CHAPTER 1

ACCESS TO ELECTRICITY

Photo: World Bank

MAIN MESSAGES

- **Global trend:** The current decade has seen significant progress in electrification across the developing world, where the great majority of the unelectrified population resides. The share of global population with access to electricity rose from 83% in 2010 to 89% in 2017. This amounts to an average annual electrification rate of 0.80 percentage points, and newly gained access for more than 920 million people. Due to this remarkable electrification growth, the global population without access to electricity fell from 1.2 billion in 2010 to 840 million in 2017. It is noteworthy that the number of people electrified between 2010 and 2017 is higher than the access deficit as of 2017. Notably, the electrification trend started to accelerate in 2015: an additional 153 million people were electrified yearly between 2015 and 2017 in comparison to 122 million between 2010 and 2015. However, after accounting for population growth, the annual net increase in the number of people with access was about 67 million during the 2015-2017 period.

- **2030 target:** Globally, there was a surge in electrification growth in 2015-2017. Despite this, the average annual gain in the electrification rate since 2010, at 0.80 percentage points per year, falls short of the target rate required to reach universal access by 2030. To make up for the lag, this rate needs to be 0.86 percentage points annually from 2018 to 2030. Meanwhile, keeping up the current momentum will be increasingly challenging as progress is uneven and there is a growing gap between fast-electrifying countries and those lagging behind. Furthermore, achieving universal access faces the difficulty of reaching the remaining unserved populations, which include those connected to frail and overburdened urban grids, as well as displaced and hard-to-reach populations. Given the many challenges facing access-deficit countries, the latest projection places the access rate in 2030 at 92%, leaving 650 million people around the world without access to electricity.[3]

- **Regional highlights:** All regions saw an acceleration in the growth in population with access to electricity over the 2010-2017 period.[4] This trend dates back to 2010 in Central and Southern Asia, where 91% of the population had access to electricity by 2017[5], as well as in Latin America and the Caribbean and Eastern and South-eastern Asia, where the regional access rates climbed up to 98% in 2017. In Sub-Saharan Africa, electrification efforts began to outstrip population growth in 2015. With a regional access rate of 44%, Sub-Saharan Africa's access deficit remains the largest: about 573 million people lacked access to electricity in 2017.

- **Urban-rural distribution:** Although the advance of electrification was more rapid in rural areas than in cities between 2015 and 2017, the rural access rate of 79% was still far behind the urban access rate of 97% in 2017. In fact, the unserved rural population of 732 million represented 87% of the global access deficit in 2017. The urban access rate has plateaued despite the relatively small share of urban populations still waiting to be electrified. This is in large part owing to the challenges of electrifying an increasing urban population, as well as those living in inner cities and informal settlements who receive electricity supply through fragile distribution networks. In Central and Southern Asia, the annual access gain in rural areas was 48 million compared with only 22 million in urban settings between 2015 and 2017, indicating a focus on rural electrification in this part of the world. However, in Sub-Saharan Africa, there was greater attention to urban electrification. Here, the incremental rural electrification of 16 million people a year was two-thirds that of the urban rate in 2015-2017.

- **Top 20 access-deficit countries:** In 2017, the 20 countries with the greatest access deficit (as measured by the number of people without access to electricity) accounted for about 78% of the global population lacking electricity. Thus, efforts to electrify these countries will determine in large part the degree of progress made on Sustainable Development Goal (SDG) indicator 7.1.1. Of these 20 countries, Bangladesh, Kenya, and Myanmar have made the most progress since 2010, at an annual rate of over 3 percentage points. Some countries with unserved populations of over 50 million in 2017—such as the Democratic Republic of Congo, Nigeria, and Pakistan—have expanded electricity access by less than 1 percentage point annually since 2010 and in a majority of the top 20 access-deficit countries, the electrification rate between 2010 and 2017 did not keep pace with population growth during the same period.

- **Affordability and reliability of service:** SDG target 7.1 calls for universal access to affordable, reliable, and modern energy services by 2030. Using electricity tariff data, the 2018 edition of the World Bank's Regulatory Indicators for Sustainable Energy (RISE) reveals that basic, subsistence-level electricity consumption (30 kilowatt-hours [kWh]/month) is unaffordable (costs more than 5% of monthly household income) for the poorest 40% of households in half of the access-deficit countries[6], representing 285 million people (ESMAP 2018d).[7] Pertinently, an electricity connection costs more than one month's income for the poorest 40% of households, or over 400 million people, residing in access-deficit countries. Regarding reliability, households in one out of three access-deficit countries face more than one weekly disruption in electricity supply that lasts over four minutes on average.[8]

- **Off-grid solar and mini grids:** According to data from the International Renewable Energy Agency (IRENA 2019), globally, in 2017, at least 34 million people had access to the equivalent of Tier 1 and above (Tier 1+) electricity service either through a standalone system or connection to a mini grid. In-depth analysis of electrification solutions in six countries (Bangladesh, Cambodia, Ethiopia, Kenya, Myanmar, and Rwanda) in 2017, conducted under the Multi-Tier Framework for Energy (MTF), indicates that off-grid solutions constitute critical sources of Tier 1+ service (ESMAP 2018a, b, and c). Most off-grid solutions centred on SHSs and solar lighting, but mini grids are gaining traction.

- **Gender gap:** Gender-disaggregated electricity access data from MTF for Bangladesh, Cambodia, Ethiopia, Myanmar, and Rwanda found significant variability in household access rates based on gender of head of household which stem from various factors including gender gaps in affordability, access to finance, and location.

ARE WE ON TRACK?

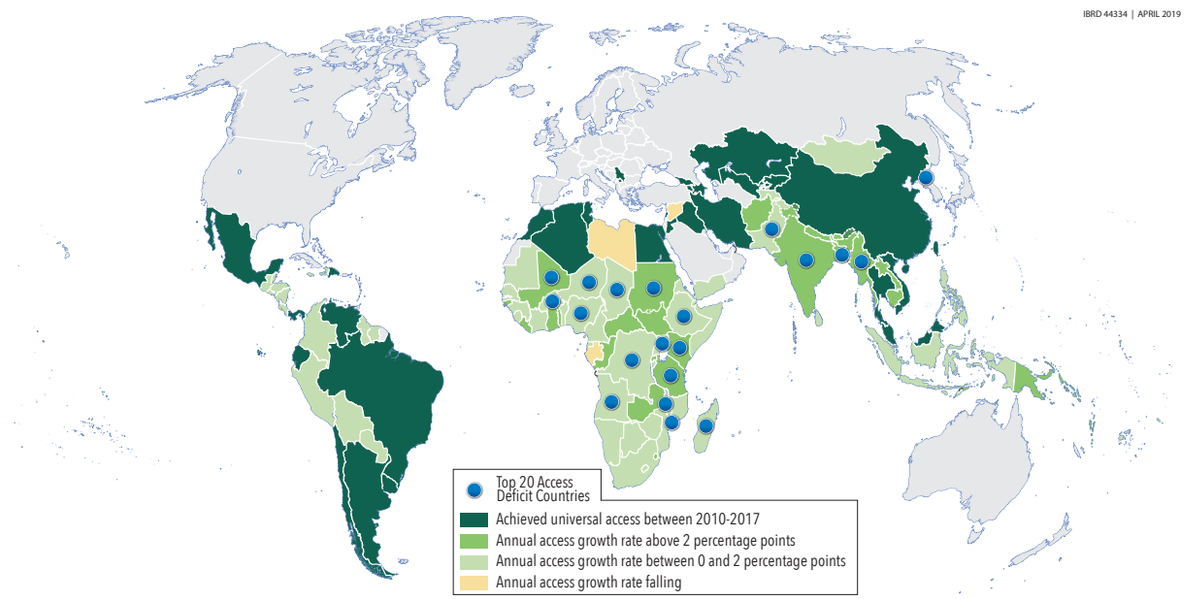
In 2017, 89% of the world's population had access to electricity.[9] Between 2010 and 2017, the global population without access to electricity fell from 1.2 billion to 840 million[10]. Encouragingly, the electrification rate has accelerated since 2015, with 153 million additional people being electrified each year. Given the wide variety of country contexts and various complexities of bringing electricity to the remaining unserved population, a projected 92% of the global population will have access to electricity in 2030[11] (figure 1.1), leaving 650 million people without access[12].

FIGURE 1.1 • PERCENTAGE OF POPULATION WITH ACCESS TO ELECTRICITY (%)

Source: World Bank.

Since 2010, 44 countries achieved universal access, while another 29 countries accelerated their electrification rate at a pace of at least 2 percentage points annually.[13] However, as of 2017, 96 countries were yet to achieve 100% access to electricity, a large majority of which were in Sub-Saharan Africa and Central and Southern Asia.14 One-third of these access-deficit countries, including 8 of the 20 countries with the largest unserved populations, upped their rate by over 2 percentage points each year in the period 2010-2017 (figure 1.2). In Sub-Saharan Africa, the electricity access gained by nearly 450 million people pushed up the regional access rate from 39% in 2015 to 44% in 2017. In Central and Southern Asia, over 1.76 billion or 91% of the population had access to electricity in 2017.

FIGURE 1.2 • ANNUAL INCREASE IN ELECTRIFICATION RATE IN ACCESS-DEFICIT COUNTRIES, 2010-2017 (PERCENTAGE POINTS)



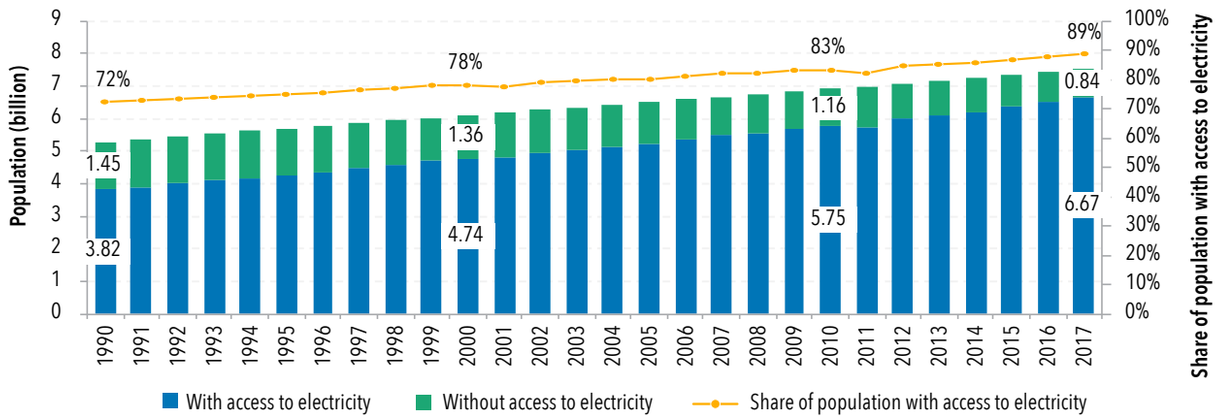
Source: World Bank.

