ACCELERATING SDG 7 ACHIEVEMENT

POLICY BRIEF 01

ACHIEVING UNIVERSAL ACCESS TO ELECTRICITY

7 AFFORDABLE AND CLEAN ENERGY

ACCELERATING SDG 7 ACHIEVEMENT

POLICY BRIEFS IN SUPPORT OF THE FIRST SDG 7 REVIEW AT THE UN HIGH-LEVEL POLITICAL FORUM 2018

Lead Organizations

Facilitated by

UNITED NATIONS
DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS

With the financial support from
Governments of Norway, Netherlands, and China through the UN sub-trust fund for the 2030 Agenda for Sustainable Development
as well as the European Commission, ENERGIA and HIVOS

POLICY BRIEF #1

ACHIEVING UNIVERSAL ACCESS TO ELECTRICITY

Developed by

International Energy Agency (IEA), United Nations Development Programme (UNDP) and International Renewable Energy Agency (IRENA)

In collaboration with

The European Commission, UNESCWA, UNECE, UNECA, UNESCAP, EnDev, PBL Netherlands Environmental Assessment Agency, World Bank and Norad

KEY MESSAGES

Status of electricity access and progress towards achieving SDG 7.1

- The number of people without access to electricity fell to around 1 billion in 2016 from 1.7 billion in 2000. The number of people gaining access to electricity each year is accelerating, thanks to strong successes in some countries, including Bangladesh, Ethiopia, India, Kenya and Tanzania. Grid electrification has been the source of almost all energy access gained since 2000 and is likely to remain the most favourable option for many households, especially in more densely populated areas.
- To deliver universal energy access by 2030, decentralized options are the least-cost option for 60 per cent of people currently lacking access. Public programmes and private-business models providing electricity access with off-grid solar are thriving, and many countries are also exploiting their renewable potential in the centralized electricity mix.
- However, having a source of electricity is not a guarantee of full access. To serve the needs of households, schools, health centres and local enterprises, electricity needs to be available at the right time, at an affordable price and with a reliable supply and appliances.
- Current progress towards delivering universal access is promising in many parts of Asia and some countries in sub-Saharan Africa, but not in all. Based on recent trends and policies, the number of people without electricity access is expected to remain over 670 million in 2030, with over 80 per cent of those lacking access concentrated in rural areas of sub-Saharan Africa.

Priority actions

- Guarantee leadership, commitment and strategic planning Elevate universal access to electricity to a high level on the political agenda, backing up commitments with strategic planning, clear policies and regulatory frameworks, and dedicated institutions.
- Identify a strong champion institution for electrification programs, with a clear mandate, the authority and resources to fulfil the mandate, and accountability for achieving that mandate.
- Enable private sector participation To achieve the estimated US$ 52 billion per year in investment necessary to deliver universal access, private investment is needed to complement public spending. De-risking tools, affordable financing and a clear enabling policy framework are needed to attract the private sector.
- Household electrification strategies should take into account other development goals and opportunities to use energy access to stimulate sustainable economic activity.
- Support technology development and standards Decentralized systems are benefiting from innovative control and payment solutions, such as smart metering, customer data management and communications, and mobile payments Electrification planning needs to take into account the dynamic and integrated nature of energy demand and storage, and ensure technical standards and energy efficiency in end-use appliances.
- Address affordability, which remains a critical barrier, by lowering upfront costs in providing targeted financing and subsidies, harnessing new business models such as the pay-as-you-go model, integrating energy efficient appliances with electricity access solutions, and creating sound policies and institutions.

Electricity access and the Sustainable Development Goals

Energy has long been recognized as essential for humanity to develop and thrive, but the adoption of new United Nations Sustainable Development Goals (SDGs) in 2015 marked a new level of political recognition of the importance of energy to development. The SDGs include, for the first time, a target to ensure access to affordable, reliable, sustainable and modern energy for all. Electricity access is crucial to the achievement of many of the other SDGs. Providing connections to households, however, is not enough to ensure economic and social development. Electricity needs to be available reliably and affordably not only for households to access meaningful services but also for income-generating activities and public services. Improvements and cost declines in decentralized technologies offer new opportunities for delivering universal electricity access, but many challenges remain, particularly for providing electricity access affordably for remote and poor households.

