

POWER_{FOR}ALL



Decentralized Renewables: From Promise to Progress

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About this Paper

Despite the U.N.'s goal of ensuring access to affordable clean energy for all people by 2030, default approaches—primarily extending conventional electricity grids—are not meeting the needs of the one billion-plus energy impoverished, who largely live in rural areas.

While recent technological advances have transformed the economics of rural electrification, many energy-poor countries are not taking full advantage of the energy evolution to accelerate access. This paper provides evidence that integrating decentralized renewable energy (DRE) into national energy policy and strategy will provide the fastest, cleanest, most cost-effective

path to universal energy access. Specifically, governments can accelerate electrification by including DRE in national energy policies and rural electrification plans, integrating DRE in energy system planning, and instituting collaborative DRE stakeholder policy design.

Power for All is a global campaign to accelerate the deployment of market-based DRE as the key to achieving universal energy access. The campaign is a coalition of over 170 businesses and civil society organizations focused on DRE, including solar, hydro, biomass, and wind designed for households and businesses. Learn more at powerforall.org.

I. Executive Summary

Historical approaches to energy and development are out of date and out of time. Achieving universal energy access by 2030, as envisioned in Sustainable Development Goal 7 (SDG7), will require a thoroughly different approach that focuses on radically accelerating access to energy at the country level through decentralized renewable energy (DRE).

In many countries, policy bias favoring grid-centric, fossil fuel approaches is holding back access in rural areas where the vast majority of the energy impoverished reside. Instead, national governments must focus on expanding electrification through the best available options, including decentralized renewable products and services—and adopt policies that can speed DRE adoption. This paper provides evidence that specific policy actions, if implemented in each energy-impo­verished nation, can accelerate the organic growth of a DRE market and help deliver power to all before 2030.

While the lack of achievement in access is a complex equation with many factors, one thing is clear: most countries suffering from energy poverty have yet to truly

mobilize the power of decentralized renewable energy to accelerate universal energy access—either in policy or in practice. Among low energy access countries, half have national energy access targets, only 42 percent have rural electrification targets, and a mere 23 percent have specific DRE targets (Appendix A).

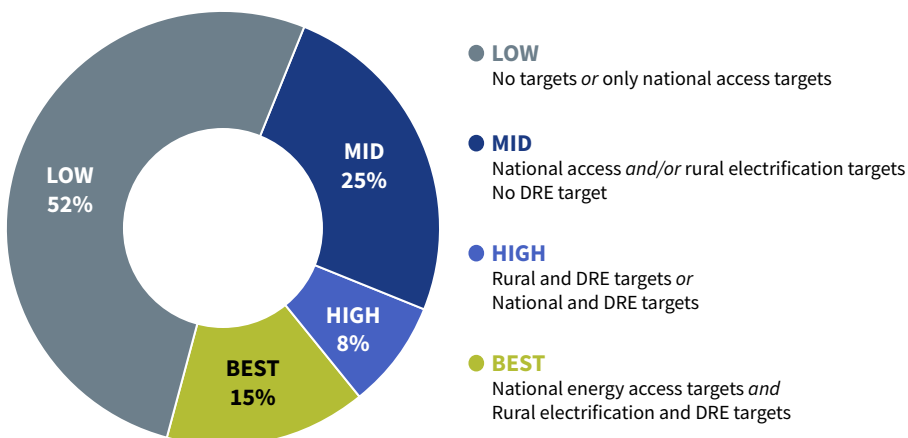
Most countries suffering from energy poverty have yet to truly mobilize the power of decentralized renewable energy to accelerate universal energy access—either in policy or in practice.

National governments hoping to achieve universal access by 2030 without using decentralized renewables are neglecting

powerful electrification tools. While many countries are fighting a losing battle using business-as-usual approaches to reach electrification goals, the DRE sector—ranging from pico solar and micro-hydro to mini-grids and mobile solar farms—is providing energy to more customers than many of the largest global utilities today (Figure 2).¹ Why the gap? With limited awareness of DRE, restricted capacity to implement market-based solutions, and an outdated institutional architecture that values grid-equivalent levels of access, energy officials lack the information, incentives, and tools they need to deploy the DRE technologies and business models that will achieve their access goals faster.

There is a better way: energy impoverished nations can take specific actions not only to attract the DRE sector, but also to help the sector flourish and increase national capacity to end energy poverty. By adopting a suite of policies correlated with DRE market growth—including promoting quality products, designing tax incentives that build the sector, providing strong market signals, and designing grid interconnectivity plans—countries from Botswana to Cambodia can support the ecosystem needed to accelerate the adoption of DRE products and services. To this end, Power for All calls on countries working toward national electrification by (or before) 2030 to prioritize these three policies and processes that will speed achievement of universal energy access: (1) include DRE in national energy policy, (2) integrate DRE into energy system planning, and (3) proactively engage in stakeholder-led policy design to speed market growth.

FIGURE 1: DRE POLICY PERFORMANCE OF LOW ENERGY ACCESS COUNTRIES²



II. The Missing Link: Policy Implementation Gaps



Countries that stand to benefit the most from DRE often have the least developed policy frameworks.

Decentralized renewable energy is designed for places the grid will not easily or cost-effectively reach, where majorities of those without energy access now reside. An estimated 1 billion people—nearly one-fifth of the global population—do not have access to electricity.³ More than 95 percent of those living without electricity are in countries in sub-Saharan Africa and developing Asia, predominantly in rural areas (around 80 percent of the world total).⁴ While many countries have less than 100 percent access, the majority of truly energy-poor people reside in the 48 low energy access countries, or LEAs (Appendix A), where less than 50 percent of the rural population has access to electricity. As many of the energy poor live in peri-urban, rural, and off-grid communities where connection to the central grid can be difficult, focused attention on faster, less expensive, and cleaner electricity solutions in these areas is critical to meeting energy access goals.

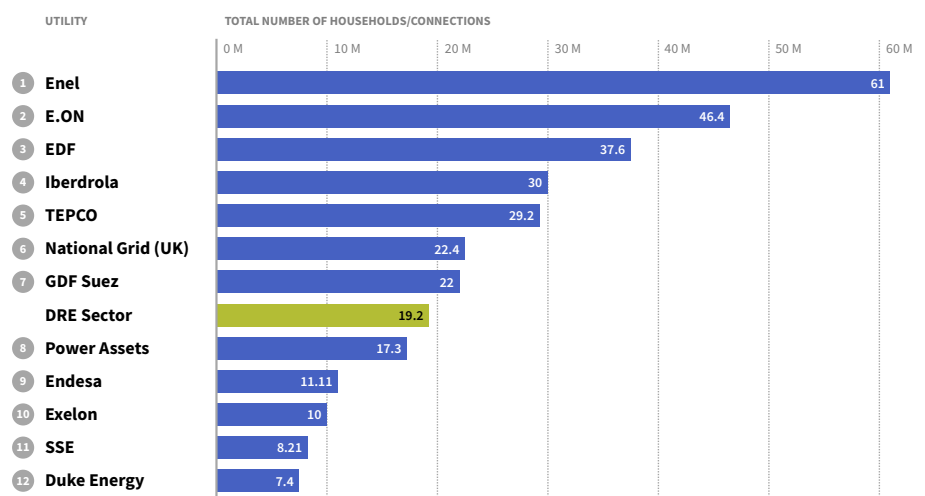
Governments—responsible for long-term energy strategies and regulations that inform generation, transmission, distribution, and consumption in rural and urban areas alike—have a significant role to play in advancing solutions that will end energy poverty. Distributed renewable energy is a