LOOKING BEYOND THE MAIN INDICATORS

ACCESS AND POPULATION

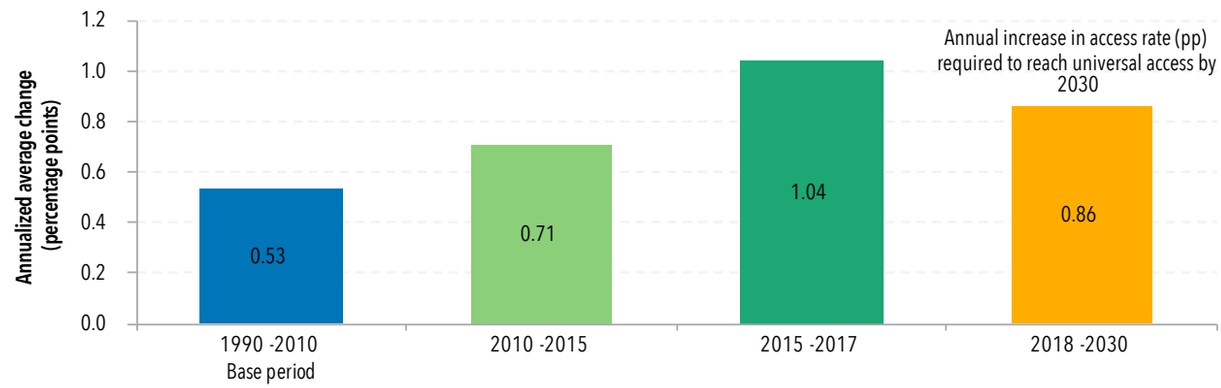
Recent trends confirm that the sustained electrification rate of recent years is faster than the pace of population growth in the underserved parts of the world. Global electrification has seen a consistent uptick since 2010, surging from 83% in 2010 to 89% in 2017 (figure 1.3). During the same period, the global population without access to electricity fell from 1.2 billion to 840 million. Despite accelerated electrification growth at 1 percentage point between 2015-2017, it will be challenging to achieve the 0.86 average annual percentage point increase needed to reach universal access by 2030 (figure 1.4), given lagging progress in many large access-deficit countries and difficulties in bringing electricity to the remaining unserved population.

FIGURE 1.3 • GAINS IN ELECTRICITY ACCESS, 1990-2017 (IN BILLIONS OF PEOPLE AND SHARE OF POPULATION WITH ACCESS TO ELECTRICITY)



Source: World Bank.

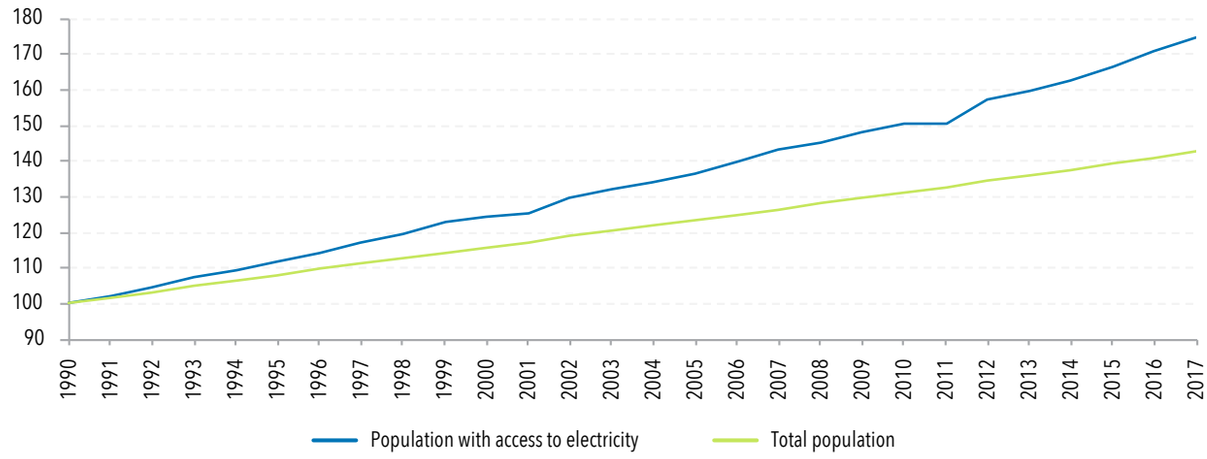
FIGURE 1.4 • AVERAGE ANNUAL INCREASE IN ELECTRICITY ACCESS RATE (PERCENTAGE POINTS)



Source: World Bank.

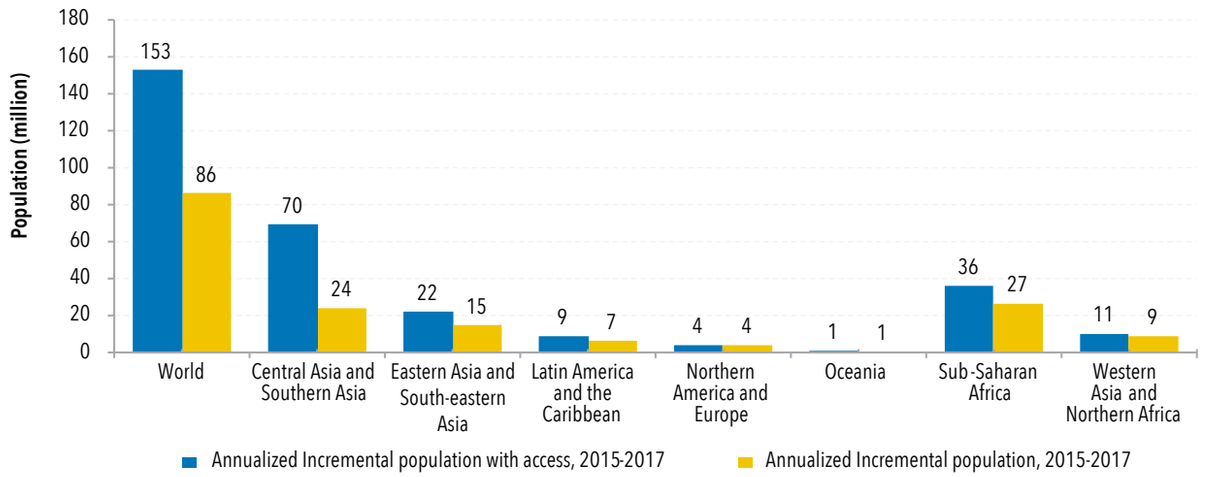
As a result of robust electrification efforts in 2015-2017 (figure 1.5), the global electrification rate accelerated 1.8 times faster than population growth. In a reinforcement of a trend seen since 2011, when the gains in the electrified population began to outpace population growth, the years 2015-2017 also saw a net decline in the number of people lacking access in all regions of the world (figure 1.6). This was underscored by a drop in unserved populations in Central and Southern Asia, and Sub-Saharan Africa. An annual net decrease of 45 million in Central and Southern Asia is particularly stunning, driven mainly by progress in India and Bangladesh, which together constitute 14% of the global access deficit. Central and Southern Asia's remarkable progress brought the region's access rate from 75% in 2010 to 91% in 2017. In 2015-2017, the annual net decrease in Sub-Saharan Africa was 10 million people.

FIGURE 1.5 • PACE OF ELECTRICITY ACCESS VS POPULATION GROWTH, 1990-2017 (INDEX, 1990 = 100)



Source: World Bank.

FIGURE 1.6 • ANNUAL INCREMENTAL GAINS IN ELECTRIFICATION AND POPULATION GROWTH, 2015-2017, BY REGION

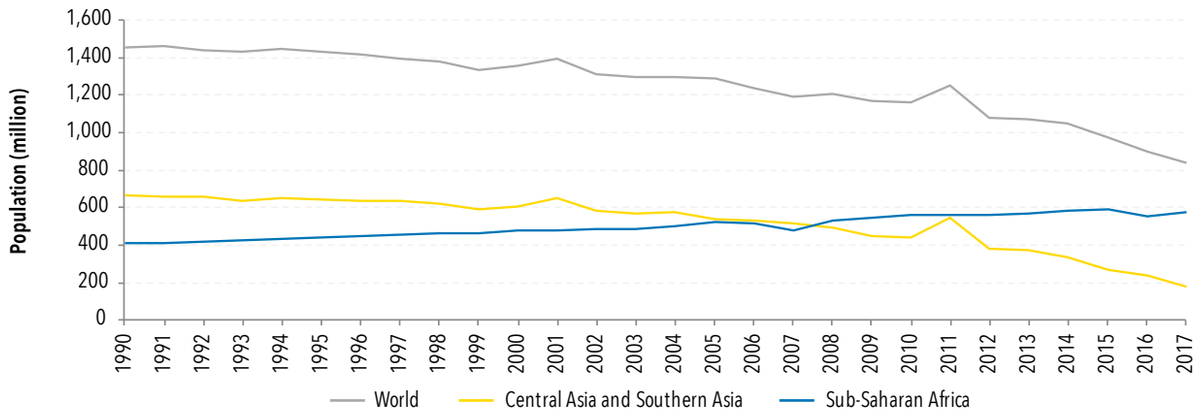


Source: World Bank.