Current status of electricity access

Efforts to promote electricity access are having a positive impact in all regions, and the pace of progress has accelerated. The number of people without access to electricity fell to around 1 billion in 2016[1] (IEA, 2017; IEA, IRENA, UN Statistics, World Bank and WHO, 2018). Nearly 1.2 billion people have gained access since 2000, but population growth in areas with low access rates has offset some gains (see figure 1.1). Where access to electricity is incomplete, it is characterized by a considerable urban-rural divide.

Most progress has been made in developing Asia, where around 900 million people have gained access since 2000. India accounts for 500 million—one of the largest electrification success stories in history—while universal electrification was announced in China in 2015. Today about nine-in-ten people in the region has access and the absolute number of people without access has halved in the last 10 years despite population growth. Based on current policies and trends, the region is on track to achieving universal access in the early 2030s.

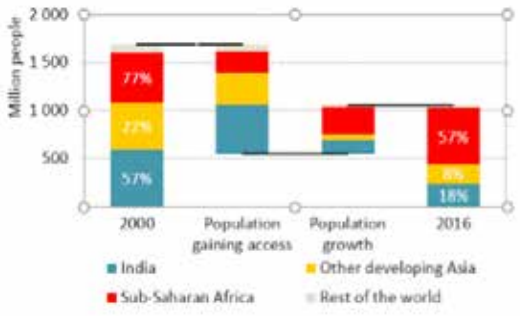
In the past few years, when a peak in the number of people without access was registered in sub-Saharan Africa, there is for the first time a positive trend. Progress has been led by Cote d'Ivoire, Ethiopia, Ghana, Kenya and Tanzania. The vast majority of the 590 million people who remain without access live in rural areas, where the average electrification rate is less than 25 per cent. Despite positive developments, population growth and uneven progress means that on the basis of current efforts, some 600 million will remain without access in 2030 (IEA, 2017).

1 The IEA Energy Access Database, which reports government values for access where available, calculates 1.06 billion people without access in 2016 (IEA, 2017). The World Bank, which relies on survey and modelled estimates, calculates 0.94 billion people without access in 2016 (IEA, 2017; IEA, IRENA, UN Statistics, World Bank and WHO, 2018). Both organizations are working towards assessing differences, a process which is described in chapter 1 of the 2018 Tracking SDG 7 Report.

Around 95 per cent of the global population without electricity access is in Asia and sub-Saharan Africa. While other world regions have reached near-universal access, there are several exceptions, including Yemen and Haiti, where less than half the population has access.

Figure 1.1

Change in population without access to electricity between 2000 and 2015



Note: Percentages within the graph indicate the share of population without electricity access. IEA (2017)

Even in countries where access is universal, unplanned service disruptions and power outages can be common; there is no guarantee that supply is affordable, and many rural off- and mini-grid systems can supply only a few hours of electricity services per day. Consequently, even for many of those who have gained access, the absolute level of electricity consumption, and access to electricity services is low. There is no universally accepted minimum threshold for what constitutes electricity access, particularly in establishing policy targets[2].

Electrification solutions

Grid electrification has been the source of electricity access for an estimated 97 per cent of people who have gained a connection since 2000 (IEA, 2017) and from a system perspective offers the lowest-cost path to household electrification for areas with sufficient density of electricity demand. Given the economies of scale associated with centralized power generation, grid extension and connection will likely remain the most favourable electrification option for many households, particularly those in more densely populated areas. IEA geospatial analysis (IEA, 2017) suggests that to deliver

2 In the IEA's scenarios, a household initially gains access to enough electricity sufficient to power a basic level of energy services, growing over time so that by 2030, the average household has electricity to power four light bulbs operating at five hours per day, one refrigerator, a fan operating 6 hours per day, a mobile phone charger and a television operating 4 hours per day. The Multi-Tier Framework (MTF), developed by ESMAP, is a complex metric of energy access going beyond whether a household has an electricity connection or not. MTF incorporates energy service attributes such as "Capacity", "Reliability", "Quality", "Legality", "Safety" and "Affordability to determine five tiers (from Tier 0 as the lowest to Tier 5 as the highest rating) (IEA and World Bank, 2017).

universal access by 2030, grid extension is the lowest-cost option for around 40 per cent of households that do not currently have access. The importance of centralized generation from renewables is projected to grow, to around half of generation for electricity access to 2030, an increase from the 30 per cent share seen since 2000; coal's role is expected to decline. One barrier, however, is the significant financial weakness of utilities in many cases (Kojima and Trimble, 2016). In such cases, attending to the financial health of the domestic power sector, focusing on "commercially oriented" operations, is of great importance.