critical part of quickly and cost-effectively meeting future energy needs in emerging markets, especially in more remote, rural areas. Unencumbered by significant infrastructure build-out requirements, DRE generates capacity closer to end users, reducing transmission losses and capital costs. Decentralized renewable energy aligns supply with demand and willingness to pay; customers invest in their preferred level of energy access over time. Competitively tendered mini-grids can achieve an optimum mix of tariff revenues and tariff subsidies, as well as an ideal mix of public and private investment—delivering

maximum access at minimum cost. The sector’s success speaks for itself: altogether, DRE provides energy to more customers than many of the largest global electrical utilities in the world (Figure 2). Not only is DRE a viable energy option, but evidence suggests that DRE can deliver a basic level of universal energy access in a fraction of the time and cost of conventional approaches.⁵

Yet national policy rarely reflects proportional support for DRE. In fact, LEA countries that stand to benefit the most often have the least developed DRE policy

FIGURE 2: LARGEST GLOBAL ELECTRICAL UTILITIES⁶



II. The Missing Link: Policy Implementation Gaps

frameworks. While 40 percent of these countries had rural electrification targets, only 23 percent have DRE targets (Appendix A). The majority have not yet committed to supporting DRE markets in their efforts to achieve universal energy access. In just one example of this disconnect, Power for All's informal survey of experts working to promote the development of household solar markets found that although energy-poor countries were aware of DRE, these nations had (1) a pervasive bias toward the traditional, centralized grid, and (2) rural electrification agencies with inadequate power, resources, and knowledge of decentralized renewables to ensure achievement of universal energy access.⁷

Without a substantive knowledge of the sector, it is impossible to design effective policies to attract the DRE market.

Even when governments have publicly committed to supporting DRE market growth, policy implementation remains challenging. Politicians can feel caught in a bind when it comes to endorsing DRE. In a world that has yet to truly embrace the Global Tracking Framework's Multi-Tiered Framework for measuring energy access,⁸ support for fast, cost-effective DRE can appear to be an admission that the grid will never come. Civil servants are challenged to meet targets for basic electrification using business-as-usual approaches (that is, centralized, fossil-fuel based grid energy).



Yet bringing a single, large donor-supported traditional power plant from conception to operation takes an average of nine years.⁹ By extension, to achieve universal energy access by 2030 using conventional methods, plants that will be needed by 2025 would already have to be in development. This pipeline doesn't exist; thus, business as usual will result in energy poverty as usual.

To compound the difficulty, many energy officials, overwhelmed by unmet consumer demand and global expectations, are struggling to learn about and prioritize new technologies and business models, like DRE, that will help countries achieve their electrification goals faster. Without a substantive knowledge of the sector, it

Not only are decentralized renewables a viable energy option, but evidence suggests that DRE can deliver a basic level of universal energy access in a fraction of the time and cost of conventional approaches.

is impossible to design effective policies that are critical to attract the DRE market and free the sector's competitive forces to drive energy access. Limited by historical approaches to regulation, generation, transmission, and distribution, national energy policy and planning in most LEA countries aren't designed to incorporate decentralized energy. The threat of the current mismatch between "what is" and what "should be" is captured in Kenya's draft revised National Energy Policy 2015: "Going by the current pace at which connections are being effected, achievement of 70 percent and universal access to electricity by 2017 and 2020, respectively, will not be possible without a paradigm shift in the electrification strategy."¹⁰

III. Learning from Leaders: Policy & DRE Growth

With the right enablers in place, decentralized renewable energy has potential to radically alter both global and national universal energy access timelines.

Since 2010, several excellent assessments from leading organizations such as the Shell Foundation, SELCO, the Global Off-Grid Lighting Association (GOGLA), United Nations Environment Programme (UNEP), the National Renewable Energy Laboratory (NREL), and the World Bank’s new RISE scores¹¹ have outlined how to accelerate energy access—including policy’s role. Power for All’s Call to Action builds on this research by (1) identifying the policy interventions that are most strongly correlated with accelerated DRE market growth, and (2) showing how energy-poor countries can use this insight to develop and implement pro-DRE reforms of their own. Power for All draws on the best available market data, policy analysis, and practitioner insight to translate the advice in prior studies into actionable information for governments to use.

Energy-poor countries can use this insight to implement pro-DRE reforms of their own.

Five countries lead the world in solar home system (SHS) and quality-verified pico-PV lighting adoption: India, Bangladesh, Kenya, Tanzania, and Ethiopia (Table 1). According to GOGLA and Bangladesh’s Infrastructure Development Company Limited (IDCOL) cumulative sales data, India and Bangladesh account for 97 percent of SHS and pico-PV adoption in South Asia, and Kenya, Tanzania, and Ethiopia account for 67 percent of adoption in sub-Saharan Africa. The number of companies operating

in-country also indicates the level of activity in a market (Table 1). These market metrics, together with policy indicators, serve as a foundational measure to create usable insights regarding common policy “success factors” in countries with stronger DRE markets. Market activity estimates are conservative, because solar lighting sales do not track mini-grids or other DRE systems, and because the number of active companies does not consider company size. (Note: The need for better national and international support for tracking mini-grid and SHS/pico-PV market penetration is underscored by this assessment.)

Power for All conducted a correlation analysis to understand the relationship between DRE market growth in these five leading countries and policy “scores” developed by Bloomberg New Energy Finance’s (BNEF) highly-regarded Climate-scope report (Appendix B). While both RISE and Climatescope offer a scorecard on energy policies that help assess the

TABLE 1: DRE MARKET DATA FOR HIGH-PERFORMING COUNTRIES¹²

Country	Total Unelectrified Population (Millions) ^A	Estimated Number of Households using SHS/pico-PV as of mid-2015 (Millions) ^B	Number of Active SHS/pico-PV Companies ^C	Number of Active Mini-Grid Companies ^D
Ethiopia	73	2.00	36	15
Tanzania	36	2.50	67	36
Kenya	36	2.70	89	42
Bangladesh	60	3.70	46	19
India	244	8.10	63	84
Rest of SS Africa	632	3.50		
Rest of Asia	512	0.40		

^AData from IEA World Energy Outlook Electricity Access Database. Data for 2014 or the latest available year.