THE ACCESS DEFICIT

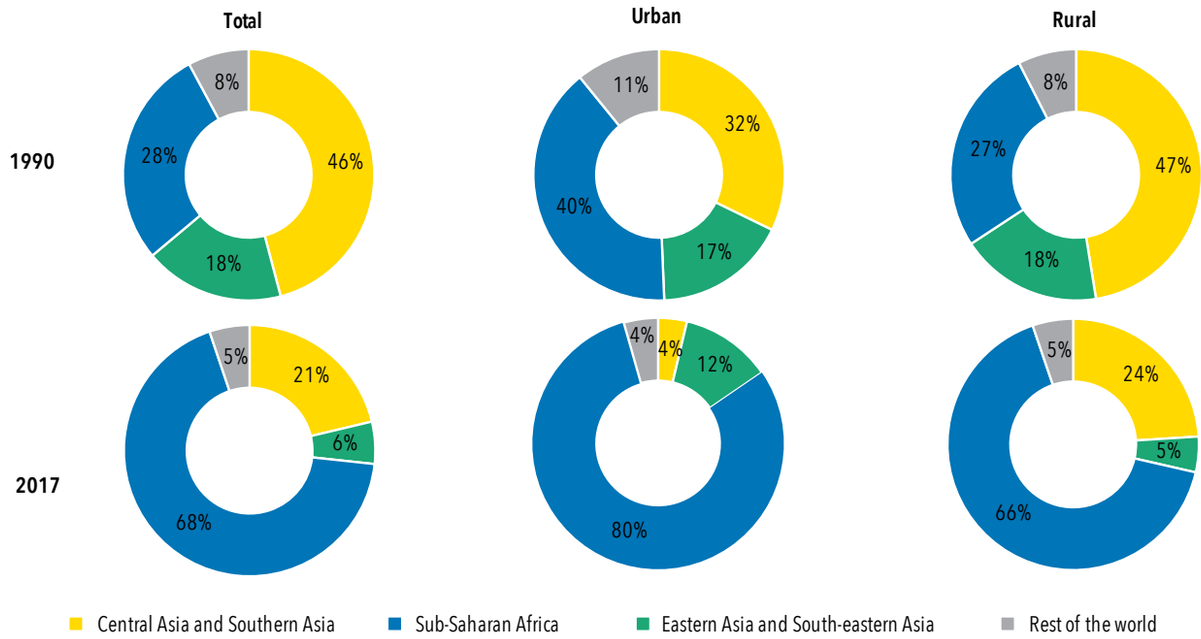
The number of people without electricity has been falling across all regions since 1990, a trend that started to accelerate in 2015. This decline has been significant in Central and Southern Asia, and to a lesser degree in Sub-Saharan Africa, where 7 out of 10 people without access resided in 2017 (figure 1.7). As of 2017, the share of global population without access to electricity in Eastern and South-eastern Asia fell to about a quarter of what it had been in 1990 (figure 1.8). Over that same period, 1990-2017, the share in Sub-Saharan Africa doubled, reaching 68% in 2017, with the result that Sub-Saharan Africa supplanted Central and Southern Asia as the region with the largest unserved population. In 2017, there were 178 million people without electricity in Central and Southern Asia and 573 million people without access in Sub-Saharan Africa. Latin America and the Caribbean is closing in on universal access, with an access rate of 98%, leaving close to 12 million people without access to electricity in 2017.

FIGURE 1.7 • EVOLUTION OF THE ACCESS DEFICIT (MILLIONS OF PEOPLE), 1990-2017



Source: World Bank.

FIGURE 1.8 • REGIONAL SHARES OF THE GLOBAL ACCESS DEFICIT, IN TOTAL AND ALONG THE URBAN/RURAL DIVIDE, 1990 AND 2017



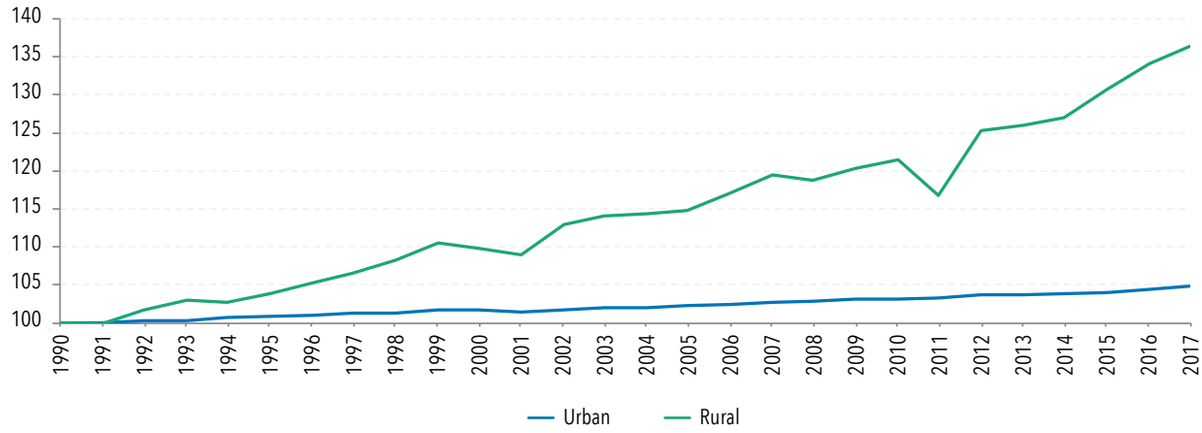
Source: World Bank.
Note: Based on population without access to electricity

URBAN-RURAL DIVIDE

While the pace of access expansion accelerated in rural areas, it remained almost constant in urban areas (figure 1.9). The 2017 global rural access rate of 79% (comprising an access deficit of 728 million people) was significantly lower than the urban access rate of 97% (or 108 million people unserved). A global focus on electrifying the rural population meant that, on average, an additional 60 million rural residents gained access to electricity each year between 2015 and 2017 (the number goes down to a net increase of 54 million people taking population growth into account (figure 1.10)). Incremental rural electrification was six times the additional rural population in Central and Southern Asia over the period 2015-2017. In Sub-Saharan Africa, meanwhile, electrification kept pace with population growth in rural areas.

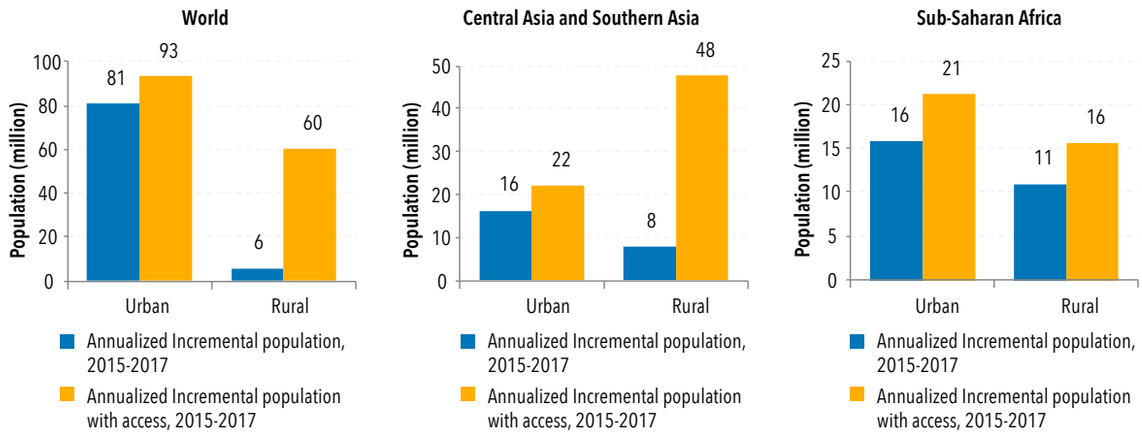
An even larger number of urban residents, about 93 million on average, gained access each year, outpacing the world's urbanization growth. It is important to note that maintaining the urban access rate is more challenging than improving rural access from its low base, and global urbanization trend anticipated over the next decade could lead to larger populations without access in urban areas.

FIGURE 1.9 • SHARE OF POPULATION WITH ELECTRICITY ACCESS IN URBAN AND RURAL AREAS, 1990-2017 (INDEX 1990 = 100)



Source: World Bank.

FIGURE 1.10 • ANNUAL INCREMENTAL ACCESS GAINS AND POPULATION IN THE WORLD, SUB-SAHARAN AFRICA, AND CENTRAL AND SOUTHERN ASIA, ALONG THE URBAN/RURAL DIVIDE, 2015-2017



Source: World Bank.

BOX 1.1 • THE GENDER GAP IN ELECTRICITY ACCESS

Gender-disaggregated analysis of electricity access for Bangladesh, Cambodia, Ethiopia, Myanmar, and Rwanda show significant variability in households' access rates based on gender of head of household. In rural areas, results are mixed: in Ethiopia and Myanmar, female-headed households have higher access rates, while in Bangladesh, Cambodia, and Rwanda, male-headed households are more likely to have access (figure B1.1.1). In urban areas, electricity access is higher among female-headed households in all countries except Rwanda. Shifting focus to electricity source, there is a more significant gender gap in off-grid penetration. Male-headed households are more likely to be connected to the grid than female-headed households in Bangladesh, Cambodia, and Rwanda, while the contrary is true for Ethiopia and Myanmar. Male-headed households have higher access to off-grid electricity in Ethiopia, Myanmar, and Rwanda, while female-headed households have higher off-grid access in Cambodia. Ethiopia and Myanmar have the widest gender gaps, while there is no gender gap in Bangladesh (figure B1.1.2).

FIGURE B1.1.1 • ELECTRICITY CONNECTIVITY IN URBAN AND RURAL HOUSEHOLDS, BY GENDER OF HOUSEHOLD HEAD, 2017

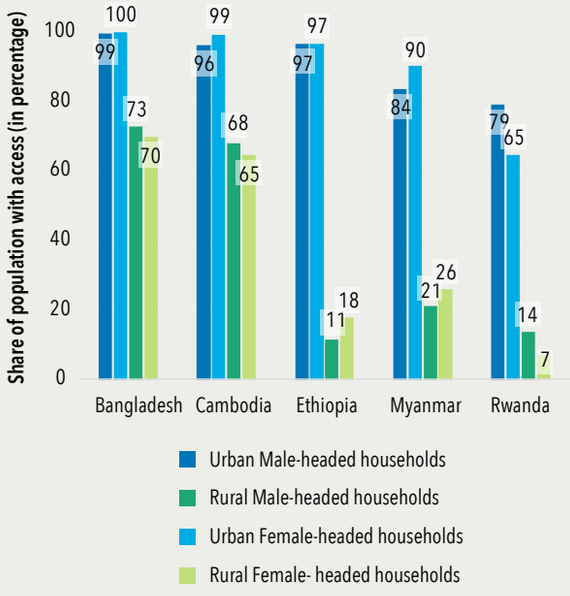
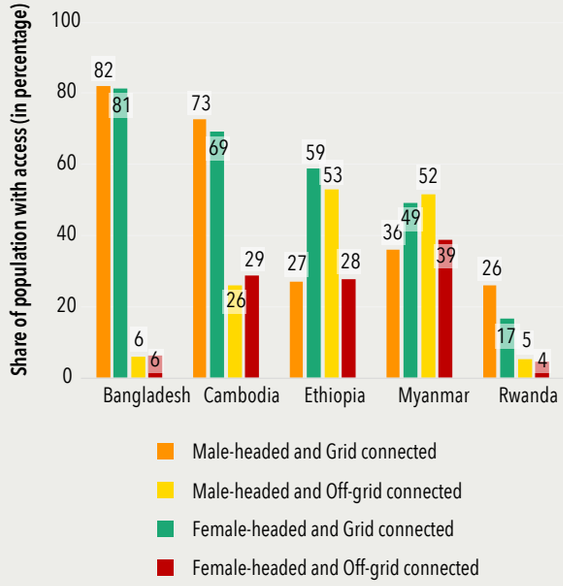


FIGURE B1.1.2 • TYPE OF ELECTRICITY CONNECTIVITY, BY GENDER OF HOUSEHOLD HEAD, 2017



Source: MTF, World Bank.