Grid extension is less favourable than decentralized options[3] under conditions of complex terrain, low population density, regulatory and institutional hurdles, or high investment and maintenance costs that may not be recoverable by utilities. The IEA estimates that to deliver universal electricity access by 2030, decentralized solutions are the least-cost option for 60 per cent of people lacking access, with the role of grid expansion expected to increase with increasing power demand, urbanization and economic activity. Currently, decentralized access solutions are small but accelerating: the IEA estimates that 33 million people have access to electricity with decentralized renewables (excluding pico solar, which IRENA estimate benefit 114 million users), with the rate of connection accelerating (***IEA 2017).*** IRENA estimates that globally, off-grid renewable electricity capacity for residential and commercial purposes is around 4,030 MW (IRENA, 2017c). Decentralized electricity systems can also have co-benefits for local job creation and economic growth. The dynamics of electrification solutions are not static: in Western economies the network emerged from local systems (both private and municipal) and later interconnected; the same may become true for areas currently gaining access as power demand grows.

Several converging trends are making decentralized options more and more competitive, with the potential to transform the energy access landscape in rural areas. These trends include the declining cost of renewables and storage (historically, most decentralized capacity has been oil-based); the increasing availability and affordability of efficient appliances and lighting; the emergence of new technologies enabling smart metering and mobile payments; the liberalization of energy markets enabling more actors, including the private sector, to participate; and an increased focus from international initiatives, microfinancing institutions and crowd-funding platforms.

Affordable financing models have also been instrumental, two in particular. The pay-as-you-go (PAYG) model has emerged in recent years with considerable momentum. Consumers use their phones to pay a fixed upfront cost for a device—usually a solar panel bundled with battery storage and appliances—and then pay for its use in instalments. Critically, the daily payments can be less than a household pays for poor-quality energy alternatives, such as kerosene for lighting. This model is well-established in East Africa, where mobile money is widely used, and has expanded to more than 30 countries, serving an estimated 700,000 households (REN21, 2017). The PAYG model is scalable with private sector capital; however, so far PAYG businesses have been almost exclusively reliant on international investors, exposing businesses to the foreign exchange risk, which can lead to price increases for consumers.

In Bangladesh, a successful micro-credit model has been in operation for more than a decade. There, the Infrastructure Development Company (IDCOL) channels international funding to microcredit groups and installers, sets technical specifications and loan terms, and certifies products and components for quality-control purposes. While affordability has been key, household loan terms have moved from concessional towards commercial. A cumulative 4.1 million solar home systems have been installed (IDCOL, 2017) and more than 100,000 jobs have been generated. Replicable lessons include adaptation of equipment to local needs, enforcement of product standards and workforce training. A designated "national champion" like IDCOL can be tasked with establishing an overall policy framework within which financing, product certification and other activities unfold.

The sustainability of new energy access models requires that portions of the supply chain and the attendant benefits are localized (developing relevant competencies among domestic enterprises), and that domestic financial institutions develop the needed understanding and capacity to offer lending for off-grid solar and other products.

The role of mini-grids, currently limited, is expected to increase, especially when access initiatives aim to provide electricity for productive and commercial activities as well as households. For sustainable mini-grid development and operation, an enabling environment is needed that covers dedicated policies and regulations, tailored financing mechanisms, enabling institutional frameworks, a focus on capacity-building, and adapted technology. Within such an en abling environment, suitable policies and regulations for mini-grids include a clear rural-electrification strategy, a tailored licensing and permitting framework, a mechanism to address compensation/integration of mini-grids when the main grid arrives, clear rules for setting tariffs which incentivize investment and enable sustainable operation, and measures to facilitate access to finance for both developers and end-users (IEA, 2017; IRENA, 2016).