^BCumulative sales data for pico-PV and SHS products estimated from Off-Grid Solar Market Trends Report by BNEF (2016). Cumulative Bangladesh SHS sales from IDCOL’s After Sales Service of Solar Home System Program (2015); assumes sales are one per household.

^CCompiled from a variety of sources, including the members lists of the Alliance for Rural Electrification, GOGLA, and Bennu Solar, as well as the renewable energy associations of each country.

^DNumber of active mini-grid companies is estimated, in the absence of reliable data.

III. Learning from Leaders: Policy & DRE Growth

presence of specific policy indicators, the breadth of Climatescope’s “off-grid” [sic] indicator group provides a quantifiable, numerical basis for observing correlation between many popular energy policy indicators and DRE market size.¹³ For this assessment, Climatescope’s energy policy indicators included: Clean Energy Policies, Power Sector Structure, Distributed Energy Regulatory Framework, Clean Energy Rural Electrification, Energy Access Policies, Policy Barriers (import tariffs), Loans and Grant Programs, Local Investment, and Number of Green Microfinance Institutions (MFIs).¹⁴

While the analysis is restrained by the small sample size of five countries, the limitations of the Climatescope indicators, and the market proxy data in Table 1, there are nonetheless important findings for governments in low energy access countries seeking to catalyze DRE market growth.

Described in detail in [Policy Priorities for Catalyzing DRE Markets: Practical Lessons from the Most Successful Markets](#),¹⁵ a collaborative analysis between Power for All and the Renewable and Appropriate Energy Laboratory at the University of California, Berkeley, found that the following policies most strongly correlate to number of companies and sales in a given market:

- » Low import duties (such as low or no general services taxes on DRE);
- » The presence of “green” microfinance institutions that can help reduce first costs for affordable, reliable, and clean alternatives to kerosene and other fossil-fuel based energy;
- » A strong distributed energy regulatory framework, including components such as specific mini-grid regulations;
- » Energy access policies, including specific national targets; and
- » Loans and grants that can help finance and support operations of companies.

The results of this quantitative analysis are consistent with a private sector survey Power for All conducted in parallel. The survey asked private sector partner companies operating in these five leading countries to identify their top policy needs to grow their businesses and expand in new markets, encapsulated in Table 2.

TABLE 2: POLICY PRIORITIES: A PRIVATE SECTOR PERSPECTIVE

#1 Need in:	SHS/Pico PV	Mini-grids
Energy Policy	Clear Targets and Time Frames Signals of total addressable market and business potential	Integrating DRE into National Electrification Plans Signals that mini-grids are part of electrification plans and creates policies on grid integration
Regulatory	Adoption of Global Quality Standards Protects consumers and incentivizes reliable products	Fast, Low-Cost Licensing and Permitting Remove a significant disincentive and massive barrier to faster deployment
Fiscal Policy	Absence of Import Duties and Tariffs Helps level the playing field with fossil fuels and incumbent energy sources	Improved Access to Financing Provides substantially higher capital for longer time periods needed by mini-grids versus SHS products

This combination of statistical policy analysis and private sector experience can provide valuable, objective guidance to policy makers and government officials. With such strong corroborating evidence, a more in-depth analysis of Climatescope indicators—supported by private sector opinions—highlights the importance of specific policy accelerators in low energy access countries:

1. Reducing import duties and tariffs on DRE-related products.
2. Supporting the availability of local finance through loans, grants, and microfinance.
3. Establishing energy access targets or national commitments to electrification.
4. Establishing rural electrification plans or programs that incorporate DRE.
5. Establishing technical regulation through licensing procedures for mini-grid operators and adoption of quality standards.

While a correlation analysis cannot capture causality, it does help identify policy and regulatory trends across the most vibrant DRE markets. The establishment of energy access targets and incorporation of DRE into planning are identified as the two principal national policy “building blocks,” critical for laying the foundation of an enabling environment for decentralized energy that can accelerate universal energy access. Armed with this information, energy-challenged countries committed to maximize DRE can help achieve national access goals by 2030 and can take specific actions to build an innovative DRE sector and ecosystem, leveraging modern technology, economies of scale, and the power of consumer choice.

IV. From Promise to Progress: A Call to Action



Targets are a powerful market signal that a government is committed to DRE market growth.

Solving the access challenge—and accelerating achievement of the multitude of development objectives enabled by electrification—is possible if energy-poor nations adopt the full suite of available solutions, including the best technologies and business models in energy generation, like decentralized renewables. By prioritizing the creation of appropriate DRE targets, creating a useful and accessible regulatory framework with integrated energy planning, and, finally, engaging DRE stakeholders in the design and execution of electrification plans, governments can help the DRE market thrive and, therefore, accelerate universal energy access.

1. Set the Target: Include Decentralized Renewables in National Policies and Rural Electrification Plans

Setting targets for universal energy access and for DRE adoption is one of the most important things governments can do to accelerate the development of energy access markets and reduce energy poverty. In Africa and Asia, the countries with the highest DRE market growth have adopted specific plans for universal energy access, such as Ethiopia's and Kenya's commitments to 100 percent electrification by

2030, usually with a specific target dates (such as India's "24x7 Power for All" by 2019), and with structures to support this public commitment. Governments can further demonstrate commitment if targets are accompanied by specific headline policy reforms such as VAT/tariff reductions or other programs to support market growth. DRE appears most likely to thrive in countries where a specific government entity, such as a ministry of energy, is tasked with achieving 100 percent energy access, with independent budgets and responsibility for specific DRE targets. Examples include Kenya's goal of 100,000 solar home systems by 2017, Bangladesh's 25 MW of solar micro-grids (500 MW Solar Programme of 2013) and India's 2 MW (out of 175 MW renewables) goal (Appendix C).

Targets are a powerful market signal that a government is committed to DRE market growth, helping to attract international companies and investors. Targets also send an important signal to decision makers and civil servants that DRE market growth is official government policy and pro-DRE reforms must be implemented. Of these reforms, the current binary definition of electrification—where households are either on-grid and "electrified" or off-grid and "unelectrified"—is out of date and

out of time. Those wanting to maximize engagement of the DRE sector must recognize that any access to modern energy is better than none—that the ability to power LED lighting, phone chargers, and basic appliances is better than reliance on kerosene, batteries, or candles. By using a tiered framework when setting targets, governments can incentivize civil servants to promote DRE as a key to quickly improving energy access in remote rural areas—and ensuring that no one gets left behind.

2. End the Implementation Gap: Institute Decentralized Energy in Integrated Energy Planning

If governments want to maximize chances of accelerating energy access, it is critical to *integrate* DRE into energy plans where grid extension, mini-grids, and standalone systems are given equal consideration. Integrated planning involves the systematic analysis of *all* the factors that influence the design of energy systems, including the full range of options available, and the costs and benefits of different scenarios and technologies. With an integrated approach, governments can make more informed decisions about how to invest scarce public resources, leveraging more private investment and thus maximizing the total investment deployed in pursuit of energy access goals. In one example, as a direct result of Tanzania's policy and licensing frameworks for Small Power Producers (less than 1 MW) and Very Small Power Producers (less than 100 kW), there is more mini-grid investment and activity than anywhere else in Africa.