OFF-GRID ELECTRIFICATION

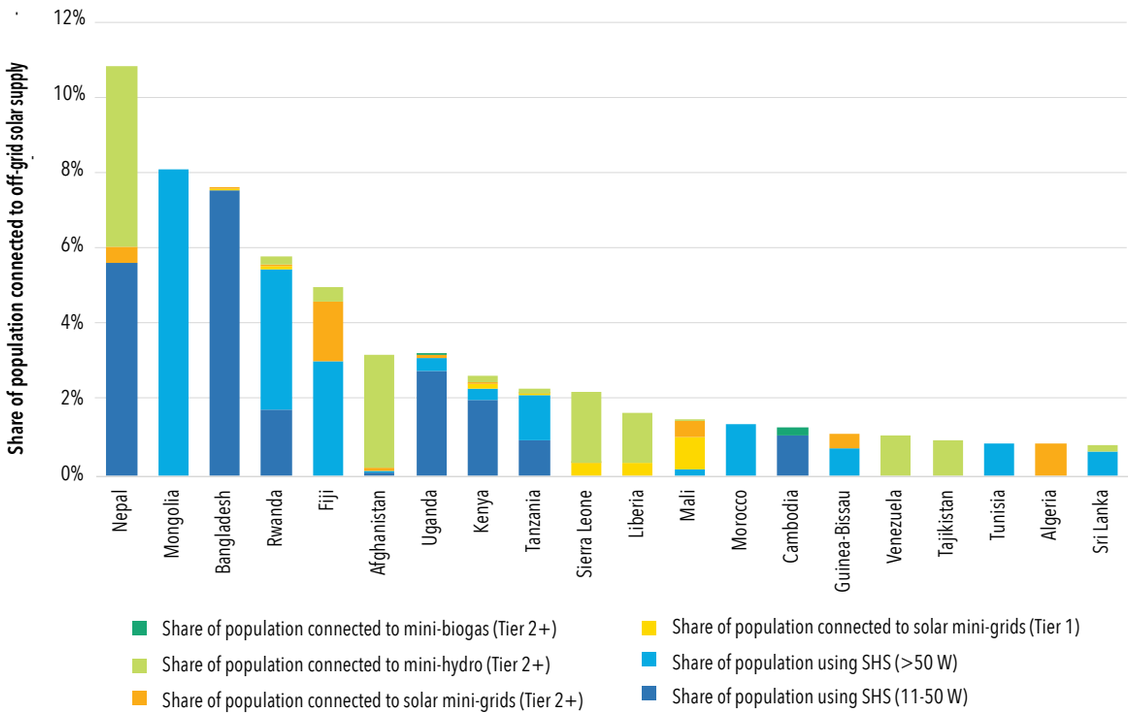
While significant strides are being made to improve data on off-grid electrification, the progress is difficult to track because it is often private sector-driven, and includes small, local, and even informal providers. It is therefore necessary to rely on a supply-side data in the IRENA or GOGLA's databases[15] as well as demand-side perspective available through the MTF (Box 1.2).

Globally, at least 34 million people had access to the equivalent of Tier 1+ electricity service either through SHSs or connection to mini grids based on solar, hydropower and biogas in 2017 (IRENA 2019).[16] This marks a threefold increase from 2010 – 2017 in the population connected to electricity from off-grid sources. Population with access to SHS providing Tier 1+ service has grown 3.5 times between 2010 – 2017, while population with access to PV mini grids grew 4.5 times between 2010 – 2017. In In 2017, a small set of access-deficit countries—Afghanistan, Bangladesh, Fiji, Mongolia, Nepal, Rwanda, and Uganda—provided 3-11% of their populations with access to electricity from off-grid sources (figure 1.11). Another 34 such countries (10 more than in 2016) supplied 0.25-3% of their population with access to Tier 1 supply from off-grid solar sources. 71% of Tier 1+ access came from SHSs of minimum 11 watts (W) and above and the rest from mini grids.

In addition to Tier 1+ supply, a sizeable population of about 120 million globally had access to basic electricity services provided by solar lights of under 11-watt capacity in 2017. In about 10 countries (Benin, Burkina Faso, Fiji, Jordan, Kenya, Papua New Guinea, Rwanda, Samoa, Tanzania, and Vanuatu) at least 9% of the population benefited from such lighting systems (figure 1.12).

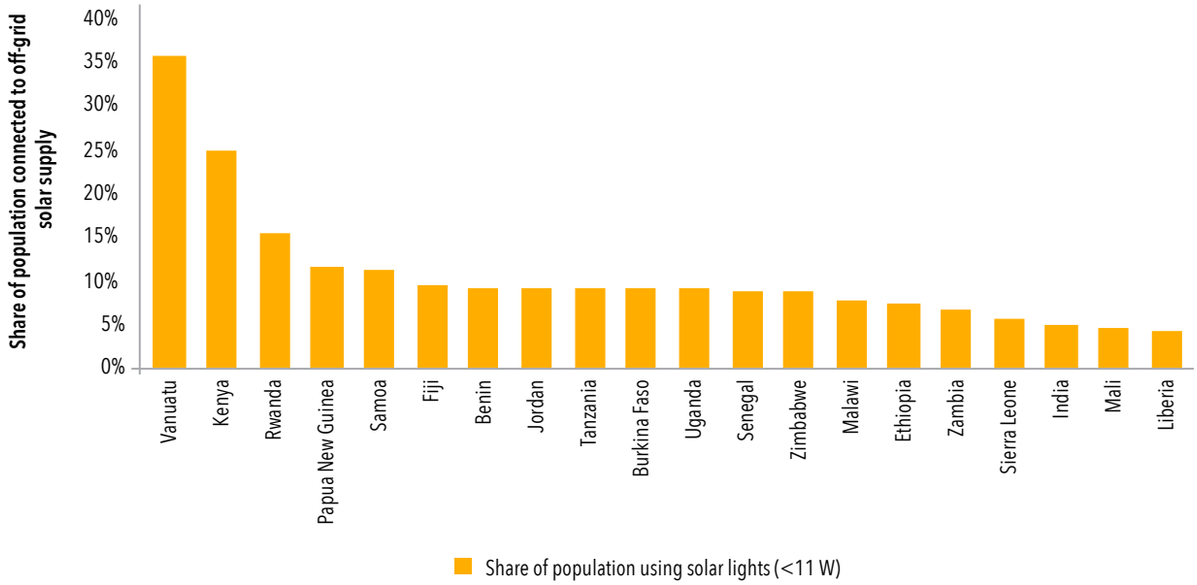
There is a slowdown in the uptake of Tier 1+ SHS in recent years because of the transition to grids and mini grids in countries such as Bangladesh, but there continues to be an uptick in in several countries including Kenya, Rwanda and Uganda. The share of the population getting access through min grids increased by 16 percentage points between 2015 and 2017. These trends indicate the increasing maturity of off-grid and mini grid markets and technologies, but there is still scope for countries to exploit the full potential of these electricity sources.

FIGURE 1.11 • TOP 20 COUNTRIES WITH HIGHEST RATES OF ELECTRICITY ACCESS TO OFF-GRID SOLAR SUPPLY (TIER 1 OR HIGHER), 2017



Source: IRENA.

FIGURE 1.12 • TOP 20 COUNTRIES WITH HIGHEST SHARE OF SOLAR LIGHTING SYSTEMS (BELOW TIER 1), 2017



Source: IRENA.

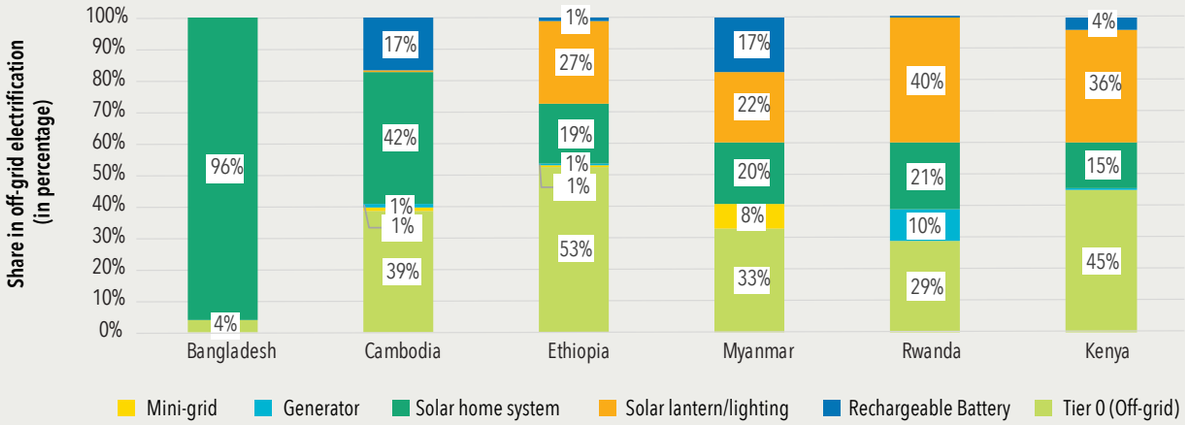
BOX 1.2 • OFF-GRID DEVELOPMENT: A DEEP DIVE THROUGH THE MULTI-TIER FRAMEWORK ENERGY SURVEYS

Off-grid electrification solutions that provide Tier 1+ access, including mini grids, generators, off-grid solar products, and rechargeable batteries, served 14% of the combined population of Bangladesh, Cambodia, Ethiopia, Kenya, Myanmar, and Rwanda in 2017.

The role of off-grid energy solutions is crucial in electrification, but the type of off-grid energy solutions varies between countries (figure B2.2.1). In Myanmar, mini grids have made strong inroads and been instrumental in bolstering electrification efforts in the country. In Rwanda or Ethiopia, the most prevalent off-grid energy solutions are solar lantern or solar lighting systems which provide basic lighting services along with mobile charging and radio. Even though currently only 3.6% and 11.3% of Rwandan and Ethiopian households, respectively, use Tier 1+ level of off-grid solar solutions, most of these households have obtained their off-grid solar products within the last 2-3 years. In Bangladesh, where there is high grid connectivity, off-grid penetration was relatively low at around 5% serving more than 9.7 million of households in remote rural communities.

Off-grid solar solutions constitute about 85% of all off-grid energy solutions: Solar home systems and solar lanterns/solar lighting systems account for about 50% and 35%, respectively. This is followed by rechargeable batteries (10%) and mini grids (2%).