Anchoring mini-grid development to productive sectors, such as telecom towers or agriculture (irrigation/processing) can provide important, stable long-term revenue to the supplier and increase

[3] "Decentralized" electricity access here encompasses off-grid (stand-alone) systems powering individual households, and mini-grids powering a network of clustered homes and/or businesses.

the financial viability of the mini-grid (as well as having benefits to the local economy and rural development). It is therefore important to promote productive uses sooner rather than later.

Investment to deliver universal electricity access

Providing electricity for all by 2030 would require an estimated annual investment of US$ 52 billion per year in power generation and infrastructure, equal to 3.4 per cent of average annual global energy sector investment over this timeframe. In the IEA Energy for All scenario, renewables make up around 90 per cent of investment in new capacity. However, the IEA projects that less than half of this needed investment will be made under current trends and policies, and that over 95 per cent of the investment gap will affect countries in sub-Saharan Africa (of the 670 million people projected to be without access in 2030, 600 million are expected to live in sub-Saharan Africa) unless more investment is mobilized. Bundling very efficient appliances with off-grid renewable systems can reduce the overall cost by around one-third (IEA, 2017).

Interlinkages with other SDGs

Energy (including electricity) is not useful in itself: it is only useful to the extent that it provides desired services and drives actions. Therefore, while it is important to measure energy access directly, the true impact is on enabling the success of other SDGs. Modern energy access is an important factor for the achievement of virtually all development goals, but for some SDGs it is essential.

No poverty (SDG 1); Gender equality (SDG 5); Decent work and economic growth (SDG 8); Industry, innovation, & infrastructure (SDG 9): People deprived of modern energy are trapped in a reinforcing cycle with insufficient means to improve their living conditions and basic services, including lighting, education, health and fresh water to meet basic human needs. At the same time, poor households without energy access spend a significant share of their very limited income on expensive, unhealthy, unsafe, time-consuming and inefficient forms of energy. Modern, affordable energy is essential for breaking this cycle. Moreover, electricity access can improve livelihoods. This is especially the case for women, for whom the chance to work from home can create an independent source of income. The deployment of decentralized energy can create employment in the electricity value chain itself, in assembling, distributing, installing and maintaining equipment, and more broadly support rural economies by removing the barrier a lack of electricity poses to productive activities. Electricity is essential for economic sectors—agriculture, tourism, commerce, industry—to thrive and create income-generating opportunities, increase value added, and therefore revenues, in rural areas. In addition, telecommunications improve access to markets and information.

Zero hunger (SDG 2); clean water and sanitation (SDG 6): Today energy inputs are limited throughout the agri-food chain in developing and least-developed countries, hindering efficient food production and threatening food security. Modern energy offers many benefits. Electricity for irrigation pumps can double the yield of croplands, and refrigeration reduces spoilage. Energy for processing can vastly improve the efficiency of food production, increase the value of the products and generate economic and employment gains, which in rural areas would potentially reduce the pressure towards urban migration. Moreover, installing and operating water extraction, transport and treatment systems requires a considerable amount of energy; expanding these services to poorer populations is dependent on a reliable source of electricity.

Good health and well-being (SDG 3): At present, an estimated 4 million people die prematurely each year due to the use of polluting fuels and technologies in households for cooking, heating and lighting, without adequate ventilation. Women and children suffer most of the worst effects. Providing access to modern energy (including modern cooking facilities) for all can lower the premature death toll by around 1.8 million people per year in 2030 (IEA, 2017). Thermal comfort (heating and cooling) and refrigeration are also key to good health and nutrition. Moreover, health care facilities require reliable electricity to function and power medical devices, and good lighting is needed to provide essential services. Refrigerators used in health clinics with unreliable electricity cause significant failure of vaccines. Yet, an estimated 1 billion people globally are served by health facilities without electricity, including 255 million people in sub-Saharan Africa (Practical Action, 2013). Energy access rates drop dramatically for rural clinics, and those that do have access often have an unreliable supply (WHO and World Bank, 2014); this contributes to the immense health care challenges developing countries face.

Quality education (SDG 4): Ensuring electricity access can reinforce education goals. Well-lit, well-heated and well-cooled schools and households are essential for creating learning spaces for children and adults. Information and communication technologies, on which modern education is based, also require energy input. Conversely, quality education is an enabling factor in achieving SDG 7, given that knowledge and skills influence the feasibility of implementing access solutions from technical, financial and political perspectives.

