribution. It has a monopoly over the purchase and sale of wholesale electricity.
Association Sénégalaise de Normalisation (ASN, Senegalese Association for Standardisation)	Government body that oversees national standards across the economy. Two labs have been set up under ASN to ensure national standards for solar PV components are adopted.

Key civil society organisations and academic institutions*	
Enda Energie	Civil society organisation that provides advisory services, training and research related to several environment issues, including: access to energy, climate change, and desertification.
Centre d'Etudes et de Recherches sur les Energies Renouvelables (CERER, Center for Study and Research in Renewable Energy)	Centre located at the University Cheikh Anta Diop of Dakar that focuses on renewable energy research. This includes studies on RE potential across the country, solar, wind and thermal energy pilot projects, and socioeconomic research related to energy access.
Key off-grid private sector actors*	
Solar mini-grids and SHS	• ENERSA • Solar-Ka • Matforce • Oolu PAYG
International donors and actors	
Power Africa	A $7 billion US government effort launched by President Obama in 2013 to enable 60 million new connections and 30,000 MW of new and cleaner generation. In Senegal, Power Africa focuses on capacity building, primarily for government entities (MEDER, SENELEC and CSRE). Through the US Energy Association, Power Africa has led trainings with government stakeholders (including ANER and ASER). Power Africa is also providing transaction advisory support to help connect IPPs to SENELEC. Lastly, they are assessing opportunities to pursue off-grid electrification projects via USAID projects in agriculture.
World Bank	Leading energy donor in Senegal that has provided technical and financial assistance to electricity sector reforms, starting with the early institutional reforms in 1998. Currently, the Bank is working on tariff harmonisation for on-grid and off-grid electricity.
GIZ	Leading energy actor co-implementing the ERSEN project with ASER through its Programme for the Promotion of Renewable Energy, Rural Electrification, and Sustainable Supply of Household Fuels (PERACOD).
Lighting Africa	A joint program between the International Finance Corporation (IFC) and the World Bank that works with the private sector to build the market for safe, affordable, and modern off-grid lighting. In Senegal, most efforts have focused on promotion of household lighting products (e.g., solar lanterns). One issue Lighting Africa plans to focus on in the future is tariff exemptions.
AFD	Leading energy donor in Senegal tasked with conducting a feasibility study for a renewable energy feed-in tariff. The status of this study is unknown.
Energising Development (EnDev)	EnDev is an energy access partnership funded by six donor countries: the Netherlands, Germany, Norway, United Kingdom, Switzerland, and Sweden. It is currently operational in 25+ countries in Africa, Asia, and Latin America. The EnDev project in Senegal is called ERSEN. ERSEN has supported mini-grid and SHS projects in 270+ villages. GIZ and the Netherlands Enterprise Agency (RVO) serve as the co-directorate that manages EnDev

*Not exhaustive

5 UGANDA COUNTRY REPORT

EXECUTIVE SUMMARY

Access to affordable electricity is a key socio-economic challenge in Uganda today. In 2016, 19% of Ugandan households had access to electricity, leaving approximately 6,6 million households unelectrified. Urban-rural disparities in electrification rates are sharp – only 12% of rural households have electricity access compared to 52% of urban households. With residential electricity tariffs at $0.21/kWh and connection costs of $150, electricity is unaffordable for many even in the vicinity of the grid. The government intends to increase rural electricity access to 26% by 2022 by adding 1.28 million new grid connections and 140,000 off-grid connections. It also aims to achieve 80% electrification by 2040.

The government has recently identified that off-grid technologies can be cost-effective in providing electricity to a dispersed rural population. Uganda's rural communities, which constitute 75% of the country's population, are dispersed and demand insufficient electricity (at existing prices) to justify the cost of extending the grid. Thus, going forward, off-grid technologies are likely to play an increasingly important role in bringing electricity to the rural poor. Currently, 4.9% of Ugandan households get their electricity from solar PV and it is estimated that the proportion of households that receive off-grid electricity could grow to 33% by 2030. To address the challenge of energy access, the government has begun a master planning process to determine which rural areas are appropriate for grid expansion and which areas are better suited to off-grid solutions.

That said, policy support for off-grid electricity, although growing, is inadequate and poorly streamlined. There are no specific regulations/policies or forms of financial support for mini-grids and solar PV systems. Policy-makers are concerned that due to the lack of support, few mini-grid models are viable in Uganda. Given this, they regard SHS as the most promising and cost-effective avenue for rural electrification in the short and medium term.

Key policy-related challenges thwarting the growth of the off-grid sector include the lack of direction on how rural electricity access can be increased, scepticism about the economics of mini-grids, and lack of appropriate subsidies and financial incentives to drive off-grid uptake. Given these challenges, a number of key questions emerged through stakeholder interviews, including: Where should the grid be expanded and where could mini-grids be cheaper than the grid, if at all? Are there anchor/productive load models (from other places) that could work in Uganda? What are the kinds of policies that could be put in place to support off-grid solutions in Uganda? Since affordability is a challenge, what innovative financing schemes can enable end-user connectivity?

4.9% of Ugandan households get their electricity from solar PV and it is estimated that the proportion of households that receive off-grid electricity could grow to 33% by 2030.

I. INTRODUCTION

This report presents a policy analysis of the decentralised renewable energy (DRE) landscape in India, with a focus on solar off-grid energy. It details current policies impacting DRE, identifies key stakeholders and analyses challenges that inhibit the growth of the sub-sector in India (particularly in the least electrified states of Uttar Pradesh and Bihar). It also identifies key questions on the minds of policy-makers and policy influencers and proposes solutions to help answer them. We derived the findings presented in this document through desk research and qualitative interviews with key stakeholders from government, civil society, donor agencies and the private sector.

The report is structured as follows: Section II sets the stage for the analysis by outlining the current state of electrification and DRE in India – including electricity access, shortfalls between supply and demand and renewable energy targets. Section III describes the current DRE policy landscape, the key stakeholders active within it and important emerging policy trends. Within this policy landscape and the state of the sector, Section IV presents the key questions posed by policy-makers and policy influencers that, if answered, could move the sector forward. Section V concludes with some key policy challenges in India and highlights opportunities for action.

The Government of Uganda has set an ambitious target to increase electricity access to 80% by 2040, primarily by increasing generation capacity and expanding the grid.

II. OVERVIEW OF THE ENERGY SECTOR

Access to affordable electricity is a key socio-economic challenge in Uganda today. In 2016, 19% of Ugandan households had access to electricity, leaving approximately 6,6 million households (31 million people) unelectrified.[227] Urban-rural disparities in electrification rates are sharp – only 12% of rural households have electricity access compared to 52% of urban households.[228] With residential electricity tariffs at $0.21/kWh[229] and connection costs of $150[230], electricity is unaffordable for many even in the vicinity of the grid. Unsurprisingly, electricity consumption is low; in 2012, Uganda's per capita electricity consumption stood at about 84 kWh, far lower than the African average of 153 kWh.[231] Grid quality is poor, with over 50% of 'on-grid' Ugandans getting access to less then four hours of reliable electricity per day.[232] Given these high costs, since 37.7% of Ugandans live below the poverty line (less than $1.25 a day),[233] it is unsurprising that 90% of the country relies on traditional biomass for their energy needs.[234]

The Government of Uganda has set an ambitious target to increase electricity access to 80% by 2040,[235] primarily by increasing generation capacity and expanding the grid. To meet this target, a key short-term priority for the government is to increase generation supply from 856 MW in 2015 to 2500 MW in 2020.[236] Given the aggressive push, the government expects that generation will exceed demand by 2020. The government is also undertaking investments to strengthen the transmission networks to integrate new power plants, improve quality of supply , and increase new connections and last-mile distribution.[237] By 2022, the government intends to increase rural electricity access to 26%, by adding 1.28 million new

[227] Uganda Bureau of Statistics 2016, The National Population and Housing Census 2014 – Main Report, Uganda Bureau of Statistics, Kampala, Uganda

[228] Uganda Bureau of Statistics 2016, The National Population and Housing Census 2014 – Main Report, Uganda Bureau of Statistics, Kampala, Uganda

[229] The current tariff regime, outlined in the Electricity (Tariff code) Regulations (2003), requires that tariffs are cost-reflective. Electricity tariffs in Uganda are the highest in east Africa (source: EAC Secretariat 2015, East African Community Facts and Figures 2015, EAC Secretariat, Arusha)

[230] Stakeholder interviews, 2016. Unsubsidised (minimum) grid connection costs are $150. In 2011, it cost an additional $ 320-800 per household for last mile pole and wiring (http://siteresources.worldbank.org/EXTAFRREGTOPENERGY/Resources/717305-1327690230600/8397692-1327691245128/World_Bank_Dakar_Rural_Electrification_Access_Nov2011.pdf).