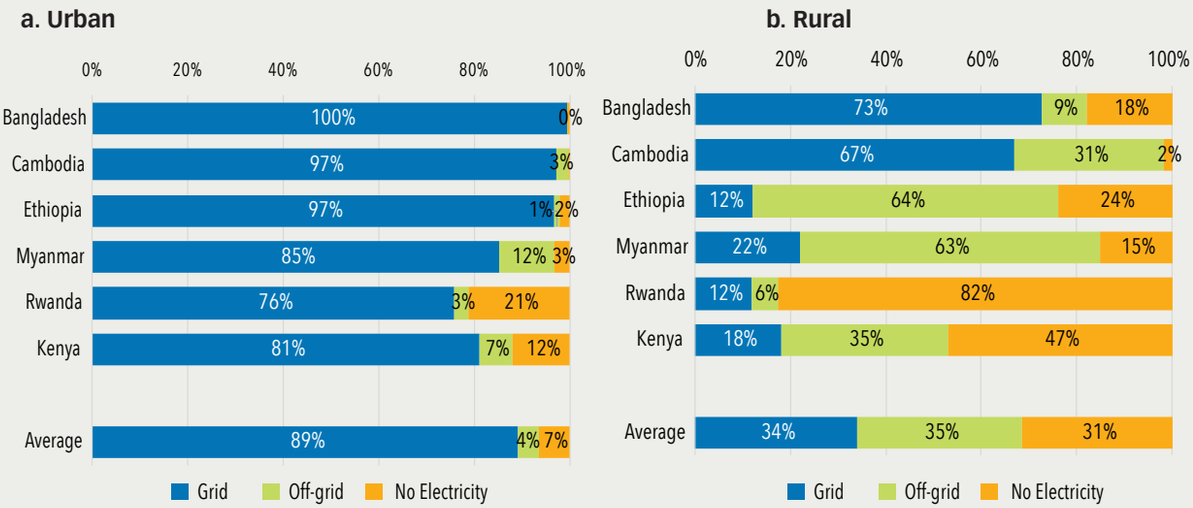
FIGURE B1.2.1 • OFF-GRID SOLUTIONS IN BANGLADESH, CAMBODIA, ETHIOPIA, MYANMAR, KENYA AND RWANDA, BY TECHNOLOGY, 2017



Source: MTF, World Bank

Off-grid energy solutions play a critical role in serving rural areas where the grid electrification rate is lower than urban areas. On average, 35% of rural population have access to electricity via off-grid energy solutions while 4% of population in urban areas use off-grid energy solutions as their primary electricity source (figure B2.2.2). MTF data also shows that poor households benefit more from off-grid energy solutions than rich households across all MTF countries. For example, in Myanmar, 61.1% of the bottom expenditure quintile, on average, have access to electricity via off-grid energy solutions compared to 34.5% of the top 20%.

FIGURE B1.2.2 • TYPE OF ELECTRICITY CONNECTIVITY IN BANGLADESH, CAMBODIA, ETHIOPIA, KENYA, MYANMAR, AND RWANDA, BY SHARE OF TOTAL AND ALONG THE RURAL/URBAN DIVIDE, 2017

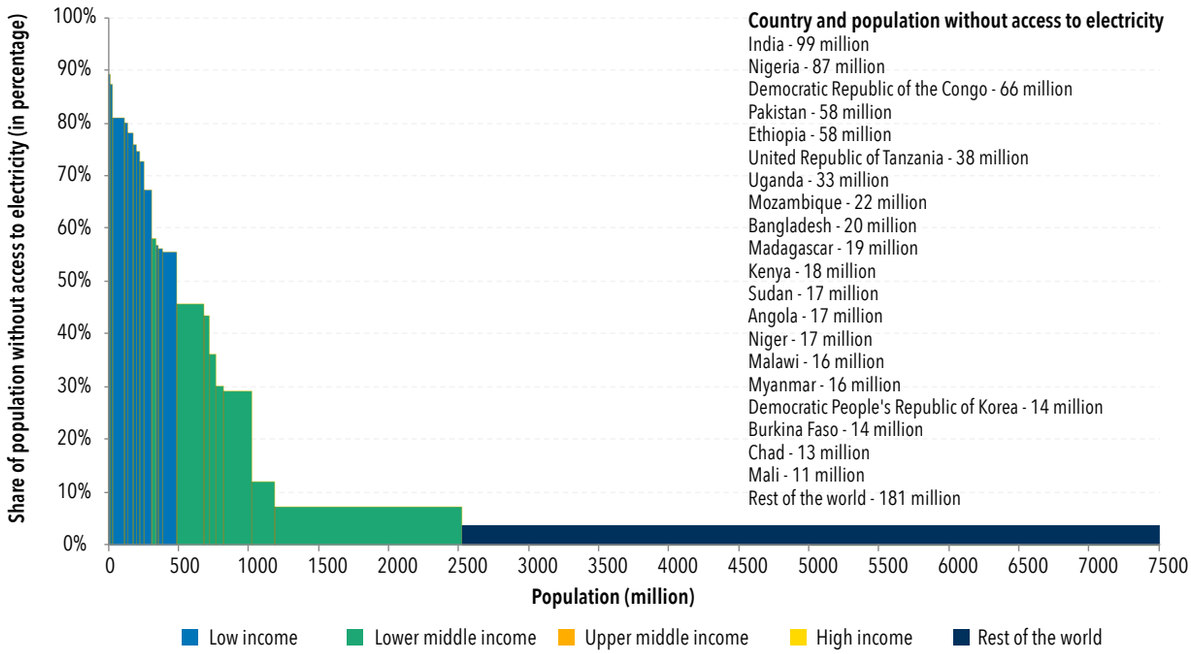


Source: MTF, World Bank

COUNTRY TRENDS

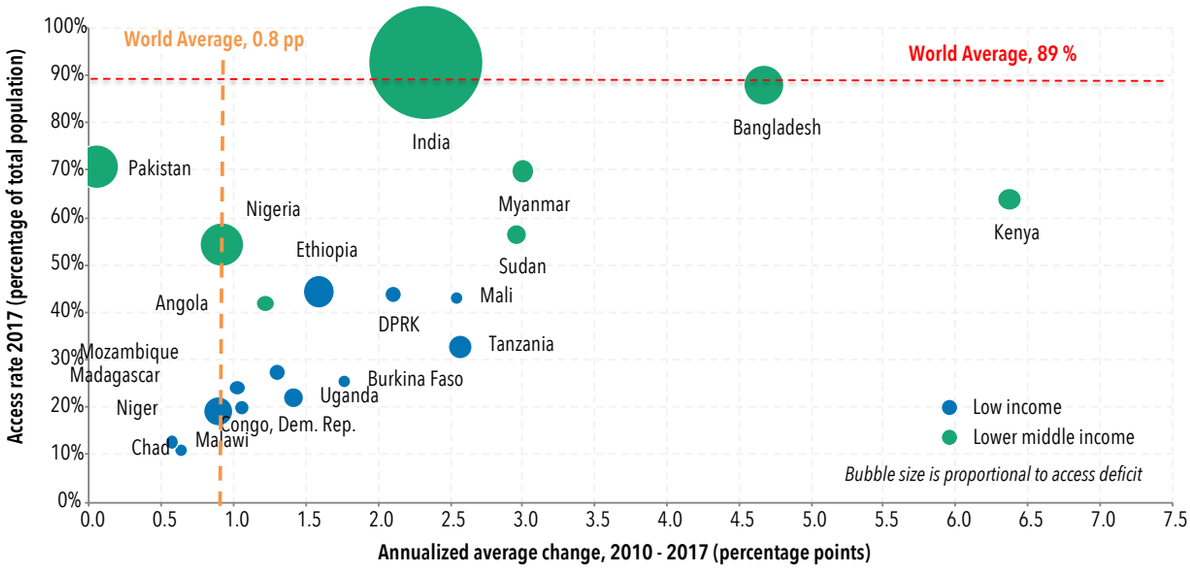
In 2017, about 78 percent of the world's population without electricity lived in the top 20 access-deficit countries (figure 1.13). Although India, with 12% of the global deficit, reached an access rate of 93%, surpassing the global electrification rate, 99 million of its population remained without access to electricity in 2017. With 16 out of the top 20 countries electrifying at over 1 percentage point each year since 2010, the largest access-deficit countries are also driving the global increase in electrification (figure 1.14)—and progress on SDG indicator 7.1.1. But, this growth had only a marginal effect on the net decline in the population without access. Global growth in access was in fact driven by countries like India and Bangladesh, where incremental access outpaced population growth by a significant margin. Yet, in a majority of the top 20 access-deficit countries, this incremental access between 2010 and 2017 did not keep pace with population growth. Moreover, some of the countries with unserved populations of over 50 million in 2017—like the Democratic Republic of Congo, Nigeria, and Pakistan—have electrified less than 1 percentage point of their population annually since 2010.

FIGURE 1.13 • SHARE OF POPULATION AND TOTAL POPULATION WITHOUT ACCESS, TOP 20 ACCESS-DEFICIT COUNTRIES AND REST OF THE WORLD, 2017



Source: World Bank.

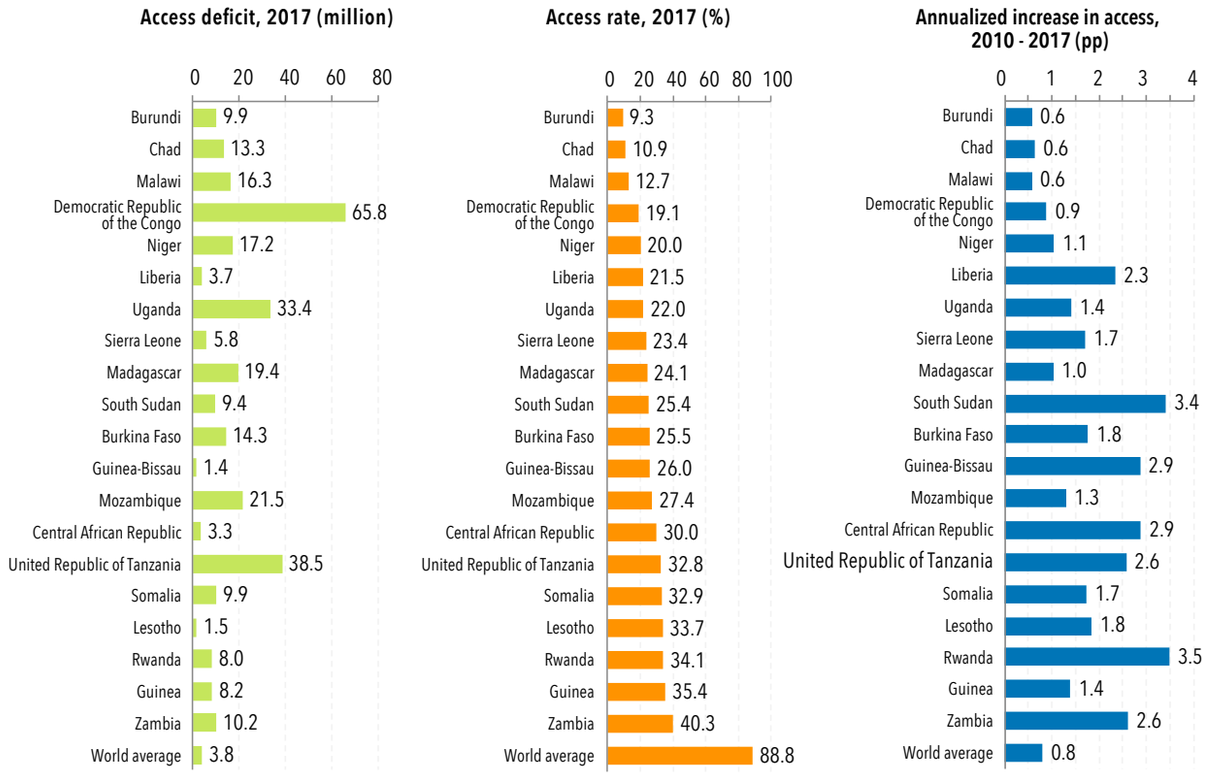
FIGURE 1.14 • CHANGES IN ELECTRICITY ACCESS RATES IN TOP 20 ACCESS-DEFICIT COUNTRIES, 2010-2017



Source: World Bank.