The foundations of integrated planning—institutional expertise/standards (such as a dedicated regulator, dedicated teams within utilities, and quality standards),

IV. From Promise to Progress: A Call to Action

guiding principles/strategy, and mini-grid specific policies—are among the policies associated with stronger DRE markets.¹⁶ Integrated energy policy designed to end the implementation gap between promise and progress on access will require a level planning field that pays equal attention to grid, mini-grid, and household-level solutions. This kind of planning will appropriately value (1) time to access, (2) the cost of delayed energy access, and (3) the Energy Access Dividend¹⁷ produced in education, health, and gender equality improvements (among other benefits) that result from early access to modern energy services. In this model, the planning priority becomes helping every citizen in energy-poor countries reach at least Tier 1 or Tier 2 access, creating cost savings that can enable citizens to invest in higher levels of access to energy in the longer term.¹⁸ This approach to electrification will demand more awareness of decentralized renewable technologies, as well as an understanding of business models and knowledge of market dynamics.

3. Institute Collaborative Policy Design: DRE Stakeholder-Led Policymaking

Because the underlying technologies that enable DRE to outperform the grid in the speed, affordability, and reliability of electrification are evolving so rapidly, it is challenging for any government to stay abreast of the latest developments—much less create fast-track policies that take full advantage of energy innovations to speed universal energy access. Particularly in such a dynamic market, resolving weaknesses in underlying public policy processes—including lack of clarity around electrification plans, limited knowledge of DRE policy requirements, changing tariff

regimes, and inconsistent public notice proceedings—will hamper the growth of the supporting DRE ecosystem. This ecosystem—including private sector and indigenous civil society organizations—is fundamental to helping national governments achieve universal energy access goals. Yet in many energy-poor countries, there is no mechanism for government, the private sector, and civil society to work together to build the trust and mutual accountability needed to accelerate organic market growth. For this reason, instituting a DRE-specific task force is a central part of Power for All's call to action for countries that want to accelerate universal energy access with decentralized renewables.

Based on task force examples in Sierra Leone, setting up a long term, collaborative entity that supports goal setting and mutual accountability among the broader DRE ecosystem has been shown to accelerate implementation of pro-DRE policy reform, which in turn accelerates DRE market growth. Once established and empowered by a country's head of state, the energy ministry, and the local donor coordination committee (including aid agencies, development finance institutions, and multilateral development banks), a DRE task force can become a powerful collaboration tool to bridge the goals of a rural electrification agency and the interests of the renewable energy association to accelerate universal energy access. With a mandate to achieve electrification targets leveraging DRE, the agency can use its position to champion the DRE accelerators with customs, revenue authorities, and ministries of finance. On the association side, private sector groups, civil society organizations (CSOs), and other development organizations can focus their limited resources on developing a collective voice with specific, actionable

priorities that will help the sector succeed. Also, with energy planners engaged in the task force, there will be a consistent and reliable channel to educate the central government about the technologies, business models, and specific incentives that will help encourage market growth.

Sierra Leone: A Tipping Point Case Study

In 2016, the Power for All campaign teamed up with Sierra Leone's Ministry of Energy, President Ernest Bai Koroma, Energy Africa, and local partners to set a bold, ambitious goal: Power for All by 2025, with a specific target of 250,000 DRE connections by the end of 2017.

The Energy Revolution Task Force, focused on DRE, became a platform for market activation: establishing a renewable energy association (REASL), Africa's first quality-linked VAT/tariff exemption, awareness campaigns that led to market growth (School Campaign by Oxfam IBIS), and supported development of an MFI association to unlock local finance.

In just over six months, Sierra Leone's DRE market more than doubled in size and attracted key DRE companies like Azuri, Barefoot, Mobile Power, Ignite, Greenlight Planet, d.light, and TOTAL (Awango).

V. Answering the Call to Action



The battle for energy access will be fought and won in the countries suffering from energy poverty. Governments in low energy access countries can support the DRE market by prioritizing proven policy solutions that are strongly correlated with market acceleration. At the same time, the broader DRE sector—including donors—must work together to measure and monitor progress and share information to prioritize effective approaches that accelerate access.

Governments: Prioritize Market Acceleration Policy Creation

As demonstrated above, one of the most powerful relationships between the strength of the DRE market—purpose-built to solve energy poverty—and government policy lies in (1) publicly stated access targets, ideally based on globally-endorsed tiers of use, (2) integrated energy access policy and planning that appropriately values grid, mini-grid, and distributed household solutions, and (3) an empowered, well-funded rural electrification entity with a clear plan, targets, and the clout necessary to create incentives for DRE generation. While there are a number of policy and regulatory changes that can bolster DRE (such as exemptions for DRE products

from import duties, or establishing low cost, priority permitting, registration, and licensing), the value of an empowered DRE task force cannot be overstated. In any energy-poor country, it is possible to create a mechanism for government, the private sector, and civil society to work together to build the trust and mutual accountability needed to accelerate organic DRE market growth (Appendix D).

Sector-wide cooperation between civil society and the private sector is critical to complete the circle of demand creation and supply delivery.

DRE Ecosystem: Collaborate in Creating Success Factors

No single policy, program, or product will create universal energy access. While governments can do their part to support market acceleration by prioritizing

policies designed specifically to support the growth of DRE markets, sector-wide cooperation between civil society and the private sector is critical to complete the circle of demand creation and supply delivery. In each country seeking to accelerate access to energy, the foundations of (1) DRE industry associations, (2) shared, country specific DRE market data, and (3) DRE-specific task forces are critical building blocks for sector success. The broadest possible coalition of industry constituents must work together, through local renewable energy associations like the Renewable Energy Association of Nigeria (REAN), or international trade groups such as the Global Off-Grid Lighting Association (GOGLA) and the newly formed African Mini-Grid Developers Association (AMDA) to share insights, best practices, lessons learned, and data. Members of this evolving sector come from highly diverse fields of practice—engineering, fast-moving consumer good sales, civil society organizations, and even a savings group or MFI—and often do not form a natural constituency. Two-way communication is critical to provide the fastest runway for success, including the development of clear, actionable “asks” through industry associations, regular performance reporting, and identification of gaps in the ecosystem.

Donors: Support Market-Building Initiatives and Country Coordination

Donors—including aid agencies, foundations, foreign ministries, and multilateral institutions—play a significant role in bridging the access implementation gap in energy-poor countries. Donors can support the creation of national and sub-national integrated energy plans by (1) building technical and human capacity to integrate

V. Answering the Call to Action

DRE into national electrification planning, (2) funding market development programs that build the ecosystem of support and coordination for DRE, and (3) supporting a neutral third-party to track and report verified data for tiered access.