[231] African average excludes South Africa. Source: Ministry of Energy and Mineral Development 2015, Uganda's Sustainable Energy for All (Se4all) Initiative: Action Agenda, Ministry of Energy and Mineral Development, Kampala, Uganda

[232] Estimates range from 30-40% bad-grid households to over 50% as estimated in proprietary surveys conducted by Dalberg clients in 2015-2016, with an estimated 0.5 million on-grid Ugandans being able to access the grid for an average of less than 4 hours daily due to load shedding and grid intermittency

[233] Ministry of Energy and Mineral Development 2015, Uganda's Sustainable Energy for All (Se4all) Initiative: Action Agenda, Ministry of Energy and Mineral Development, Kampala, Uganda

[234] WWF Uganda 2015, Kasese District Renewable Energy Strategy, World Wildlife Fund https://D2ouvy59p0dg6k.Cloudfront.Net/Downloads/Kasese_District_Renewable_Energy_Strategy.Pdf.

[235] There are multiple and inconsistent targets for rural electrification. Uganda Vision 2040 seeks to achieve 80 % electrification by 2040, SE4ALL aims for universal access by 2030, and the RESP is targeting 26% rural electrification by 2022

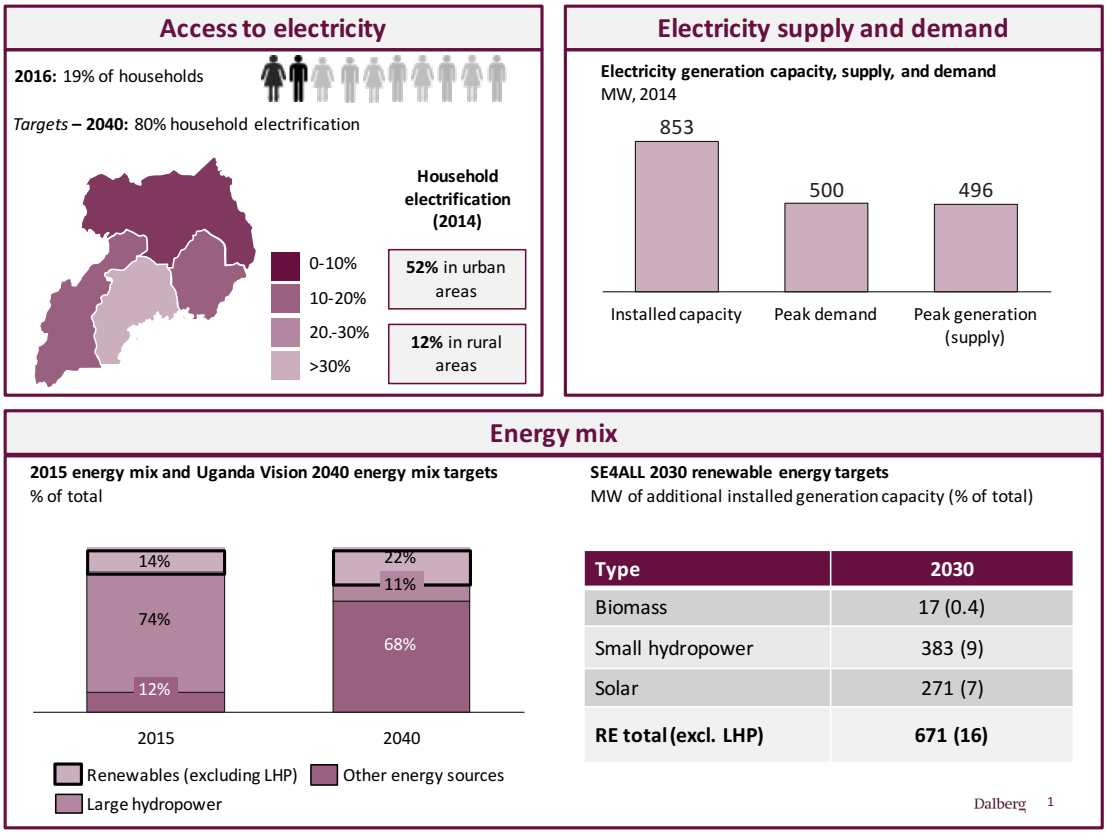
[236] Electricity Regulatory Authority 2015, Performance of The Authority for The Period 2010 - 2015, Electricity Regulatory Authority

[237] UETCL is also building interconnection projects with Kenya, Rwanda and the DRC for the East African Power Pool. These developments will impact regional power trading, and hopefully foster energy security

grid connections and 140,000 off-grid connections.[238] To ensure that these goals are met, the government is strengthening, upgrading and expanding the grid.

The government has recently identified that off-grid solutions can be a cost effective approach to providing electricity to a dispersed rural population.[239] Uganda's rural communities, which constitute 75% of the country's population[240], are dispersed and demand insufficient electricity (at existing prices) to justify the cost of extending the grid.[241,242] The SE4ALL Action Agenda estimates that expanding off-grid services to an estimated 3.17 million Ugandan households will allow Uganda to reach its electrification targets at a lower cost than the current policy.[243] Going forward, despite aggressive grid extension targets, off-grid technologies are likely to play and increasingly important role in bringing electricity to the rural poor. Currently, 4.9% of Ugandan households get their electricity from solar PV and SE4ALL estimates that the proportion of households that receive off-grid electricity could grow to 33% by 2030.[244] SHSs are also increasingly popular with urban households due to the unreliability of grid electricity.[245] Uganda based pay-as-you-go SHS players like Fenix, SolarNow, and M-KOPA are continuing to see very rapid growth. In early 2016 they had a cumulative total client base of over 100,000 customers, expanding at a compound annual growth rate of ~70%.[246]

FIGURE 17: OVERVIEW OF THE POWER SECTOR IN UGANDA [247]



[238] Rural Electrification Agency 2013, Rural Electrification Strategy and Plan 2013-2022, Ministry of Energy and Mineral Development, http://www.Rea.Or.Ug/Docs/Strategic_Plan2013-2022.Pdf

[239] Ministry of Energy and Mineral Development 2015, Uganda's Sustainable Energy for All (SE4ALL) Initiative: Action Agenda, Ministry of Energy and Mineral Development, Kampala, Uganda [240] Uganda Bureau of Statistics 2016, The National Population and Housing Census 2014 – Main Report, Uganda Bureau of Statistics, Kampala, Uganda

[241] Baanabe, J. 2016, The Future of Private Sector Investment in Renewable Energy in Uganda, GETFIT Forum 2016, http://www.Getfit-Uganda.Org/App/Download/25331129/MEMD+Presentation+On++Investment+In++RE+Get+Fit+Forum.Pdf

[242] Uganda's electricity demand is estimated at 100 kWh compared with African average of 578 kWh. Source: Government of Uganda 2015, Second National Development Plan (NDPII) 2015/16 – 2019/20, Government of Uganda, Kampala, Uganda.

[243] Ministry of Energy and Mineral Development 2015, Uganda's Sustainable Energy for All (SE4ALL) Initiative: Action Agenda, Ministry of Energy and Mineral Development, Kampala, Uganda Ministry of Energy and Mineral Development 2015, Uganda's Sustainable Energy for All (SE4ALL) Initiative: Action Agenda, Ministry of Energy and Mineral Development, Kampala, Uganda

[244] Overseas Development Institute 2016, Accelerating Access to Electricity in Africa with Off-Grid Solar:

[245] Off-Grid Solar Country Briefing: Uganda, www.Odi.Org/Publications/10200-Accelerating-Access-Electricity-Off-Grid-Solar,. and stakeholder interviews, 2016

[246] Dalberg Africa PAYG database based on publicly reported figures

[247] Rural Electrification Agency 2013, Rural Electrification Strategy and Plan 2013-2022, Ministry of Energy and Mineral Development, http://www.Rea.Or.Ug/Docs/Strategic_Plan2013-2022.Pdf; Ministry of Energy and Mineral Development 2015, Uganda's Sustainable Energy for All (SE4ALL) Initiative: Action Agenda, Ministry of Energy and Mineral Development, Kampala, Uganda

III. POLICY LANDSCAPE

KEY STAKEHOLDERS AND ROLES

In 1999, the Government of Uganda undertook extensive reforms of the power sector in order to address the challenges of inadequate electricity supply and access. Through the Electricity Act (1999) the government unbundled the Uganda Electricity Board, separating generation, transmission and distribution. While transmission remained state controlled, the government privatised generation and distribution, and utilities and generation companies received twenty-year concession contracts.[248] As a result, Uganda's power sector today is one of the most deregulated on the continent[249] with numerous players active within it. What follows is a non-exhaustive summary of the key stakeholders within this landscape.