The 20 least-electrified countries are concentrated in the Sub-Saharan African region and were home to over 320 million people lacking access to electricity in 2017 (figure 1.15). Apart from Burundi, Malawi, Chad, and the Democratic Republic of Congo, these countries have been electrifying at a rate of over 1 percentage point annually since 2010. South Sudan and Rwanda, in particular, stand out for their annual rate of over 3 percentage points.

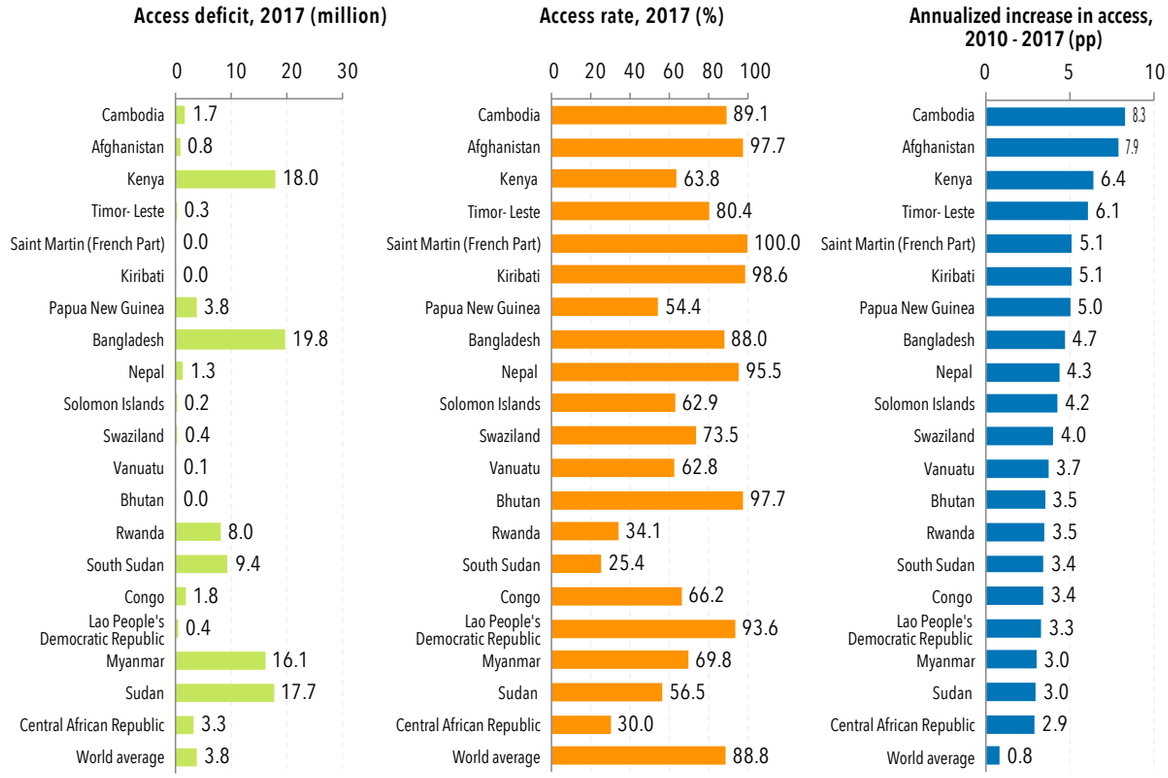
FIGURE 1.15 • ELECTRICITY ACCESS IN THE 20 LEAST-ELECTRIFIED COUNTRIES, 2010-2017



Source: World Bank.

Four countries have electrified at a rate of about 5 percentage points each year since 2010: Afghanistan, Bangladesh, Cambodia, and Kenya (figure 1.16). In Afghanistan's two-pronged approach, urban electrification was improved through grid expansion and rural electrification through the widespread use of SHS. In Cambodia, off-grid solutions constitute the fastest means for expanding access in rural areas. The diversity amongst the fastest-electrifying countries with low access rates, like Rwanda and South Sudan, as well as countries close to universal access, such as Lao People's Democratic Republic, Cambodia, and Afghanistan, shows that it is possible to maintain fast-paced electrification both at early and late stages of the electrification process if the right enabling environment is put in place.

FIGURE 1.16 • ELECTRICITY ACCESS IN THE 20 FASTEST-ELECTRIFYING COUNTRIES, 2010-2017



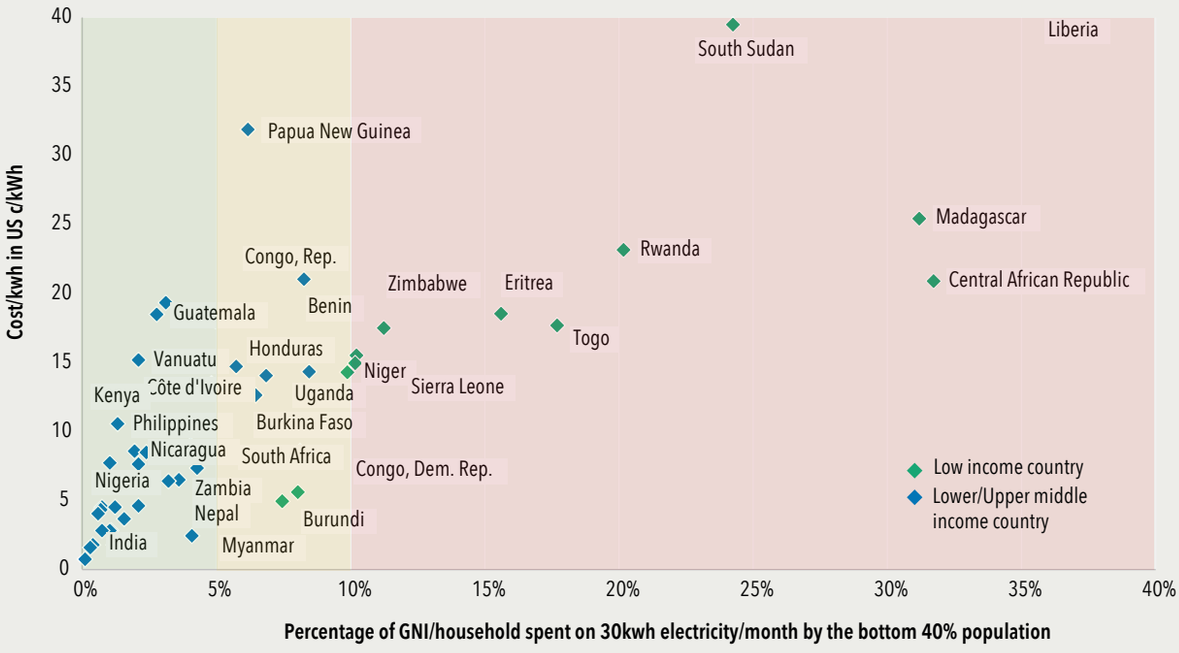
Source: World Bank.

BOX 1.3 • THE AFFORDABILITY AND RELIABILITY OF ELECTRICITY: TWO ELEMENTS CRITICAL TO MAKING PROGRESS ON SDG INDICATOR 7.1.1

Affordability: According to the Regulatory Indicators for Sustainable Energy (RISE) (ESMAP 2018d), in 26 access-deficit countries in 2017,17 the poorest 40% of households spent more than 5% of their monthly household expenditure on 30 kilowatt-hours (kWh) of electricity (figure B1.3.1). For 285 million people with access to electricity in these countries, basic subsistence levels of electricity consumption were unaffordable. Pertinently, a third of the access-deficit countries face relatively high electricity tariffs in excess of $0.15 per kWh, which amounts to monthly expenditures in excess of $4.50 for just 30 kWh of electricity. High costs are often associated with landlocked countries (Rwanda), island states (Madagascar, Papua New Guinea), or small fragile countries with poorly developed infrastructure (Liberia, Somalia).

Also, in 2017, in over half of these countries, getting an electricity connection cost more than one month's income for their poorest 40%, representing 400 million people (figure B1.3.2). In over one-third of these countries, the connection fee was greater than $100 (figure B1.3.3). To tackle the burden of electricity connection costs, over 30% of the access-deficit countries subsidize connection fees. In others, consumers may pay the connection fees in instalments, or utilities may recover connection costs through general tariffs.

FIGURE B1.3.1 • ELECTRICITY TARIFFS AS A SHARE OF GNI PER HOUSEHOLD AMONG THE POOREST 40% OF HOUSEHOLDS, BY COUNTRY, 2017



Source: RISE 2018, World Bank.