To give the full picture of DRE's contribution to access, comprehensive collection and tracking for DRE is needed, especially regarding DRE-specific access-creation or connection data,¹⁹ verifiable sales, and harmonized accounting energy access tiers.²⁰ No country systematically tracks electrification through DRE solutions in off-grid areas; most global data (e.g., World Bank) reflect only grid-based connections. More comprehensive collection and tracking for the DRE sector is needed to give the full picture of DRE's contribution to universal energy access. This would include DRE-specific access-creation or connection data (numbers of active mini-grids are painfully difficult to procure),²¹ verifiable (but anonymous) sales, and DRE connections (harmonized accounting energy access tiers).

Achieving universal energy access in our lifetimes will require a thoroughly different approach to energy.

Delivering on the Promise of DRE

While the lack of achievement in access is a complex equation with many factors, one thing is clear: countries suffering from



energy poverty have yet to truly mobilize the power of decentralized renewable energy to accelerate universal energy access. Solving the access challenge—and accelerating achievement of the multitude of development objectives enabled by electrification—is possible if energy-poor nations adopt the full suite of available solutions, including the best technologies and business models in energy generation, like DRE.

Historical approaches to energy and development are out of date and out of time. Achieving universal energy access in our lifetimes will require a thoroughly different approach to energy, focused on radically accelerating access at the country level through DRE. In order to achieve energy

access goals, national governments must focus on expanding electrification through the best available options, including DRE products and services—and the policies that can speed their adoption—not simply waiting for organic market growth. With this information, energy-challenged countries committed to maximize DRE can help achieve national access goals before 2030 by taking specific actions to build an innovative DRE sector and ecosystem, leveraging modern technology, economies of scale, and the power of consumer choice.

Appendix A: Energy Access and DRE Targets

COUNTRY ²²	UNELECTRIFIED POPULATION (MILLIONS)	RURAL ELECTRIFICATION RATE (%) ²³	ENERGY ACCESS TARGETS ^{24, 25}		DRE TARGET
			NATIONAL	RURAL	
● Benin	7	9	-	-	-
● Botswana	1	32	+	-	-
● Burundi	10	2	+	-	-
● Cameroon	9	23	-	-	-
● Chad	13	1	-	-	-
● Congo	3	16	-	-	-
● Djibouti	1	1	+	-	-
● DPR Korea	18	11	-	-	-
● DR Congo	62	0	+	-	-
● Equatorial Guinea	0	48	+	-	-
● Eritrea	3	17	-	-	-
● Gabon	0	38	+	-	-
● Gambia	1	13	-	-	-
● Guinea	9	11	-	-	-
● Guinea-Bissau	1	6	-	-	-
● Haiti	7.5	8	+	-	-
● Lesotho	2	8	-	-	-
● Myanmar	36	18	+	-	-
● Namibia	2	17	-	-	-
● Niger	16	4	-	-	-
● São Tomé and Príncipe	0	40	-	-	-
● Somalia	9	4	-	-	-
● South Sudan	12	0	-	-	-
● Sudan	24	26	-	-	-
● Yemen	14.2	32	-	-	-
● Burkina Faso	14	1	+	+	-
● Cambodia	10	18	-	+	-
● Central African Republic	5	1	+	+	-
● Côte d'Ivoire	8	31	+	+	-
● Madagascar	21	8	-	+	-
● Mali	13	9	-	+	-
● Mauritania	3	2	-	+	-
● Nigeria	98	36	+	+	-
● Senegal	6	40	+	+	-
● Togo	5	21	+	+	-
● Zambia	11	5	+	+	-
● Zimbabwe	7	40	-	+	-
● Ethiopia	73	10	+	-	+
● Liberia	4	11	-	+	+
● Mozambique	16	27	+	-	+
● Sierra Leone	5	1	+	-	+
● Angola	16	6	+	+	+
● Ghana	8	50	+	+	+
● Kenya	36	7	+	+	+
● Malawi	15	5	+	+	+
● Rwanda	8	9	+	+	+
● Tanzania	36	18	+	+	+
● Uganda	31	12	+	+	+

● **Low:** No targets or only national access targets

● **Mid:** National access and/or rural electrification targets; no DRE target

● **High:** Rural and DRE targets or national and DRE targets

● **Best:** National energy access targets and rural electrification and DRE targets

Appendix B: Methodology and Limitations

Methodology: Identifying Priorities for Early Stage Sector Development from Empirical Analysis

As captured in *Policy Priorities for Catalyzing DRE Markets: Practical Lessons from the Most Successful Markets*, the methodology used in this report is two-tiered empirical analysis of the five most active DRE markets (Kenya, Ethiopia, Tanzania, India, and Bangladesh) using recent, best available data to provide practical insight into policy prioritization for low energy access countries. This includes (1) a survey of a sample of DRE practitioners and (2) a regression analysis between policy performance and market growth for these top performing countries to confirm that statistically significant relationships corroborate the experiences and perspectives of practitioners as reported in the survey.

“Survey Says”: Clear Policy Favorites Identified by DRE Companies in Local Operation

Power for All surveyed practitioners in the campaign partner network who operate in one or more of the top five performing countries. Twenty-three companies participated in the survey, including 11 solar home systems (SHS) and pico-photovoltaic (pico-PV) companies, 5 micro- or mini-grids operators, and 7 providers of both mini-grid and SHS or pico-PV services. Participants were asked to rank a specific subset of policy instruments within three groupings (national energy policy, technical regulation, and financial regulation and policy) according to how important or beneficial the respective instrument has been (or would be) in supporting their local business operation. They also were asked to explain their choice for their top-ranked policy measure.

“The Five Habits of Highly Effective Markets”: Trends Across High-Performing Countries

To observe the correlation between policy performance indicators and DRE market growth for the same five top performing countries, Power for All used BNEF’s clean energy investment-climate assessment tool, Climatescope, which evaluates the policy and investment climate for clean energy investment in 55 developing countries across the world based on expert evaluation of over 53 distinct indicators. Indicators related to energy policy used in the assessment include: Clean Energy Policies, Power Sector Structure, Distributed Energy Regulatory Framework, Clean Energy Rural Electrification, Energy Access Policies, Policy Barriers (import

tariffs), Loans Grants and Grant Programs, Local Investment, and Number of Green Microfinance Institutions (MFIs).

Climatescope Indicators and Regression Methodology (Regression, Residual Plots, Inverse Correlations)

A least-squares linear regression was performed for each measure of market growth, after normalizing Climatescope indicators to percent value of the maximum country score awarded for that indicator. The slope of a positive correlation can be defined as the increase in market growth or development per percent increase in policy performance score. Per the small sample size, validity was checked by plotting residuals against the values for market development. Three indicators (Clean Energy Policies, Power Sector Structure, and Local Investment) were shown to contain influential outliers under both market metrics and regression models and therefore are likely invalid. These were also indicators with lowest r-squared value in each market metric analysis, rendering them statistically insignificant linear relationships. The five remaining indicators correlated strongly and positively to both market metrics.