- **The government:** The Ministry of Energy and Mineral Development (MEMD) is responsible for establishing and developing Uganda's electricity generation capacity, transmission, and distribution to increase energy access. A number of institutions fall under its purview: the Rural Electrification Agency (REA) is responsible for ensuring and planning electricity access for rural areas and the Electricity Regulatory Authority (ERA) is responsible for processing on and off-grid licensing applications, establishing tariff structures, and developing and enforcing performance standards related to electricity distribution. The Uganda National Bureau of Standards (UNBS) is responsible for monitoring and enforcing standards related to solar PVs and SHS, although this is increasingly done in partnership with the ERA.[250]

- **The private sector:**

1. Grid players: Electricity distribution is privatised in Uganda, and the country is divided into 13 service areas. Eskom Uganda and IPP's such as Bujugali Energy Limited generate most of Uganda's electricity. There are a few grid-connected RE generators such as Simba Power. UMEME, a fully privatised utility company, has 800,000 customers and controls 96% of Uganda's electricity distribution.[251] Other regional distributors include WENRECO, BECS, PACMECS, KIL, and Ferdsult.
2. Off-grid players: The private sector dominates the off-grid market. Fenix International, M-KOPA, Village Power, and SolarNow are among the most prominent players in Uganda's large and growing solar PV market. There are many mini-grid players such as Mandulis Energy (biomass), Eco Power Uganda Limited (small hydro), Kirchner Solar Power, and Cambridge Clean Energy (solar), all of which are in early stages of operation in Uganda.

- **Donors and global foundations:** Numerous donors and foundations are active in Uganda. The World Bank, KfW, GIZ, DfID, AfDB, and Power Africa all support RE projects and electrification in their own capacity and through SE4ALL. Recently, the joint task force of the Arab Coordination Group (ACG) and OECD has been working to further energy access. There is also an Energy and Minerals Development Partners (EMDP) working group that meets on a monthly basis to share information on the energy sector in Uganda.

- **Financial institutions:** Most off-grid projects are financed through donor funding and private capital raised outside of Uganda. The Uganda Energy Credit Capitalisation Company (UECCC) is an important player in financing and providing technical assistance to energy companies and it pools resources from various sources and transfers them to RE projects.[252] Microfinance institutions (MFIs) such as FINCA provide end-user finance. Mobile money providers such as Airtel, MTN, and Simbatel play an important role in receiving customer payments for both UMEME and off-grid players. [253]

- **Civil society organisations** – Most civil society organisations in Uganda focus on improved cooking stoves, biogas, and rural electricity access. Some notable organisations include: Pro-biodiversity Conservationists in Uganda (PROBICOU), Africa Institute for Energy Governance (AFIEGO), and Earth Savers Movement–Uganda. Academic institutions such as Makerere University and Massachusetts Institute of Technology (MIT) conduct research in RE sector. Recently, MIT worked with REA on mapping and electricity planning in south Uganda.

[248] Kapika, J, And Eberhard, A. 2013, "Uganda: Brave Reforms and New Growth" In Power Sector Reform and Regulation in Africa: Lessons from Kenya, Tanzania, Uganda, Zambia, Namibia and Ghana HSRC Press, Cape Town, pp. 85-125

[249] Kapika, J, And Eberhard, A. 2013, "Uganda: Brave Reforms and New Growth" In Power Sector Reform and Regulation in Africa: Lessons from Kenya, Tanzania, Uganda, Zambia, Namibia and Ghana HSRC Press, Cape Town, pp. 85-125

[250] Stakeholder interviews, 2016

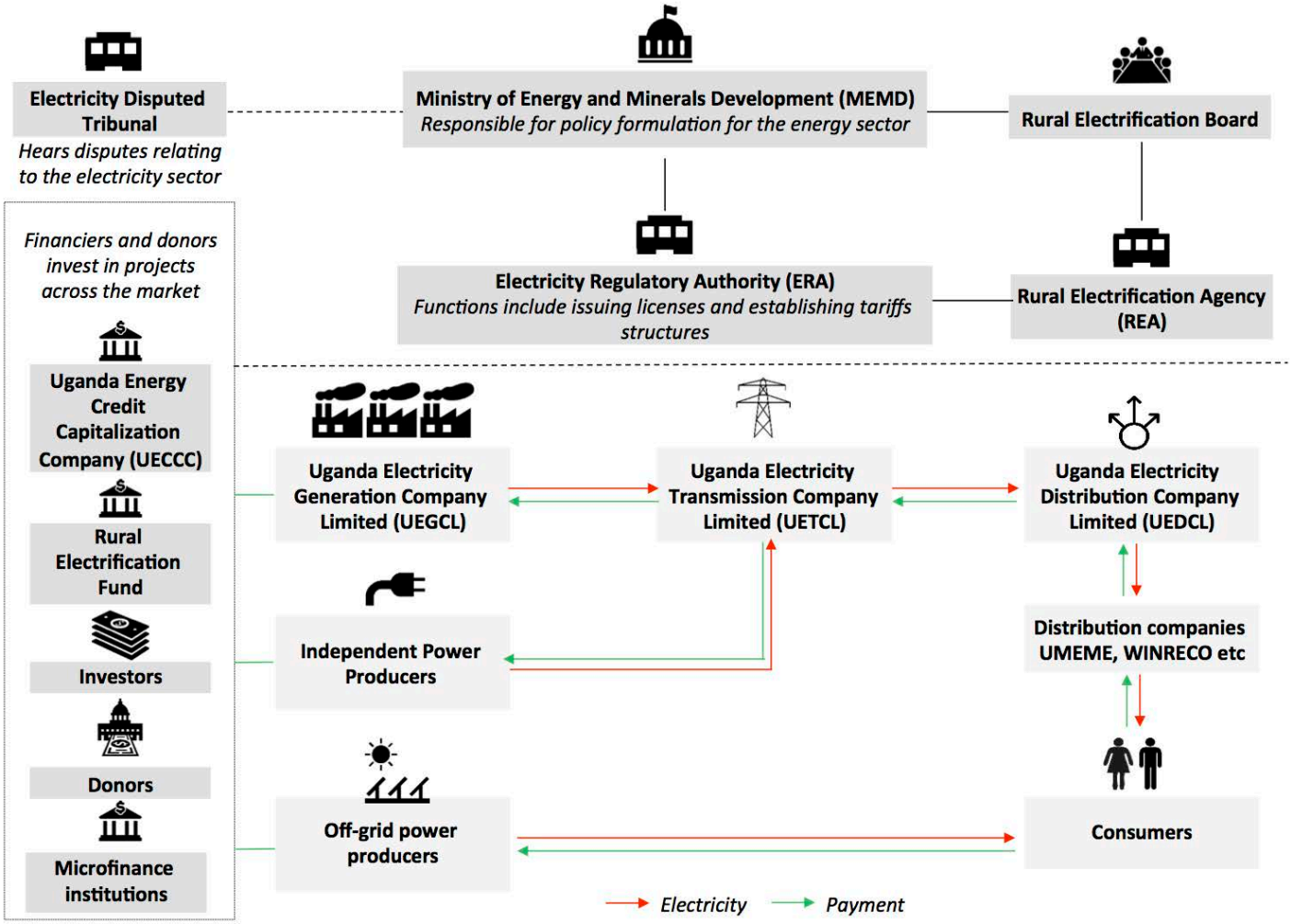
[251] Stakeholder interviews, 2016

[252] Overseas Development Institute 2016, Accelerating Access to Electricity in Africa with Off-Grid Solar: Off-Grid Solar Country Briefing: Uganda www.odi.org/Publications/10200-Accelerating-Access-Electricity-Off-Grid-Solar

[253] For example, Fenix International partnered with MTN, branding their 'ReadyPay' product as an MTN product. Fenix only accepts mobile money. MTN benefited from more customers as 99% of the Readypay customers had never made an outgoing payment (implying hence new market). Airtime usage also increased by 8%.

Figure 18 provides a schematic overview of the key players, their roles and relationships to each other, and Annex 5.1 provides an extended list of key stakeholders.

FIGURE 18: KEY STAKEHOLDERS, THEIR ROLES AND RELATIONSHIPS [254]



Within this landscape, there are a few key influential local and international actors who can help drive the evolution of the DRE sector from a policy standpoint. MEMD, ERA, and REA are the key government actors that influence the enabling policy environment for the growth of DRE. International stakeholders with strong interest in energy policy-related activity in Uganda include the African Development Bank, GIZ, KfW, the World Bank, Power Africa, DfID, ACG, and the OECD. Solar PV players such as M-KOPA and Fenix International provide services to a large number of Ugandans (Fenix has sold 70,000 systems since its arrival in 2013[255]) and operate without much government/donor assistance. Makerere University is well known for a strong talent bench and a number of professors with deep energy access and off-grid expertise; it could be a good partner for local impact research. Starting in June 2016, the University's College of Engineering, Design, Art and Technology (CEDAT), has started serving as a host of a UN and African Community funded East African Centre for Renewable Energy and Energy Efficiency (EACREEE) with a focus on promoting increased access to modern, affordable, sustainable, and reliable energy services in Uganda and the East African region.[256]

[254] Adapted from Netherlands Embassy in Uganda 2015, 'Energy Country Report: Uganda'

[255] Stakeholder interviews, 2016

[256] https://cedat.mak.ac.ug/news/makerere-to-host-first-regional-renewable-energy-centre