FIGURE B1.3.2 • ELECTRICITY TARIFFS AS A SHARE OF GNI PER HOUSEHOLD AMONG THE POOREST 40% OF HOUSEHOLDS IN 54 ACCESS-DEFICIT COUNTRIES, 2017

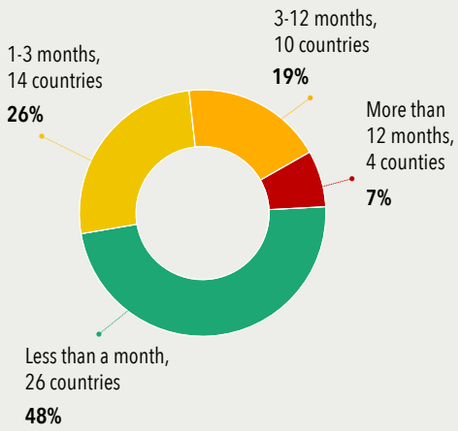
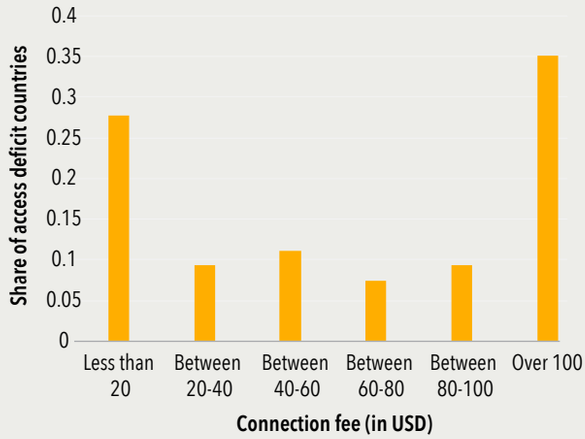


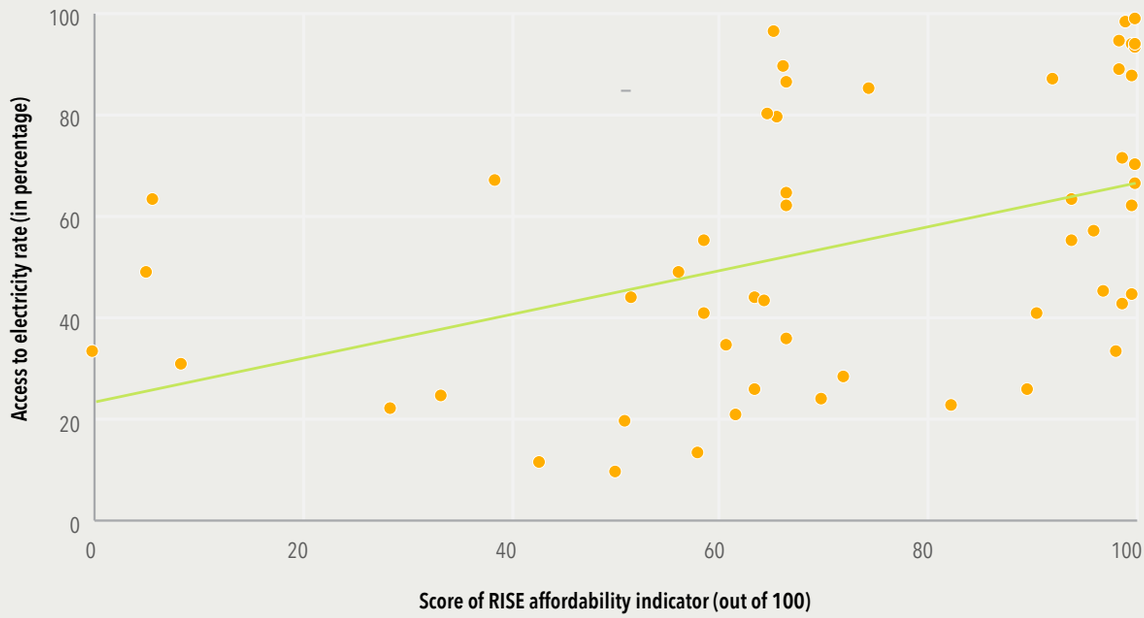
FIGURE B1.3.3 • ELECTRICITY CONNECTION FEES (US$) IN 54 ACCESS-DEFICIT COUNTRIES, 2017



Source: RISE 2018, World Bank.

There is a moderate correlation between electricity access rates and country-level policies that make electricity connection and supply affordable. This goes to show that the countries best placed to achieve progress on SDG indicator 7.1.1 are those that are simultaneously furthering affordability and progress toward universal access (figure B1.3.4).

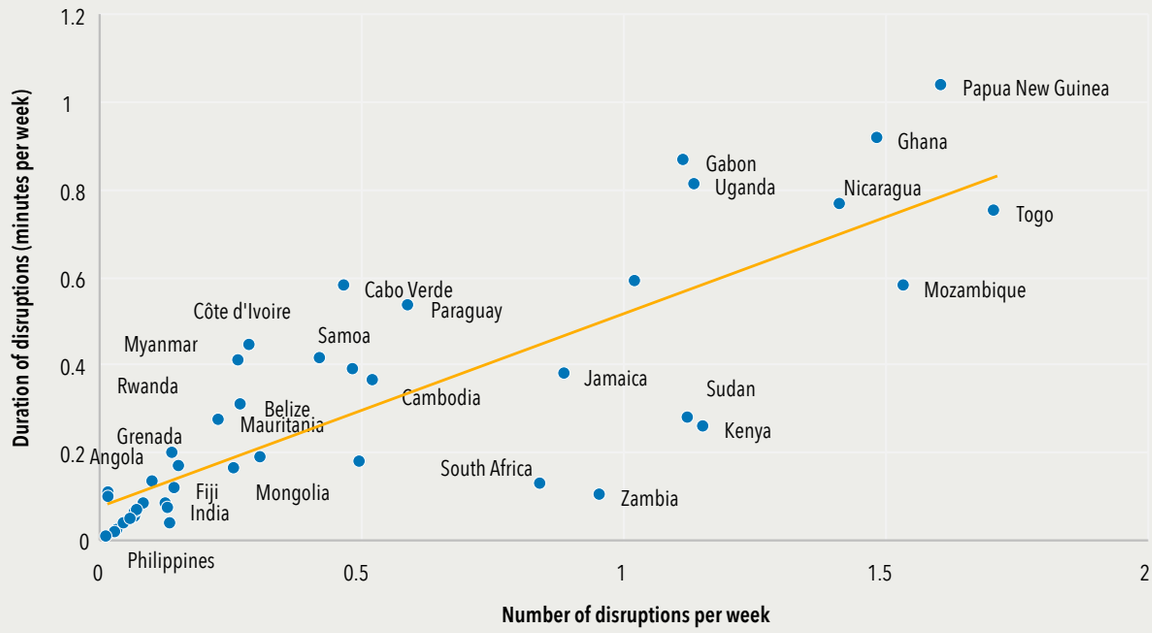
FIGURE B1.3.4 • CROSS PLOT OF 54 COUNTRY-LEVEL ELECTRICITY ACCESS RATES (%), AND SCORE ON RISE AFFORDABILITY INDICATOR (OUT OF 100), 2017



Source: RISE 2018, World Bank.

Reliability: Another important attribute of electricity access is the reliability of its supply as envisaged under SDG indicator 7.1.1. Captured by utilities through a combination of two indexes—the frequency of outages using the System Average Interruption Frequency Index (SAIFI) and the duration of outages using the System Average Interruption Duration Index (SAIDI)—the continuous and uninterrupted supply of the right quantity and quality of electricity is the cornerstone of reliable electricity access. One-third of the access-deficit countries18 face more than one weekly disruption in electricity supply that lasts over four minutes on average19 (figure B1.3.5). Six countries—namely Eritrea, Eswatini, Honduras, Maldives, Palau, and South Sudan have more than three disruptions or aggregate disruption of more than two hours per week.20 In a continuation of the trend seen since 2014, a strong correlation persists between SAIDI and SAIFI, indicating that where disruptions are frequent, they also tend to last longer.

FIGURE B1.3.5 • WEEKLY AVERAGE NUMBER OF AND DURATION OF DISRUPTIONS, 2017



Source: IFC 2018.

POLICY INSIGHTS

The surge in electrification in 2015-2017 is a promising development. But to achieve universal access, sustain the acceleration and leave no one behind, steady progress is needed across all access deficit countries. Electrification will become more difficult as the focus shifts to people who are the hardest to reach – including those living in the most remote areas, marginalized urban communities and the displaced. Examples of tapered progress in electrification as countries near the 100% mark can be found in Colombia, Indonesia, Peru, the Philippines, and Sri Lanka.

Nearly halfway to the SDG 7 target date of 2030, it is imperative to identify the success factors that have enabled progress since 2010 and to highlight the potential game changers.

REINFORCING DATA-DRIVEN DECISION MAKING

Access to more and better data has helped to inform policy and to target policy actions. Geospatial planning, meanwhile, has become an affordable way for policy makers and utility managers to design electrification roadmaps and identify least-cost options. Satellite imagery of night-time lights can precisely identify electrified settlements and track shifts in access. Such analyses are cost-effective complements to surveys performed on the ground. Improving the accuracy of demand estimates is also imperative, since they are indispensable for planning electrification efforts, power systems, and long-term investments.

Understanding end-user needs and perceptions enables policy makers to deploy their tools with greater accuracy. Supply and demand-side data complement each other and will help fill data gaps notably on off grid deployment. Equally important is the availability of sex-disaggregated data on electricity access which needs to be enhanced to allow for an accurate understanding of users' energy needs and priorities, including how male and female users experience electricity supply.

ADOPTING AN ADVANCED POLICY FRAMEWORK AND LEVERAGING PRIVATE FUNDING

A strong policy and regulatory framework are key to successful and sustainable efforts to expand access to electricity. Countries that have increased their access rates the most since 2010 also showed a noticeable improvement in access policies (ESMAP 2018d). National electrification planning is a primary step in building the policy apparatus for the expansion of electricity access. Creating an enabling environment for the three supply options of grids, mini grids, and stand-alone systems is critical, as are policies designed to ensure affordability. As countries improve their policies and regulations, it is also imperative to ensure that these are properly implemented, monitored, and enforced.

In the 20 countries with the greatest access deficit, financing commitments for residential uses of electricity amounted to over $8 billion in 2015-2016. About 60% of the financing came from the domestic and international private sector, doubling the private share from its 2013-2014 levels (SEforALL and CPI 2018). The investment needed to achieve universal access is estimated at $55 billion annually between 2018 and 2030 (IEA 2018). Increased private sector investment will require an enabling business environment characterized by regulatory certainty, investment safeguards, accessible and affordable financing, and, where needed, public sector funding (ESMAP 2017). Easily accessible incentives for both male and female entrepreneurs aimed at supporting their entry into the renewable energy market—including microfinancing, financing for small and medium enterprises, grants, concessional loans, tax benefits, and technology rebates—should be developed. Measures and incentives improving domestic banks' and financial institutions' risk perceptions and awareness regarding lending to women entrepreneurs could facilitate access to finance (ADB 2012).