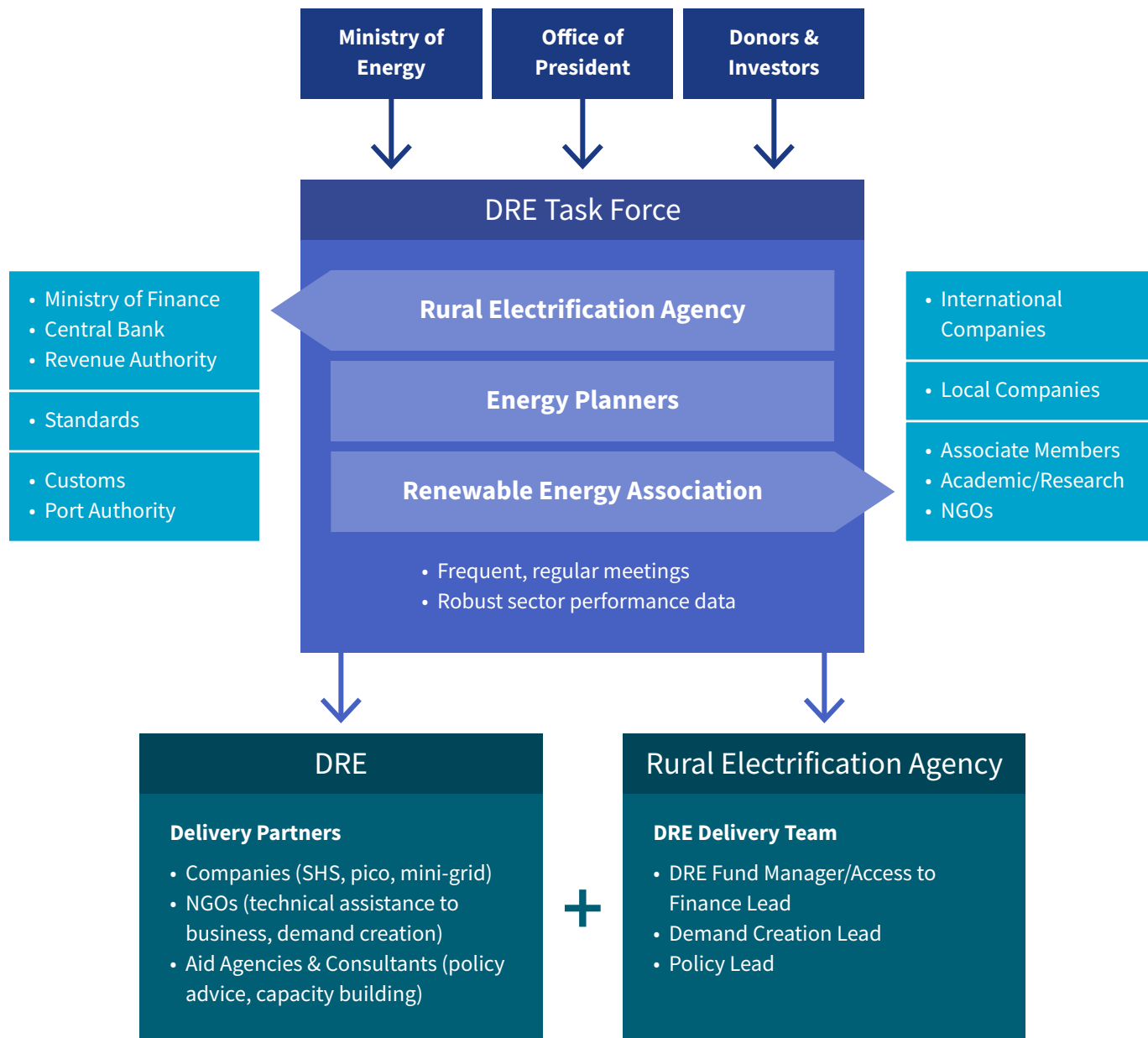
Limitations

The statistical significance of the relationships observed through correlation analysis is limited for a number of reasons. First, little to no sales data is available for developing countries with small DRE markets, so the analysis is constrained to a small sample of highly performing countries. Second, it is not possible to conduct time series analysis of market growth and policy performance as historical yearly data for policy performance is inconsistent and limited; this includes sales data. Furthermore, the number of compounding factors involved in policy implementation and market development can skew temporal relationships between the two. Third (and conversely), snapshots of present policy performance, even where historically informed, cannot fully explain past market development. This is in addition to limitations posed by the use of SHS and pico-PV sales data from GOGLA (which is self-reported and which does not include unverified products); and the high-level nature of Climatescope’s indicator scoring, which is largely based on expert evaluation of performance rather than any other empirical data source. Causal relationships thus cannot be inferred through this correlative methodology.

Appendix C: Five-Country DRE Policy Instruments

	KENYA	ETHIOPIA	TANZANIA	BANGLADESH	INDIA
National Energy Policy or Strategy	National Energy Policy (NEP) of 2013 ²⁶	Growth and Transformation Plan I (2010) and II (2015) ^{33,34}	Rural Energy Master Plan (REMP) part of Sustainable Energy Access Agenda ⁴³ with focus on <1 MW	Renewable Energy Policy of 2008; 500 MW Solar Program ^{50,51}	National Energy Policy of 2005 ⁵⁷
Universal/Rural Electrification Targets	National: 100% by 2020 goal ²⁶	National: 90% by 2020 ³⁵	National: 75% electrification by 2030 ⁴⁴	National: 100% electrification by 2021 ⁵¹	National: 100% electrification by March 2017; example: Andhra Pradesh ⁵⁸
DRE Specific Targets	NEP DRE-specific targets, including 100,000 SHS by 2017 ²⁶	Plans to produce 3,600,000 solar lanterns, 400,000 household solar PVs, 3600 institutional solar PVs, 135 mini hydropower stations ³⁶	REA Long Term Strategy: 6,000 settlements will be electrified through off-grid electrification and 5,500 through grid connections by 2022 ⁴⁵	500 MW Solar Program of 2013, committed to 25 MW of solar micro-grids ⁵¹	Target of 2000 MW of off-grid solar systems by 2022 under National Solar Mission ⁵⁹
Rural Electrification Plan or Program	Rural Electrification Authority (REA) through the Energy Act of 2006 ²⁷	Rural Energy Development & Promotion Centre (REDPC); regional bureaus via Ministry of Water Irrigation & Energy (MOWIE) ³⁷	Rural Electrification Agency (REA) works with Ministry of Energy and Minerals ⁴⁶	Rural Electrification And Renewable Energy Development (RERED) Project II ⁵²	Remote Village Electrification Program (2009); ⁶⁰ the Rural Electrification Corporation (REC) support, subsidy
Technical Quality Product/Service Standards	NEP commissioned minimum standards for solar energy technologies	Rural Electrification Fund (REF) gives a secretariat authority on acceptable safety and economic standards ³⁸	National Energy Policy draft specifies upcoming technical standards for solar energy technologies ⁴⁴	Government subsidies apply only to solar home systems that meet IDCOL's technical specifications ⁵³	Technical specifications of solar systems, batteries, light bulbs, and other components ⁶¹
Mini-grid Permitting/Licensing Procedures	Under update; prior regulations for public and private mini-grids were evaluated under contract by ECA ²⁸	REF offers loans for 95% of mini-grid project costs at 7.5% interest ³⁹	Regulatory framework for mini-grids up to 10 MW, including small power purchase agreements ⁴⁷	Modified Rural Area Power Supply System (RAPSS) guidelines for mini-grids ⁵¹	Mini-grid policies by state; example: Uttar Pradesh includes capital subsidy, regulatory framework ⁶²
Current Import Duty and VAT/GST Rating	16% VAT on solar products removed in 2014, now exempt; ²⁹ lantern tariff: 5%, PV module tariff: 0% ³⁰	Removal of 100% of taxes levied, including those that are related to energy; ⁴⁰ lantern tariff: 2.25%, PV module tariff: 2.25% ⁴¹	0% import duties Value Added Tax Act of 2014 (solar-focused); lantern tariff: 5%, PV module tariff: 0% ³⁰	5% VAT exemption for RE equipment and raw materials; ⁵⁴ lantern tariff: 11.7%, PV module tariff: 2.5% ³⁰	Removed excise duties on DRE solar (2014); lantern tariff: 8%, PV module tariff: 0% ³⁰
MFI Activity (Number, Customer Base, Credit Availability)	13 companies, 800 thousand customers, US\$3.03 billion in loans ^{31,32}	35 companies, 3.12 million customers, US\$268 million in loans ⁴²	82 companies, 343 thousand customers, US\$44.2 million in loans ^{48,49}	676 companies 19.98 million customers, US\$3.5 billion in loans ^{55,56}	268 companies 39.9 million customers, US\$9.38 billion in loans ^{63,64}