CURRENT POLICIES

Since 2002, a number of policies have been passed to support both renewable energy and rural electrification, but the pace of progress has been slow. There have been numerous policies to support rural electrification over the years – the Renewable Energy Policy (REP), the Rural Electrification Strategy Plan (RESP I and II), and the Energy for Rural Transformation Strategy (ERT I, II, III) – but they have collectively only made minor dents in electrification rates. For instance, RESP I (2000-2010) sought to achieve 10% rural electrification by 2010 but achieved less than 7% rural electrification (up from 1% in 2001).[257] In order for the SE4ALL goals of rural electrification to be met by 2030, the pace of adding new connections needs to be increased from under 100,000 a year to 670,000 a year.[258]

The Government of Uganda has seen grid extension as the primary method of providing electricity to its population, although its view is slowly changing. Until 2014, plans for rural electrification primarily relied on extending the grid and enabling distribution concessions for those areas that were not on the grid.[259] Poor electricity supply, service, capacity and high tariffs rendered these concessions unviable. The ERA and REA recently changed the model of electrification by creating thirteen service territories, some of which have concessions and others which are serviced by REA.[260] Given the low population density of rural Uganda, the cost-effectiveness of extending the grid to rural areas has been called into question, and the government has begun to encourage off-grid electrification. This change is reflected in the Rural Electrification Strategy and Plan (RESP II) (2013-2022) which aims to increase rural electricity access to 26% by providing 1.28 million new on-grid service connection and 140,000 off-grid service connections. To achieve this, the RESP II asserts that the government will give increased priority to investments in small distributed power generation facilities as local sources of supply.[261]

FIGURE 19: KEY POLICIES AND PROGRAMMES RELATED TO RENEWABLE ENERGY ELECTRIFICATION IN UGANDA

Policy	Description
Renewable Energy Policy (REP), 2007	• Increase the share of "modern renewables" of total energy consumption to 61% (2017) by: • Publishing standardised PPAs with feed-in-tariffs (creating REFiT) • Putting in place legislation and regulations to promote appropriate use of REs • Implementing innovative financing mechanisms through PPPs
Rural Electrification Strategy and Plan 2013-2022 (RESP II), 2013	• Intends to increase rural electricity access to 26% by 2022 • Addresses the shortcomings of RESP I by centralising rural electrification planning where the REA will be responsible • Investment in small distributed power generation facilities as local sources of supply will be given increased priority and enhanced support.
National Development Plan II 2015-2020 (NDP II), 2015	• Aims to increase power generation capacity to 2,500 MW by 2020 for the national grid, largely through hydro and geothermal power. • Aims to increase overall access to electricity to 30% and per capita consumption to 584kWh by 2020 • Intends to increase energy efficiency and public investment in the energy sector • Remains silent on the government's stance on off-grid technologies

[257] Rural Electrification Agency 2013, Rural Electrification Strategy and Plan 2013-2022, Ministry of Energy and Mineral Development, http://www.Rea.Or.Ug/Docs/Strategic_Plan2013-2022.Pdf
[258] Ministry of Energy and Mineral Development 2015, Uganda's Sustainable Energy for All (Se4all) Initiative: Action Agenda, Ministry of Energy and Mineral Development, Kampala, Uganda
[259] Netherlands Embassy in Uganda 2015, 'Energy Country Report: Uganda'
[260] Netherlands Embassy in Uganda 2015, 'Energy Country Report: Uganda'
[261] Rural Electrification Agency 2013, Rural Electrification Strategy and Plan 2013-2022, Ministry of Energy and Mineral Development, http://www.Rea.Or.Ug/Docs/Strategic_Plan2013-2022.Pdf

On-grid renewable generation has and continues to receive substantial policy and financial support from the government and donors. In 2007, the government introduced the Renewable Energy Feed-in Tariff (REFiT) programme. The aim was to fast-track RE projects (via streamlining PPAs and offering other support) and provide feed-in tariffs (FiT) to 0.5 - 20 MW sized on-grid projects. The first phase saw limited uptake from developers as they felt that the tariffs were too low for project viability. The tariffs were revised in 2011, but uptake remained poor.[262] Therefore, the government along with a consortium of donors, launched the GETFiT programme in 2013. Through GETFiT, selected on-grid RE projects have access to finance, 20 year PPAs with UETCL, an additional 'top-up' FiT per kWh above and beyond the REFiT tariff, and a partial risk guarantee from the World Bank. Furthermore licensing requirements, although arduous, have been streamlined and PPA's have been standardised. At present, the programme has a pipeline of 17 power projects, totaling 128 MW. Overall, GETFiT has attracted more than $450 million of private investment into Uganda.[263] Developers and policy-makers lauded it as a successful initiative.

Policy support for mini-grids, although growing, is inadequate and poorly streamlined. As mentioned earlier, the RESP II aims to add 140,000 connections through installations of solar PV systems and mini-grid distribution service connections by 2022. Given the cost implications of extending the grid, SE4ALL projects/hopes that 33% of the population will have off-grid electricity by 2030. The REA covers the cost of the mini-grid distribution infrastructure (if they approve of the mini-grids location). , Yet, neither the REFiT nor GETFiT provide financial support for off-grid projects. Furthermore, there is no specific mini-grid regulation or policy and there are therefore a number of concerns around licensing, tariffs, and costs. First, although mini-grids under 2 MW are exempt from licensing, developers still have to undergo an arduous and time-consuming process to receive the license exemption. Project developers feel that there is little clarity on the process that needs to be followed to receive this exemption. Second, the ERA determines the tariff for mini-grids and project developers feel that in many instances the tariff set by the ERA is too low (on average 45 cents/kWh) to ensure project viability. Given this level of support, there have been very few successful mini-grid projects to date.[264] That said, in June 2016, the UECCC launched a $25 million working capital facility for solar off-grid projects, through the World Bank funded ERT III programme.[265] It remains to be seen whether this support will help move mini-grids forward.

While there are no specific policies that support SHSs/ solar lanterns, the market is growing nonetheless. The REA launched the PV Target Market Programme, which pre-screened off-grid Solar PV providers to receive a 50% subsidy for each unit sold. Some providers did not pass on the cost-savings to the end users, and others did not receive the expected reimbursement from the REA for providing subsidised units. Therefore the scheme was discontinued.[266] Since then, the policy approach to solar PVs has largely been one of non-interference; the ERA does not regulate tariffs and costs of solar PV products; the UNBS has not adopted the IEC standards for solar portable lighting products.[267] Solar products are VAT and tariff exempt, although there is some ambiguity regarding which components qualify for VAT exemption (at present, product parts that are not solar specific, e.g., cables are billed at 18% VAT). In 2014, 4.9% of Ugandans received their electricity from SHSs[268] and the market is expected to grow.

Financially, the sector relies heavily on foreign and donor funding to promote off-grid solutions and electrification, but it is grossly inadequate given the scale of the electrification challenge. There are more than nine donor funded electrification projects in Uganda (see Annex 5.1 for a full list), among them an AfDB rural electrification project costing $121 million.[269] In support of RE, Uganda is set to receive a share of $7 million from a SIDA programme that aims to expand RE through interventions designed to increase the supply of capital to businesses.[270] Additionally, in 2015, Uganda received $134 million of RE investment in private capital.[271] That said, despite the large sources of funding, significant financial gaps remain as the projected cost for reaching SE4ALL goals is $6.2 billion.

[262] GETFiT Uganda 2015, Global Energy Transfer Feed-In Tariff Annual Report, GETFiT Uganda, http://www.Getfit-Reports.Com/2015/

[263] GETFiT Uganda 2015, Global Energy Transfer Feed-In Tariff Annual Report, GETFiT Uganda, http://www.Getfit-Reports.Com/2015/

[264] There is less experience in Uganda with Solar PV mini and micro-grids, which are small centralised solar PV systems serving several households and small businesses. Two pilot projects in this category are being carried out in Western Uganda financed largely by the GoU and bilateral donors. The 5 kWp project in Kasese by a Danish company is currently operational and benefiting 94 customers. The charge is a monthly bill of UGX 5,000 (about USD 1.5) for one bulb, and, UGX 7,000 (USD 2) for two bulbs. The micro-grid project at Kyenjojo by the University of Southampton is for 13.5kWp and is still under construction.