EXPLOITING THE FULL POTENTIAL OF DISTRIBUTED RENEWABLE-BASED SOLUTIONS

The 2018 High-Level Political Forum called upon governments and other stakeholders to close the access gap by harnessing the potential of the decentralized renewable energy solutions that are transforming the power sector. The strength of off-grid solutions lies in their suitability for rapid deployment and for reaching last-mile customers unlikely to be served by the national grid in the foreseeable future. They also support varying demand and supply needs through a range of products available to end users. From solar lights to SHSs to large stand-alone solar systems to solar/hydro mini grids to biodigesters, off-grid solutions can meet various levels of electricity needs and help ensure households' transition to higher tiers of service.

RISE suggests that programs supporting mini grids and stand-alone systems have benefited from a stronger regulatory push since 2010 than grid electrification. Finance commitments for off-grid solutions, including mini grid technologies, nearly doubled between 2013-2014 and 2015-2016 to reach an average of $380 million per year. While this is a positive trend, these investments remain a small portion (1.3%) of the total finance tracked (SEforALL and CPI 2018). To make the deployment of off-grid solutions as effective as possible, adequate financing structures are needed to overcome the barriers of high up-front costs, regulatory uncertainty, competition from other technologies, and the lack of skilled operators and managers (ESMAP 2017).

STIMULATING DEMAND FOR PRODUCTIVE USES OF ELECTRICITY

Stimulating demand for electricity, especially for productive uses, could significantly enhance the financial sustainability of electrification projects while transforming communities. Therefore, it should be integral to electrification efforts (IEG 2015). Demand for electricity does not necessarily grow organically and instantly after the arrival of electricity. Obstacles to demand include limited access to markets, unreliable supply, poor access to information, inadequate access to capital and financing, and a lack of affordable appliances. Measures include end-user training and awareness raising, mechanisms to make energy efficient appliances available and affordable, appropriate financing, and advisory business services (ADB 2012). Targeting both male and female users is likely to yield the best results (ESMAP 2013).

TAILORING MULTIFACETED ELECTRIFICATION STRATEGIES TO LEAVE NO ONE BEHIND

To be effective, electrification efforts must be attuned to population growth, especially in cities, while addressing the creditworthiness of utilities. To be inclusive, they must close the gaping chasm between urban and rural electrification rates. At the same, it is important not to ignore the quality of electricity service and risk underutilizing the economic benefits of reliable electricity supply. Commitments to leave no one behind in the achievement of SDG 7 require that the energy needs of the forcibly displaced be specifically addressed. Over 85% of the world's 68.5 million forcibly displaced people are hosted by developing countries, and most of them lack access to legal, safe, reliable, and affordable electricity (UNHCR n.d.). To date, data on their rates of access to energy are limited to a few specific camps and sample studies, including the Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement (UNITAR 2019). One global study estimates that over 80% of those living in camps have minimal access, and that levels of access and incomes vary considerably across contexts (Lahn and Grafham 2015). Meanwhile 80% of internally displaced people and 60% of refugees find refuge in urban areas, where energy systems may already be under stress and under resourced (UNHCR n.d.). Much work needs to be done to identify actual needs and the most appropriate ways to put electricity within reach of these vulnerable populations under circumstances often complicated by political sensitivities and security issues.

METHODOLOGY

DATABASE

The World Bank's Global Electrification Database compiles nationally representative household survey data, and occasionally census data, from sources going back as far as 1990. The database also incorporates data from the Socio-Economic Database for Latin America and the Caribbean, the Middle East and North Africa Poverty Database, and the Europe and Central Asia Poverty Database, which are based on similar surveys (table 1.1). At the time of this analysis, the Global Electrification Database contained 1,006 surveys from 144 countries, excluding high-income countries (as classified by the United Nations) for 1990-2017.

TABLE 1.1 • OVERVIEW OF DATA SOURCES

Name	Statistical agency	Number of countries	Number of surveys	Question(s) on electrification standardized across countries
Censuses	National statistical agencies	65	125 (12%)	Is the household connected to an electricity supply? Does the household have electricity?
Demographic and Health Survey	Funded by the United States Agency for International Development (USAID); implemented by ICF International	87	275 (27%)	Does your household have electricity?
Living Standards Measurement Survey	National statistical agencies supported by the World Bank	19	26 (3%)	
Income expenditure survey, or other national surveys	National statistical agencies, supported by the World Bank	96	446 (44%)	Is the house connected to an electricity supply? What is your primary source of lighting?
Multi Indicator Cluster Survey	United Nations Children's Fund (UNICEF)	64	103 (10%)	Does your household have electricity?
World Health Survey	World Health Organization	8	8 (<1%)	
Multi-Tier Framework	World Bank	8	8 (< 1%)	
Other		12	15 (1.5%)	

Source: World Bank.

ESTIMATING MISSING VALUES

The typical frequency of surveys is every two to three years, but in some countries and regions, surveys can be irregular in timing and much less frequent. To estimate missing values, a multilevel nonparametric modeling approach—developed by the World Health Organization for estimating clean fuel use—was adapted to electricity access and used to fill in the missing data points for 1990-2017. Where data are available, access estimates are weighted by population. Multilevel nonparametric modeling takes into account the hierarchical structure of data (country and regional levels). Regional groupings are based on the UN breakdown.

The model is applied for all countries with at least one data point. In order to use as much real data as possible, results based on real survey data are reported in their original form for all years available. The statistical model is used to fill in data only for years where they are missing and to conduct global and regional analyses. In the absence of survey data for a given year, information from regional trends was borrowed, assuming access scale-up is likely to be similar. The difference between real data points and estimated values is clearly identified in the database.

Countries considered "developed" by the United Nations and classified as high income are assumed to have an electrification rate of 100% from the first year the country entered the category.

In the current report, to avoid electrification trends from 1990 to 2010 overshadowing electrification efforts since 2010, the model was run twice:

- With survey data + assumptions from 1990 to 2017 for model estimates from 1990 to 2010
- With survey data + assumptions from 2010 to 2017 for model estimates from 2010 to 2017

MEASURING ACCESS TO ELECTRICITY THROUGH OFF-GRID SOURCES

The 2017 International Renewable Energy Agency's off-grid database covers only developing countries (excluding China). The database sources data from large databases, including GOGLA, country, and regional databases, along with significant data from off-grid plants.

The tier-wise data is presented by technologies as:

- Tier 0: Lights (<11W);
- Tier 1: Small SHS (11-50W); large SHS (>50W); PV mini grid access Tier 1;
- Tier 2+: PV mini grid access and non-PV mini grids.

Detailed methodology is available at Measurement and estimation of off-grid solar, hydro and biogas energy.

CALCULATING THE ANNUAL CHANGE IN ACCESS

The annual change in access is calculated as the difference between the access rate in year 2 and the rate in year 1, divided by the number of years in order to annualize the value:

(Access Rate Year 2 – Access Rate Year 1) / (Year 2 – Year 1)

This approach takes population growth into account by working with the final national access rates.

WORLD BANK-IEA ELECTRIFICATION DATA METHODOLOGY COMPARISON

The World Bank and IEA each maintain a database of global electricity access rates. The World Bank Global Electrification Database derives estimates from a suite of standardized household surveys that are conducted in most countries every two to three years, along with a multilevel nonparametric model used to extrapolate data for the missing years. The IEA Energy Access Database sources data, where possible, from government-reported values for household electrification (usually based on utility connections).

The two different approaches can lead to estimates that differ for some countries. Access levels based on household surveys are moderately higher than those based on energy sector data (as is typical) because they capture a wider range of phenomena including off-grid access, informality, and self-supply.

A comparison of the two datasets that was initiated in the last edition of this report and updated in this edition highlights their different strengths. Household surveys, typically conducted by a national statistical agency, offer two distinct advantages when it comes to measuring electrification. First, because of longstanding international efforts to harmonize questionnaire design, electrification questions are most often standard across country surveys. Although not all surveys reveal detailed information on the forms of electricity access, as the market evolves survey questionnaire designs can and are being updated to better reflect important emerging phenomena such as

off-grid solar access. Second, data from surveys convey a user-centric perspective on electrification. Using survey data captures all the electricity access forms, painting a more complete picture of access than may be possible from service provider data.

Administrative data on electrification reported by the ministry of energy in each country convey the electrification status from the perspective of supply-side data on utility connections. Although not published by every government, these kinds of data offer two principal advantages. First, administrative data are often available on an annual basis and, for this reason, may be more up to date than surveys, which are typically updated only every two to three years, necessitating model estimates in intervening years. Second, administrative data are not subject to the challenges that can arise when implementing surveys in the field as some household surveys may suffer from sampling errors, particularly in remote rural areas, which could lead to an underestimation of the access deficit.

Data from the two methodologies yielded different results for 2017 for both access rates and the population without access at the global and country levels, with over 70 percent of the difference in results emanating from just 20 countries.

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ENDNOTES

3 IEA, 2018 - See chapter 5.

4 Regional results based on UN regional classification.

5 South Asia has an access rate of 90% and Central Asia has an access rate of 99%.

6 Access deficit countries in RISE refer to countries with over 1 million population with electricity access or an access rate of less than 90%.

7 Countries with an access deficit of over 5 million people or an access rate of less than 90%.

8 The World Bank's "Getting Electricity" data on the System Average Interruption Frequency Index (SAIFI) and duration of outages using the System Average Interruption Duration Index (SAIDI) (World Bank 2019). The database has reliability data on 43 out of 96 access-deficit countries.

9 The use of the term "access to electricity" refers to electricity being the source of lighting in a household, or to service at Tier 1 and above.

10 The World Bank's Global Electrification Database, the source of the electrification data needed to track SDG 7.1.1, uses a demand-side approach based on standardized household surveys and, as needed, fills data gaps with model estimates using a suite of alternative surveys (for more details, refer to the methodology section at the end of this chapter). The International Energy Agency's (IEA's) electrification database offers a supply-side perspective based on utility-level data (IEA 2018).

11 See chapter 5 of this report.

12 The International Energy Agency's New Policies Scenarios projects that 580 million people without access to electricity will live in Sub-Saharan Africa, 50 million in Developing Asia, and 20 million in other regions. See chapter 5 of this report for details.

13 The Dominican Republic, Ecuador, Palau, Panama, Saint Vincent and the Grenadines, and Tuvalu achieved universal access between 2015 and 2017.

14 Including India.

15 GOGLA Global Off Grid Solar Database (sourced through the Lighting Global / GOGLA Sales Data Collection).

16 Data on the number of people with access to these forms of electricity supply are gathered by IRENA (2019) based on sales of solar panels, project reports, and other publicly available sources.

17 With an access deficit of over 5 million or an access rate of less than 90%.

18 The World Bank's Getting Electricity Database contains SAIDI and SAIFI data for 47 access-deficit countries.

19 Data pertain to electricity supply to commercial enterprises (IFC 2018).

20 The World Bank's Multi-Tier Framework for Energy Access describes Tier 5 access as a maximum of three disruptions per week with an aggregate disruption duration of less than two hours per week.