Appendix D: DRE Task Force



Notes

I. Executive Summary

1. Customers are defined as households or connections. Number of residential connections obtained from company websites and annual reports. DRE providers represent the more than 100 active companies reported on by BNEF. Estimated number of households served by SHS/pico-PV from Bloomberg New Energy Finance (BNEF) et al., *Off-Grid Solar Market Trends Report 2016* (February 2016). This estimate is conservative as it does not account for mini-grid connections or sales of SHS/pico-PV products not reported by BNEF.
2. See notes to Appendix A on page 17.

II. The Missing Link: Policy Implementation Gaps

3. “Energy access database,” International Energy Agency, *World Energy Outlook*, <http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/> (accessed March 1, 2017).
4. Ibid.
5. Internal analysis. Assumes a 250 kWh/year solar system costing \$300 for a household of 5, delivering energy to 1.2 billion people (rounded to \$70 billion).
6. See note 1. For the purposes of this exercise, non-competitive state-owned utilities such as the State Grid Corporation of China or the Korean Electric Power Corporation are not included.
7. Internal survey conducted in February 2017 targeting experts working to promote the development of household solar markets in Africa. There was a 44 percent response rate. Respondents represented activity in Ethiopia, Ghana, Kenya, Mozambique, Nigeria, Rwanda, Senegal, Sierra Leone, Tanzania, and Uganda.
8. *Beyond Connections: Energy Access Redefined*. (International Bank for Reconstruction and Development Energy Sector Management Assistance Program [ESMAP], July 2015): 6, <https://openknowledge.worldbank.org/bitstream/handle/10986/24368/Beyond0connect0d000technical0report.pdf> (accessed March 20, 2017). The need for a tiered approach to energy access—including the range of Tier 1 (task lighting, phone charging), Tier 2 (general lighting, phone charging, television, and fan [if needed]), up to Tier 5 (Tier 2 plus high power appliances)—was first identified and discussed in SEforALL’s Global Tracking Framework (GTF) 2013 report.
9. “The median duration of a World Bank electricity sector investment project is 9 years, including project preparation, planned implementation, and time overrun.” *World Bank Group Support to Electricity Access, FY2000–2014: An Independent Evaluation*. (World Bank Independent Evaluation Group, 2015). <https://openknowledge.worldbank.org/handle/10986/22953> (accessed March 21, 2017).
10. *Draft National Energy Policy*. (Kenya Ministry of Energy and Petroleum, February 24, 2014).

III. Learning from Leaders: Policy & DRE Growth

11. Studies include *Accelerating Access to Energy* (Shell Foundation, 2014), *Deployment of Decentralized Renewable Energy Solutions* (SELCO Foundation, 2015), *Policies to Spur Energy Access* (National Renewable Energy Laboratory, 2015), *Delivering Universal Energy Access Recommendations* (Global Off-Grid Lighting Association [GOGLA], 2015), *Developing Effective Off-Grid Lighting Policy* (United Nations Environment Programme, 2015), and *The Mini-grid Policy Toolkit* (EU Energy Initiative, 2014).
12. An estimate for the level of market development in each country was created by collecting data on the net sales of distributed renewable energy systems and the number of active DRE companies in each country. DRE systems were separated into two categories: standalone systems (which include solar home systems and off-grid lighting products such as solar lanterns) and mini-grid systems. Active companies were also separated by the type of DRE system they provide, and companies that provide both standalone and mini-grid systems were counted in each category.
13. Climatescope is an interactive report and index that evaluates the policy and investment climate for energy/climate-related investment in 55 countries across the world based on expert evaluation of over 53 distinct indicators used to create country scores. Indicators published in 2015 were used for this analysis. For more information see the Climatescope website, <http://global-climatescope.org/en/> (accessed March 20, 2017).
14. “Methodology,” Climatescope, <http://global-climatescope.org/en/methodology/> (accessed March 1, 2017).
15. Shirley, R., et. al. *Policy Priorities for Catalyzing DRE Markets: Practical Lessons from the Most Successful Markets*. <https://rael.berkeley.edu/project/the-platform-for-energy-access-knowledge/> (accessed March 20, 2017).

Notes

IV. From Promise to Progress: A Call to Action

16. Ibid.
17. The Energy Access Dividend is a joint initiative of Power for All and SEforALL. The Energy Access Dividend evolved from the concept of an Energy Access Opportunity Cost presented in the May 2016 Power for All Call to Action on “Decentralized Renewable Energy: The Fast Track to Universal Energy Access” as well as feedback and consultations conducted by SEforALL in the context of its Strategic Framework for Results (2016-21).
18. The Energy Ladder theory suggests that as income increases, the energy types used by households would be cleaner and more efficient as energy customers are able to reinvest savings from renewable products into higher tiers of service. See Wheeldon, S., *From Ladders to Staircases: Is This the Future of Energy Access?* (Power for All, 2016). <http://www.powerforall.org/blog/2016/6/7/from-ladders-to-staircases-is-this-the-future-of-energy-access> (accessed March 20, 2017).