[265] UECCC website: http://www.ueccc.or.ug/gads_wcf_solar_companies.htm

[266] Stakeholder interviews, 2016 and Overseas Development Institute 2016, Accelerating Access to Electricity in Africa with Off-Grid Solar: Off-Grid Solar Country Briefing: Uganda www.odi.org/Publications/10200-Accelerating-Access-Electricity-Off-Grid-Solar

[267] Overseas Development Institute 2016, Accelerating Access to Electricity in Africa with Off-Grid Solar: Off-Grid Solar Country Briefing: Uganda www.odi.org/Publications/10200-Accelerating-Access-Electricity-Off-Grid-Solar

[268] Uganda Bureau of Statistics 2016, The National Population and Housing Census 2014 – Main Report, Uganda Bureau of Statistics, Kampala, Uganda

[269] Ministry of Energy and Mineral Development 2015, Uganda's Sustainable Energy for All (SE4ALL) Initiative: Action Agenda, Ministry of Energy and Mineral Development, Kampala, Uganda

[270] Ren21 2016, Renewables 2016 Global Status Report, Ren21, Paris: Ren21 Secretariat

[271] Ren21 2016, Renewables 2016 Global Status Report, Ren21, Paris: Ren21 Secretariat

FIGURE 20: OVERVIEW OF CURRENT POLICIES RELATED TO DRE IN UGANDA

Policy area	Current policies	Gaps and challenges
High-level strategy and targets		
Energy mix	• Present available generating capacity is 854 MW and this comprises 81% hydropower, 14% thermal, and 5% biomass cogeneration[272] • NDP II sets a target to increase installed generation capacity to 2500 MW by 2020 where large hydro power will comprise 83% [273]	• Challenges in completing planned projects has prevented the government in reaching targets in the past [274] • Different policies have different targets e.g. Uganda Vision 2040 seeks to increase nuclear capacity while NDP II does not.
On-grid electricity	• Approximately 15.5% of households have access to the national grid[275] • Government expanding grid electricity across the country. The RESP II, NDP II and Uganda Vision 2040 all emphasise grid expansion	
Off-grid electricity	• Approximately 4.9% of the population receives electricity from off-grid sources[276] • RESP II intends to increase off-grid sources through 140,000 additional installations of solar PV systems and mini-grid distribution service connections • SE4ALL projects that by 2030, 30% of Uganda will access energy through off-grid sources	• The government provides limited support for off-grid development[277] • There are concerns that there are no working and scalable models of mini-grids that can provide affordable electricity to rural Uganda[278]
Grid interactivity	• No clear policy on grid interactivity for mini-grids • GETFiT is supporting grid interconnection through financing critical power grid infrastructure and financing technical assistance to ERA for grid regulation[279] as the ERA does not possess reliable data on the status and performance of distribution and transmission networks • UECCC is conducting an interconnection feasibility study[280]	• Currently no specific regulatory provision for connection of an existing mini-grid to the national grid[281] • Although there are baseline plans for grid extension, there is no clarity on where the grid is going and when it will get to any particular area[282]

[272] Electricity Regulatory Authority 2015, Performance of The Authority for The Period 2010 - 2015, Electricity Regulatory Authority

[273] Government of Uganda 2015, Second National Development Plan (NDPII) 2015/16 – 2019/20, Government of Uganda, Kampala, Uganda.

[274] Rural Electrification Agency 2013, Rural Electrification Strategy and Plan 2013-2022, Ministry of Energy and Mineral Development, http://www.rea.or.ug/docs/strategic_plan2013-2022.pdf

[275] Uganda Bureau of Statistics 2016, The National Population and Housing Census 2014 – Main Report, Uganda Bureau of Statistics, Kampala, Uganda

[276] Uganda Bureau of Statistics 2016, The National Population and Housing Census 2014 – Main Report, Uganda Bureau of Statistics, Kampala, Uganda

[277] Bena, B. 2015, "Electrification Using Renewable Energy: Uganda's Experience", 'The Development and Mini-Grid Conference' Ministry of Energy and Minerals Development

[278] Stakeholder interviews, 2016

[279] GETFiT Uganda 2015, Global Energy Transfer Feed-In Tariff Annual Report, GETFiT Uganda, http://www.getfit-reports.com/2015/.

[280] Stakeholder Interview, 2016

[281] EU Energy Initiative Partnership Dialogue Facility 2014, Uganda Kisiizi Hydroelectric Mini-Grid Hybrid Operator Model, EU Energy Initiative Partnership Dialogue Facility

[282] Stakeholder Interview, 2016

Electricity regulations and incentives		
Economic/ fiscal	• **VAT:** • Solar technologies (including photo-voltaic devices, light emitting diodes; solar water heaters, solar refrigerators and solar cookers), and RE generation equipment are VAT exempt.[283] 18% VAT is charged on items such as cables that could be used with non-RE components[284,285] • The supply of any goods and services to the contractors and subcontractors of hydroelectric power, solar power, geothermal power projects are exempt from VAT[286] • **Import based incentives:** The following RE technologies receive import exemptions under the EAC General Exemption Regime allowing them to be imported into Uganda for free: • Specialised solar powered equipment and accessories including deep cycle batteries which use and/or store solar power • Specialised equipment for development and generation of solar and wind energy • Entire solar kits (with DC radio, TV etc.) can be imported VAT free[287,288]	• There is lack of clarity in the application of VAT law, particularly around VAT exemption of items that could be used with non-RE technologies[288,290]
Tariffs	• **Solar PV:** Tariff is unregulated and set by the PV system distributor/seller • **Off-grid:** Off-grid distributors are allowed to charge higher tariffs than an on-grid distributor but it is still regulated/set by ERA (to balance cost-reflectiveness and affordability)[291] • **On-grid:** The ERA is responsible for setting tariffs and requires that tariffs are cost-reflective [292] • **Feed-in tariff:** Two tariff schemes are currently in place[293]: 1. **REFIT:** The scheme covers hydro, wind, geothermal, biomass and landfill gas power ranging from $0.08/kWh for small hydropower to $0.12/kWh for wind power 2. **GETFIT:** GETFIT is paid as a top up to the REFIT and covers hydro, biomass and solar power. The solar tariff involves a reverse tender approach where ERA offers $0.11/kWh tariff and GETFIT offer gap payments to developers	• Off-grid: there is a need to review off-grid tariffs and find alternate models for tariff setting. Current mini-grid developers feel that the tariff set by the ERA is often too low for project viability.[294] More information about the cost and viability of off-grid systems is needed
Licensing and contracts	• **Generation (on-grid):** there are two distinct stages in obtaining a license: (i) obtaining a notice of intended application (NIA) (ii) applying for the operating license. The process requires:[295] prefeasibility study, feasibility study, interactivity assessment, environmental assessment, generation license and initialising a PPA with the off-taker	• Licensing process is protracted for both on and off-grid. The lack of clarity on the process for off-grid adds to project risk and cost

[283] Government of Uganda, 2016, Uganda Invest http://www.ugandainvest.go.ug/wp-content/uploads/2016/03/A-Guide-on-Incentives-Exemptions-available-Ugandan-Investors.pdf
[284] PWC 2016, Tax Watch: Tax Amendment Bills – 2016, PWC, https://www.pwc.com/ug/en/assets/pdf/tax-watch-2016.pdf
[285] PWC 2016, Tax Watch: Tax Amendment Bills – 2016, PWC, https://www.pwc.com/ug/en/assets/pdf/tax-watch-2016.pdf.
[286] PWC 2016, Tax Watch: Tax Amendment Bills – 2016, PWC, https://www.pwc.com/ug/en/assets/pdf/tax-watch-2016.pdf.
[287] PWC 2016, Tax Watch: Tax Amendment Bills – 2016, PWC, https://www.pwc.com/ug/en/assets/pdf/tax-watch-2016.pdf.
[288] EAC Secretariat 2015, Catalogue of East African Standards 2015, East African Community Secretariat, Arusha, Tanzania.
[289] Stakeholder interviews, 2016
[290] GETFiT Uganda 2015, Global Energy Transfer Feed-In Tariff Annual Report, GETFiT Uganda, http://www.getfit-reports.com/2015/
[291] Netherlands Embassy in Uganda 2015, 'Energy Country Report: Uganda'
[292] ERA 2016, "Quarterly Tariff adjustment methodology", http://era.or.ug/index.php/2013-12-14-14-58-04/tariff-adjustment-methodology
[293] Government of Uganda 2015, Scaling-Up Renewable Energy Program Investment Plan, Government of Uganda, Kampala, Uganda
[294] Stakeholder interviews, 2016
[295] ERA 2016, 'Investment in Renewable Energy', http://www.era.or.ug/index.php/opportunities/investment/renewable-energy-investment-guide

	• Costs: 0.1% of total project cost to National Environment Management Certification • Timeline: completing the process can last up to 27 months (21 months for NIA approval and 6 months for the license application) • **Generation (off-grid):** off-grid projects with a capacity <2[296] MW are exempt from obtaining a license but developers still have to go through the license process to get the waiver. The application fee for a waiver is $3000 [297] • **Transmission:** UETCL has monopoly over transmission • **Distribution:** power producers need to obtain an electricity distribution license from the ERA [298]	
Customer protection, environmental, and technical standards	• **Customer protection:** UNBS is responsible for developing and issuing national standards, providing import inspection services and testing and certification of imported goods [299] • **Solar PV standards:** Standards for solar PV are specified by the UNBS, ERA and the EAC secretariat. Uganda has not adopted IEC standards [300] • **Environmental standards:** developers need permission from the National Environment Management Authority (NEMA) and the Directorate of Water Resource Management (DWRM) before they receive a generation license.[301] Developers also need to comply by the environmental stipulations of the donors who finance projects[302] • **Technical standards:** ERA's department of technical regulation is responsible for developing and implementing the technical aspects of electricity regulation, including safety, security and supply quality[303]	• Lack of harmonisation between UNBS and IEC standards is an issue and an opportunity for policy intervention
Financial support/ subsidies	• **Grid subsidies:** Grid tariffs are cost-reflective and not subsidised. Some donors such as WB (GPOBA), GIZ and KfW provide output based aid to subsidise connection fees • **Solar PV:** No subsidies at present. World Bank funded PV Target Market end-user subsidy scheme provided a 50% subsidy on solar SHS, but it was discontinued.[304] • **On-grid:** GETFIT offers a premium FiT payment to developers, which are payments per kWh calculated on the basis of expected generation. It also offers 20-year PPA signed with UETCL, and a credit guarantee • **Off-grid:** REA can choose to cover the cost of distribution network for a mini-grid. UECCCC recently launched a working capital facility for solar off-grid projects. • **Kerosene:** no kerosene subsidy • **Financial support for DRE:** the UECCC was created to facilitate investments in the renewable	• Substantial financial support is available for on-grid generation (through the GETFiT programme) but little is available for mini-grid or solar PV

[296] Bena, B. 2015, "Electrification Using Renewable Energy: Uganda's Experience", 'The Development and Mini-Grid Conference' Ministry of Energy and Minerals Development

[297] Stakeholder interview, 2016

[298] UEDCL, 2016, [Homepage], http://www.uedcl.co.ug/

[299] Overseas Development Institute 2016, "Accelerating Access to Electricity in Africa with Off-Grid Solar: Off-Grid Solar Country Briefing: Uganda

[300] Overseas Development Institute 2016, "Accelerating Access to Electricity in Africa with Off-Grid Solar: Off-Grid Solar Country Briefing: Uganda

[301] ERA 2016, 'Investment in Renewable Energy,' http://www.era.or.ug/index.php/opportunities/investment/renewable-energy-investment-guide

[302] Government of Uganda 2015, Scaling-Up Renewable Energy Program Investment Plan, Government of Uganda, Kampala, Uganda.

[303] ERA, 2013, 'Technical Regulation,' http://www.era.or.ug/index.php/component/content/article/94-general/188-technical-regulation

[304] Overseas Development Institute 2016, 'Accelerating Access to Electricity in Africa with Off-Grid Solar: Off-Grid Solar Country Briefing: Uganda'

Enabling policies		
Mobile regulations	• Guidelines require that mobile money transactions must be completed in partnership with supervised financial institutions[306] • Mobile money service providers are required to hold an account with the partner financial institution which contains the value of all mobile money transactions • Mobile money service providers are required to publish periodic reports on their transactions and keep records for a 10-year period[307]	• Government charges VAT on mobile money which makes it costlier for its users and influences the affordability of SHS and pico-solar systems[308]
Project development		
Site identification	• Sites identified by developers have to be stipulated with the submission of the NIA during the license application process and officials from the ERA conduct a site visits before issuing a license[309] • REA have the right to reject sites identified by the developer because of planned grid extension[310]	• No information is currently provided for sites identified for grid extension which creates a challenge for developers
Human capital and local expertise	• Individuals who seek to carry out electric installation work are required to have a permit. Their names are maintained in a database administered by the ERA. Permits are graded to outline the type of electrical work one is licensed to conduct[311] • There is a very strong local talent eco-system for off-grid energy and strong government support via institutions like Makerere and the technical training education track	
Resource assessment	• The MEMD is responsible for national energy resource assessments • At the project level, the developer is responsible for conducting resource assessment.	
Land procurement	• Uganda's constitution vests land ownership to the citizens[312] and land has to be negotiated at the village level and need sub-county approval once site has been selected[313]	• This can be a time consuming process which in turn drives up project costs

[305] UECCC, 2016, [Homepage] http://www.ueccc.or.ug/

[306] Bank of Uganda 2013, 'Mobile Money Guidelines' https://www.bou.or.ug/opencms/bou/bou-downloads/Financial_Inclusion/Mobile-Money-Guidelines-2013.pdf

[307] Overseas Development Institute 2016, 'Accelerating Access to Electricity in Africa with Off-Grid Solar: Off-Grid Solar Country Briefing: Uganda'

[308] Settimba, I. J. 2016, 'Mobile Money in Uganda,' Bank of Uganda

[309] ERA 2016, 'Investment in Renewable Energy,' http://www.era.or.ug/index.php/opportunities/investment/renewable-energy-investment-guide

[310] Stakeholder interview, 2016

[311] ERA, 2016, 'Certified Installation Permit Holders,' http://www.era.or.ug/index.php/licences-permits/2013-10-15-15-44-39/certified-permit-holder

[312] Government of Uganda 2015, Scaling-Up Renewable Energy Program Investment Plan, Government of Uganda, Kampala, Uganda

[313] Stakeholder interview, 2016

KEY TRENDS

There is likely to be a coordinated effort to reach universal access under the SE4ALL initiative. Uganda opted to be part of SE4ALL in 2012, and began a process to develop and an integrated Action Agenda to achieve SE4ALL goals.[314] Uganda's specific objectives are to (i) increase the population with electricity access to 98%, (ii) increase the population with access to modern cooking solutions to 98%, (iii) reduce national wood consumption by 40%, and (iv) increase the renewable share in total energy consumption to more than 90%.[315] In order to achieve these goals, SE4ALL will (i) review existing policies in the energy sector and identify key bottlenecks and gaps, (ii) integrate on-going interventions under an Action Agenda to increase their efficiency, and (iii) design an implementation mechanism for the Action Agenda. The process began in 2015 and will continue until 2030. There is also talk of the MEMD developing an Access Acceleration Strategy to speed up electrification, in partnership with key stakeholders.

To address the challenge of energy access, MEMD and REA have begun a master planning process and require technical assistance. The master plan will be informed by SE4ALL Action Agenda and will include construction plans and timelines. This process seeks to determine which rural areas are appropriate for grid expansion within the ten-year planning period and which areas are better suited to off-grid solutions (e.g. the islands of Lake Victoria are better suited to mini-grids).[316] Further district master plans are being developed at present; the REA will consider and integrate them into overall the master plan. The master plan will also incorporate other plans that have been developed by other agencies. At present the REA is undertaking surveys to identify to collect socio-economic data on key centers. The REA has been working with MIT and Power Africa to conduct early surveys in particular areas to identify the opportunities for off-grid generation.[317]

IV. EMERGENT POLICY QUESTIONS

Desk research and interviews with key stakeholders revealed three important issues that should be taken into consideration when examining the emergent policy questions listed in Figure 21. The three issues are:

1. The government is focusing on grid extension in urban and peri-urban areas but it recognises that the grid is not cost-effective in many rural areas. Rural areas are neglected in the plans for grid extension, which creates an opportunity for SHS and mini-grids, but there are no clear policies supporting either.

2. Developers and policy-makers feel that stand-alone SHSs are more promising than mini-grids. There is particular interest in fast-scaling PAYG models. SHSs have seen robust growth and are increasingly meeting energy needs, while the financial viability of mini-grids is still to be proven.

3. Grid tariffs are cost-reflective and the highest in East Africa at $0.21/kWh.[318] There is no kerosene or tariff subsidy, making affordability an important question.

Given this, Figure 21 below summarises the key policy questions that emerged through desk research and interviews with key stakeholders in Uganda.

[314] SE4ALL goals are: (i) ensuring universal access to modern energy services, (ii) doubling the rate of improvement in energy efficiency, and (iii) doubling the share of RE in the global energy mix by 2030

[315] Ministry of Energy and Mineral Development 2015, Uganda's Sustainable Energy for All (Se4all) Initiative: Action Agenda, Ministry of Energy and Mineral Development, Kampala, Uganda

[316] Bena, B. 2015, 'Electrification Using Renewable Energy: Uganda's Experience,' 'The Development and Mini-Grid Conference' Ministry of Energy and Minerals Development, http://www.Energyfordevelopment.Net/Wp-Content/Uploads/2015/06/Electrification-Using-Renewable-Energy-Uganda-May-2015.Pdf, 11-12 May 2015

[317] Stakeholder interviews, 2016

FIGURE 21: SUMMARY OF KEY QUESTIONS FOR POLICY-MAKERS AND INFLUENCERS IN UGANDA

Stakeholder	Key questions

Policy-makers	• **Grid vs. off-grid:** Where should the grid be expanded and where could mini-grids be cheaper than the grid, if at all?
	• **Planning off-grid:**
	  o What are some high-potential areas for different kinds of off-grid solutions – biomass, small hydro, solar?
	  o How do you prioritise and sequence off-grid solutions for rural Uganda?
	  o Are mini-grids financially viable in Uganda without any subsidy? If not, what kinds of subsidies do they require?
	• **DRE business models:** Since the telecom anchor load model has not worked in Uganda, are there other anchor/productive load models (from other places) that could work? [319] For example, can the Uganda agriculture sector (production/processing/post-harvest storage and refrigeration opportunities) be used as an anchor catalyst for mini-grid and even decentralised SHS models?
	• **Grid interactivity:** How can we ensure that the grid is strong and stable enough to receive energy from mini-grids?
	• **Policy formulation:** What are the kinds of policies that could be put in place to support off-grid solutions in Uganda? What could a mini-grid policy look like?
	• **Subsidy:** What has been the impact of removing solar subsidies on the development and pricing of solar products?
	• **In-country assembly:** What would be the cost and employment implications of assembling solar PV systems in-country instead of importing them as complete sets? How could the government support in-country assembly?
	• **Tariffs:** Should the tariff be cost-reflective? If not, what should the tariff be? If you provide subsidy to an off-grid player, how should the tariff change?
	• **Curriculum:** Is there a way to generate locally relevant knowledge at universities and feed it into the curriculum to ensure that graduates are adequately trained to work on RE and electrification projects?
	• **New technology:** How can new technologies, such as smart grids, be deployed to strengthen the existing grid?
	• **Finance:** Since affordability is a challenge, what innovative financing schemes can enable energy connectivity?