V. Answering the Call to Action

19. For example, in Tanzania and India electrification is measured as a transmission line in the area, not a connection, or power flowing through the transmission line.
20. Because DRE has a particular value-added role in accelerating access through market-based approaches, tools are needed to allow for analysis across and within top-performing countries and to measure progress over time in increments of less than 2 years (the current standard for the Global Tracking Framework).
21. See notes to Table 1 on page 6.

Appendix A: Energy Access and DRE Targets

22. Low energy access country defined as one in which less than 50% of the rural population has access to electricity.
23. “Energy access database,” International Energy Agency, *World Energy Outlook*, <http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/> (accessed March 1, 2017).
24. Energy Access and DRE targets taken from official government documents. For example, SEforALL provides information on targets and plans for ECOWAS (the Economic Community of West African States) countries, according to the SEforALL Action Agendas, but these are not necessarily formally adopted or acknowledged by the respective governments. We note all ECOWAS SEforALL targets but where the corresponding government document cannot be found, we do not include in the count toward target totals.
25. Some countries may have very recently established targets that are not captured in this literature search. There may also be unpublished documents establishing targets not readily available for inclusion in this survey, affecting counts.

Appendix C: Five-Country DRE Policy Instruments

26. See note 10.
27. “The Energy Act, 2006.” Government of Kenya, 2006.
28. *Project Design Study on the Renewable Energy Development for Off-Grid Power Supply in Rural Regions of Kenya*. (Economic Consulting Associates and Trama TecnoAmbiental, November 2014).
29. *East African Community Import Duty Exemption*. (Climatescope 2015, 2016). <http://2015.global-climatescope.org/en/policies/#/policy/3887> (accessed January 27, 2017).
30. “Tariff Download Facility,” World Trade Organization 2016, <http://tariffdata.wto.org/default.aspx> (accessed March 1, 2017).
31. “List of Licensed Microfinance Banks,” Central Bank of Kenya 2017, https://www.centralbank.go.ke/lists__trashed/microfinance-banks/ (accessed January 30, 2017).
32. *2014 Sector Report on the Microfinance Sector in Kenya*. (Association of Microfinance Institutions in Kenya, October 2014).
33. *Growth and Transformation Plan (2010/11–2014/15)*. (Ethiopia Ministry of Water and Energy, November 2010).
34. *Growth and Transformation Plan II (GTP II) (2015/16–2019/20)*. (Ethiopia National Planning Commission, May 2016).
35. *Growth and Transformation Plan II (GTP II) (2015/16–2019/20)*. Federal Democratic Republic of Ethiopia National Planning Commission, May 2016.

Notes

36. Ibid.
37. “Ethiopia: Country Details,” Climatescope 2015, 2016, <http://2015.global-climatescope.org/en/country/ethiopia/> (accessed January 25, 2017).
38. Proclamation No. 317/2003 A Proclamation Provided for the Establishment of the Rural electrification Fund (2003), 9 Fed. Negarit Gazeta 35, 2098 (Ethiopia).
39. “Ethiopia Rural Electrification Fund,” Climatescope 2015, 2016, <http://2015.global-climatescope.org/en/policies/#/policy/4363> (accessed March 1, 2017).
40. “Ethiopia Import Duty Exemptions,” Climatescope 2015, 2016, <http://2015.global-climatescope.org/en/policies/#/policy/4307> (accessed March 1, 2017).
41. HS Code and Tariff website, Ethiopian Revenues and Customs Authority, <http://www.erca.gov.et/index.php/search-hs-code> (accessed March 1, 2017).
42. “Microfinance Institutes,” National Bank of Ethiopia, 2016, <http://www.nbe.gov.et/financial/microfinanceinstitutes3.html> (accessed March 1, 2017).
43. *Tanzania’s SE4ALL Action Agenda*. (Sustainable Energy for All, African Development Fund, and United Nations Development Program, December 2015).
44. *Draft National Energy Policy 2015*. (Tanzania Ministry of Energy and Minerals, 2015).
45. See note 42.
46. The Rural Energy Act, 2005 (2005) No. 8 (2005) (Tanzania).
47. Shija. *Competitive Bidding Framework for Solar and Wind Small Power Projects*. <http://www.ewura.go.tz/?p=1969> (accessed March 21, 2017).
48. “Current Members,” Tanzania Association of Microfinance Institutions, 2017, <http://tamfi.co.tz/membership/current-members/> (accessed March 1, 2017).
49. *Members Directory 2011/12*. (Tanzania Association of Microfinance Institutes [TAMFI], 2012).
50. *Renewable Energy Policy of Bangladesh*. (Ministry of Power, Energy and Mineral Resources, Bangladesh, December 2008).
51. *500 MW Solar Programme: An Initiative to Promote Renewable Energy Programme in Bangladesh*. (Ministry of Power, Energy and Mineral Resources, Bangladesh, May 2013).
52. “Rural Electrification and Renewable Energy Development II (RERED II) Project,” World Bank, 2017, <http://projects.worldbank.org/P131263/rural-electrification-renewable-energy-development-ii-rered-ii-project?lang=en> (accessed March 1, 2017).
53. *Design of Small Solar Home Systems (SSHS)*. (International Development Company Limited [IDCOL], 2014).
54. *Renewable Energy Policy of Bangladesh*. Ministry of Power, Energy and Mineral Resources, Government of the People’s Republic of Bangladesh, December 2008.
55. *Microcredit in Bangladesh*. (Microcredit Regulatory Authority, August 2015).
56. *List of Licensed MFIs as of 27 December 2016*. (Microcredit Regulatory Authority, 2016).
57. *National Electricity Policy*. (Government of India Ministry of Power, February 12, 2005). <http://powermin.nic.in/en/content/national-electricity-policy> (accessed March 1, 2017).
58. *Power For All*. (Government of India and Government of Andhra Pradesh, 2016).
59. Resolution: Jawaharlal Nehru National Solar Mission (January 11, 2010), No. 5/14/2008-P&C, India Ministry of New and Renewable Energy, <http://www.mnre.gov.in/solar-mission/jnnsnm/resolution-2/> (accessed March 1, 2017).
60. *Remote Village Electrification Programme*. No.15/1/2011-12/RVE. (India Ministry of New and Renewable Energy, July 20, 2011).
61. *Capital Subsidy Scheme for Solar Lighting and Small Capacity PV Systems under Jawaharlal Nehru National Solar Mission (JNNSM) of the Ministry of New and Renewable Energy*. (National Bank for Agriculture and Rural Development, March 9, 2012).
62. *Mini Grid Policy Uttar Pradesh*. (Government of Uttar Pradesh, 2016).
63. *Directory of Microfinance Institutions (MFIs) in India*. Version 1. (Sa-Dhan, 2014).
64. *Microfinance sector: A Snapshot of 2015–16*. (Sa-Dhan, SIDBI, and UKAID, 2016).