Policy influencers	• **Licensing:** How could ERA and REA streamline their off-grid licensing process to be easier to navigate for small off-grid projects? • **Tax:** What is the impact of the current VAT regulation (and its uneven application) on off-grid power generation in Uganda?

[318] EAC Secretariat 2015, East African Community Facts and Figures 2015, EAC Secretariat, Arusha

[319] Stakeholder interviews suggested that the telecom model has not proven successful in Uganda. Mini-grid developers are investigating the viability of using milk cooling stations, milling units, hospitals, and/or schools as anchor loads

V. POLICY CHALLENGES AND OPPORTUNITIES

Assessment of current policies and expert interviews suggest that there are some key DRE-related policy challenges. Specifically, lack of direction on how access to electricity can and will be increased in rural Uganda, scepticism about the economics of mini-grids, and lack of appropriate subsidies and incentives to drive off-grid uptake are critical policy-related barriers. Other notable barriers include little regulatory support for off-grid energy and poorly streamlined regulatory processes, and ambiguity on implementation of VAT law for solar products. The sections below provide additional detail on each of the top three aforementioned barriers, current efforts to address them, and remaining opportunities.

INADEQUATE DIRECTION ON HOW ACCESS TO ELECTRICITY CAN BE INCREASED IN RURAL UGANDA

Description: While the government has clear targets for electrification and plans to extend the grid to urban, peri-urban and some rural areas, the REA is unclear about how precisely the goals of rural electrification will be reached. Policy-makers within the REA and ERA feel that while grid extension is not cost-effective, there are few workable mini-grid business models that can be brought to scale. SHSs are likely to be the most reliable and pragmatic technology to bring electricity to rural households quickly, but it is unclear what the government can do to support and scale SHS. Further, inadequate RE resource assessments and mapping, and limited diversification on policies to address specific issues and challenges, impede proper planning.

Efforts to address the barrier: The SE4ALL Action Agenda lays out a preliminary plan for rural electrification, including an Accelerated Access Strategy. SE4ALL is also planning to conduct a regulatory framework review to assess the need for new/refreshed policies. Simultaneously, the REA is currently devising an energy/rural electrification master plan. The master plan process is in early stages and will likely require technical support. Donors such as GIZ and Power Africa, and academic institutions such as MIT, are working with REA on the development of the master plan.

Opportunities:

- **Provide data and technical expertise to assist the master planning process:** Create an interactive, web-based platform that shares compiled data resources and related analytics in partnership with the Rural Electrification Agency (REA) and SE4ALL. Assist with the master planning process by combining data on population density, village location, satellite imagery to identify optimal areas for mini-grids, SHS, and grid expansion

SCEPTICISM ABOUT THE ECONOMICS OF MINI-GRIDS

Description: Although the cost of power from mini-grids has fallen significantly over the last few years, it still remains higher than conventional grid power. Policy-makers cite the lack of scalable and financially viable business models as an important barrier to promoting mini-grids. Policy-makers and investors feel that although there are examples of profitable mini-grid pilots, it remains unclear whether extant models are replicable. Further, there are no scalable examples of successful anchor loads as the telecom tower model has not proved to be workable in Uganda. Project developers and policy-makers are struggling with identifying viable anchor loads. The absence of such knowledge prevents the government from being able to identify clear areas where mini-grids can be deployed for rural electrification. Finally, policy-makers cited concerns about the lack of support given to mini-grids relative to on-grid generation. Barring the recent UECCC working capital facility for solar mini-grids, there are no substantive subsidies available for off-grid developers and thus mini-grids remain a highly risky venture.

Efforts to address the barrier: Although mini-grid developers are experimenting and running pilots across the country, there is no sustained policy level effort to address the challenges faced by them.

Opportunities:

- **Assessment of anchor load models:** Conduct research to answer what are the different kinds of productive anchor clients that would make mini-grids viable? What kind of communities and activities can produce what kind of anchor loads? Can mini-grids be made viable in Uganda?
- **Mini-grid regulations and support mechanisms:** Help develop mini-grid regulations that provide clarity on process, financial models, and tariffs. Assist with streamlining regulatory processes for mini-grid development to reduce project risk and costs.

[211] Stakeholder interviews, 2016

[212] Stakeholder interviews, 2016

LACK OF APPROPRIATE SUBSIDIES AND INCENTIVES TO DRIVE OFF-GRID UPTAKE

Description: There are few subsidies for mini-grids or SHS in Uganda at present and there is little support for early stage project needs (prefeasibility and feasibility studies). Developers struggle to show bankable projects that are small/medium in size. Given the absence of end-user subsidies for off-grid developers and the ERA requirement that tariffs are cost-reflective, affordability challenges hamper off-grid uptake. Thus, different financial mechanisms will be needed to meet the objective of access and small off-grid companies require financial resources to increase the pace of connections. The government needs to provide regulatory support for scalable and sustainable financial models – yet, there is no clarity on what this support could look like.

Efforts to address the barrier: Many donors are supporting RE projects and are beginning to think about innovative models to finance the sector in the long-term. In June 2016, UECCC set up a working capital facility for mini-grids.

Opportunities:

- **Conduct research on innovative (and sustainable) financing mechanisms to enable connectivity:** Should the tariff be cost-reflective? If you provide subsidy to an off-grid player, how should the tariff change? What innovative financing schemes can enable energy connectivity?
- **Designing subsidy schemes:** Design appropriate end-user or developer capital expenditure subsidy to improve the economics of mini-grids.

ANNEX 5.1: KEY POLICIES AND PROGRAMMES

ELECTRIFICATION AND RENEWABLE ENERGY POLICIES

Name of institution	Function
National government	
The Electricity Act, 1999	• Privatised and decentralised the electricity sector in Uganda, unbundled the Uganda Electricity Board • The Electricity Act was enacted to facilitate this transition. The Act provides a framework for the government's rural electrification plans. It created the Rural Electrification Fund, The Rural Electrification Board (to manage the fund), and the Rural Electrification Agency
Rural Electrification Strategy and Plan (RESP I) , 2001-2010	• The primary objective is to reduce inequalities in access to electricity between urban and rural communities • Aimed at achieving a rural electrification rate of 10% by 2010 • Projects under this plan included grid expansion (funded by both the government and donor agencies) and isolated PV systems • The plan was phased out in 2010 and had achieved rural electrification rates of <7%, up from 1% in 2001
Renewable Energy Policy 2007,	• Increase renewables to 61% of total energy consumption by end of 2017 by: • Publishing standardised PPAs with feed-in-tariffs (which lead to the creation of REFiT) • Putting in place legislation and regulations to promote appropriate use of RETs in other sectors • Implementing innovative financing mechanisms through PPPs
Energy for Rural Transformation (ERT), 2002-2013	• A 10-year programme, managed by MEMD and financed by World Bank, that integrated the development of small scale rural energy and rural electrification • Included planning of Priority Rural Electrification Projects (PREP), Locally/ community Initiated Rural Electrification Projects (LIREP/CIPRE) and extension of grid to agricultural enterprises
Renewable Energy Feed-in Tariff (REFiT), 2013	• Aims to encourage greater private sector participation in power generation from RE technologies • Providing price via feed-in tariffs to 0.5 - 20 MW sized on-grid projects. Off-grid projects are not included but provisions suggest that they could be included in the future • Priority technologies currently include small hydro, bagasse, landfill gas, biogas, wind and biomass/municipal solid waste (MSW). Solar is not included as the reduction in global cost make it viable without subsidies • Mitigates the off-take, price and currency risk by getting the RE company to sign a 20-year PPA with UETCL. It also includes escalation to adjust for inflation

Rural Electrification Strategy and Plan[325] (RESP II),2013-2022	• Intends to increase rural electricity access to 26% through expanding on-grid services to provide approximately 1.28 million new service connections and approximately 140,000 additional installations of SHS and mini-grid distribution service connections. • Addresses the shortcomings of RESP I by centralising rural electrification planning where the REA will be responsible • Investment in small distributed power generation facilities as local sources of supply will be given increased priority and enhanced support.
National Development Plan II[326] (NDP II), 2015-2020	• National Development Plan II[327] (NDP II), 2015-2020
Uganda Vision 2040 [328]	• Increase renewables to 61% of total energy consumption by end of 2017 by: • Publishing standardised PPAs with feed-in-tariffs (which lead to the creation of REFiT) • Putting in place legislation and regulations to promote appropriate use of RETs in other sectors • Implementing innovative financing mechanisms through PPPs

DONOR FUNDED ELECTRIFICATION PROGRAMMES [329]

Programme/ Project Name	Beneficiaries	Lead Agency	Imple-mented by	Funded by	Start date
West Nile Grid Extension	7 towns, 40 commercial centers 6,000 customers Indirect beneficiaries approx. 40,000 people in households, businesses and social service providers such as schools and health centers	UEDCL	UEDCL	KfW, EU and GoU	2012
Switch to Prepaid (West Nile)	4,000 prepaid meters for existing customers and 2,000 new customers	WENRECo	WENRECo	Kfw	2013
Grid based Output Based Aid Facility (OBA)	120,000 - 132,500 on grid connections over a period of four to five years	REA	UMEME, BECS, WENRECo, KIL, PACMECS	World Bank, KfW, GPOBA EU and GoU	2010
Energy for Rural Transformation II	120,000 households 20,000 off grid Solar Home Systems (SHS),	REA	REA, MEMD, MOESTS, MWE,	World Bank, GEF and GoU	2016

[325] Rural Electrification Agency 2013, Rural Electrification Strategy and Plan 2013-2022, Ministry of Energy and Mineral Development

[326] Government of Uganda 2015, Second National Development Plan (NDPII) 2015/16 – 2019/20, Government of Uganda, Kampala, Uganda

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[328] Government of Uganda 2013, Uganda Vision 2040, National Planning Authority, Kampala, Uganda

[329] Table directly taken from: Ministry of Energy and Mineral Development 2015, Uganda's Sustainable Energy for All (Se4all) Initiative: Action Agenda, Ministry of Energy and Mineral Development, Kampala, Uganda

	1434 schools, 142 large agribusiness farms		PSFU UECCC, UCC, MOLG, MOH, MOFPED		
Energy for Rural Transformation III	150,000 households	REA	REA, MEMD, MoESTS, MoWE, MoH, MoFPED, PSFU, UECCC	World Bank	2016
Uganda Rural Electrification Project	164,077 potential customers, including small and medium sized enterprises	REA	AfDB, ITF, GoU	2014	Uganda Rural Electrification Project
Support to construction of 6 rural distribution projects	20,919 connections	REA	REA	NORAD and GoU	2011
Implementation and Construction of 2 Rural Electrification Distribution Projects	1,164 connections	REA	REA	NORAD	2010
RESP – On-Grid	1,290,102 connections, including the rural areas of UMEME's service territories (by 2022)	REA	REA	Multiple	2014
RESP – Off-Grid39	140,653 from SHS and mini grids (by 2022)	REA	REA	Multiple	2014
Last 1 km programme	1,438,590 grid connections	UMEME	UMEME	UMEME AFD & others	2015
EU Energy Facility 1	2,050 SHS	FRES	FRES	EU	2015
EU Energy Facility 2	50,000 SHS	Church of Sweden	Lutheran Church	EU	2015

ANNEX 5.2: KEY STAKEHOLDERS

Name of institution	Function
Government	
Ministry of Energy and Mineral Development (MEMD)	The entity responsible for energy and mineral resources in Uganda. It plays the role of policy supervisor and provides oversight in the energy and mineral sector.
Electricity Regulatory Authority (ERA)	Regulates generation, transmission, distribution, sale, export and import of electrical energy in Uganda. Guides the liberalisation of the electricity industry, manages licensing, rates, safety and other matters concerning the electricity industry. It supervises all licensed companies within the electricity sector to ensure they comply with regulation. ERA ensures that electricity companies comply with the conditions of their licenses and protects the interests of electricity consumers in respect of: (i) the prices, charges and other terms of supply of electricity, (ii) and the quality, efficiency, continuity and reliability of the supply services.
Uganda Electricity Generation Company Ltd (UECGL)	A limited liability company incorporated in 2001 and fully-owned by the GoU. UEGCL's key role is to carry on the business of electric power generation and sale within Uganda or for export to neighbouring countries. It also builds, operates and maintains a number of electricity generation power plants, monitors the operation and maintenance of its concessional assets, and provides technical support as and when required by the GoU through MEMD.
Uganda Electricity Transmission Company Ltd (UETCL)	Under the single buyer model, UETCL owns and operates the High Voltage Transmission Grid, coordinates the power supply system to achieve balance between supply and demand. It dispatches generation facilities, negotiates all bulk power purchase agreements, and manages power exports and imports.
Uganda Electricity Distribution Company Ltd (UEDCL)	Owns and manages assets consisting of substations and voltage networks, land and buildings, tools and equipment and other assets, monitors compliance to Lease and Assignment Agreement, operates and maintains off-grid stations in Moyo, Adjumani and Moroto until their divestiture. It also manages a pole treatment plant and supervises completion of the Rural Electrification Schemes that were under construction before the transfer of business to Umeme
Rural Electrification Agency (REA)	It operationalises the government's rural electrification function under a public-private partnership framework. It functions as the secretariat of the Rural Electrification Board, which carries out the rural electrification responsibilities, as per Electricity Act of 1999. It is mandated to facilitate the goal of achieving a rural electrification rate of at-least 22% by the year 2022.

Key Donors*	
African Development Bank	Recently provided a US$121 million loan and grant to help Uganda's government improve access to electricity for rural households, businesses and public institutions. In addition, it will support the scaling-up of 'inclusive and green' connections by supplying and installing ready-boards for those who cannot afford household wiring. It will also allow households to pay connection charges in installments to intensify connections for more than 99,000 new customers near the existing grid in electrified rural and urban areas.
European Union	Multiple RE and electrification programmes, including: Expanding Sustainable Energy Markets through Microfinance-Energy Enterprise, West Nile Grid Extension, Output Based Aid (OBA), access to energy services in rural and peri-urban areas in northern Uganda, scaling–up rural electrification using innovative solar photovoltaic (PV) distribution models, rural electrification project in Western and Southern parts of Uganda;,GET FiT, scaling up access to modern electricity services on a regional scale in rural Sub-Saharan Africa by means of a fee for service business model, and support to the SE4ALL Secretariat at MEMD.
GIZ	Multiple RE and electrification programmes, including: Solar PV for social Institutions, Grid extension - Western Uganda, Grid extension - Northern Uganda, Quality Management System, Energy mainstreaming in DLGs, small scale off-grid projects, policy review, market structure development, energy audits, advisory and capacity building, and climate finance.
World Bank	Multiple RE and electrification programmes, including ERT 1, 2, and 3 which will provide up to $ 300 million for: (i) On-grid Electricity Access and Associated Connections: to include grid extension and associated connections, grid intensification and associated connections, household connections from existing distribution lines and an implementation support programme for on-grid energy access. (ii) Off-grid Electricity Access: to include dissemination of institutional Solar PV systems, business development programme for rural access, financial intermediation programme for rural access and quality assurance programme for solar market development. (iii) Institutional Strengthening and Impacts Monitoring: to include an institutional strengthening programme for geothermal development.
Power Africa (USAID)	Power Africa works with Beyond the Grid partners (BBOXX, Virunga, and Fenix International, among others) to provide electricity to thousands of Ugandans for the first time. Another partner, Solar Sister, recruits, trains, and supports Ugandan women who build sustainable businesses selling portable solar lamps, mobile phone chargers and fuel-efficient cook stoves.

Private Sector	
Independent Power Producers	Some of the notable private projects include Bujagali HPP (250 MW), Kabalega HPP (9 MW), Bugoye HPP (13 MW), Kakira Cogeneration from bagasse (52 MW) and the entire GETFIT portfolio.
UMEME	Umeme is the largest electricity distribution company in Uganda (800,000 customers) and is mandated to: (i) operate, maintain, upgrade and expand the distribution network, (ii) retail electricity to its customers, and (iii) to improve efficiency within the electricity distribution system.
Key civil society organisations and academic institutions*	
Universities	Makerere University (Centre for Research in Energy and Energy Conservation and Renewable Energy Business Incubator), MIT
Micro/mini-grid (solar, hydro, biomass)	Pamoja Energy, Kalangala Infrastructure Services, Remergy Energy, Kricher Solar, E4D, Cambridge Clean Energy, Mandulis Energy
Solar home systems	M-KOPA, SolarNow, Fenix International, Village Power, Solar Energy for Africa, Village Energy, D-Light

*Not exhaustive

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