Climate action (SDG 13): Although electricity generation contributes a large share of global CO_2 emissions, delivering universal household electricity access does not pose any threat to achievement of the Paris Agreement. With the growing importance of renewables for electricity access and the relatively low levels of electricity consumption by households in developing countries, delivering universal access would increase global CO_2 emissions in 2030 by around 0.2 per cent (70 million tons of CO_2) relative to the baseline (IEA, 2017). At the same time, reliable electricity

access can improve the resilience of households and communities to a changing climate.

It is also important to note that there are interlinkages between the three SDG 7 targets themselves. For example, cost reductions in renewables, storage, and energy efficiency as a result of wider global deployment will facilitate rural electrification.

Policy recommendations

Guarantee leadership, commitment and strategic planning: To make progress in this area, it is essential that governments elevate universal access to electricity to a high position on the political agenda, backing up commitments with strategic planning, clear policies and dedicated institutions. Policy uncertainty and a lack of transparency can create the perception of excessive risk, discouraging investment and halting progress. Governments should map a clear energy development scenario, charting the expansion of the grid and the integration of decentralized solutions into rural electrification strategies, and planning for people moving up the energy ladder. Electrification strategies should also ensure a sustainable and affordable supply, and plan for providing electricity to productive sectors. To maximize socioeconomic benefits, it is important to identify priority areas, such as the electrification of health centres, schools and productive sectors.

Ensure dedicated institutions and enabling policy and regulatory frameworks: Virtually all successful public electrification programs have featured a specific leading institution. A dedicated public-sector "champion" can provide a strong framework for all actors that addresses not only technical and market development issues, but also other critical dimensions such as quality control, training, and adaptation of solutions to local needs. There are a host of stakeholders with important roles to play; it is essential to make these institutions strong, with a clear mandate, the authority and resources to fulfil the mandate, and accountability for achieving that mandate.

Enable private sector participation: The power sector is often represented by government-linked institutions, and most investment is driven by public grant/concessional funding and non-commercial equity in developing countries. To achieve the scale-up needed to deliver electricity for all by 2030 (estimated by the IEA to be US$ 52 billion per year), private investment needs to complement public investment. Policies, regulations and incentive structures can facilitate market development and ensure affordable financing for all electrification solutions. De-risking tools, such as clear targets, streamlined permitting processes, public loans, loan guarantees and risk insurance, can help attract both downstream (end-user) and upstream (enterprise) capital into the off-grid sector. This also necessitates an adequate enabling policy framework, and facilitation of access to commercial debt and equity (see Policy Brief on Finance for SDG 7).

Integrate electrification of productive uses in access strategies: No country has gone from poverty to prosperity without making electricity affordable and available in bulk for productive uses. Household electrification strategies should take into account other development goals, and opportunities to use electricity access to stimulate inclusive, climate resilient and sustainable economic activity. Electrifying communities with grids or mini-grids can allow economies of scale by leveraging power demand from productive sectors where houses, businesses and public services are physically close to one another. Mini-grids are more likely to be economical in more densely populated but remote areas. There is also an important development opportunity in using the provision of energy access to create local jobs, contingent on fostering local skills and competencies. Local entrepreneurs can play a fundamental role in extending electricity access with decentralized solutions. The Addis Ababa Action Agenda commits leaders to providing both public and private investment in energy infrastructure and clean energy technologies with the aim of delivering universal access.

Support technology development and standards: Innovative systems for control and demand-side management are gaining importance in the off-grid sector. Off-grid systems have proven to be effective at providing access to areas that are too expensive to electrify via the grid in the short or medium term. Moving beyond a basic level of electricity consumption is likely to make the case for mini-grid development or grid extension. Mini-grids themselves can be integrated into large networks, if they use compatible equipment. This underlines the need to recognize the dynamic and integrated nature of energy access development and for co-ordinated planning which takes account of ways to upgrade existing systems and integrate decentralized systems into the grid if it arrives. Similarly, grid standards should vary depending on the connected load. There is also a role for governments in putting in place standards and labelling, ensuring quality assurance, and in controlling imports of less efficient and reliable goods. Low-quality goods and poor information can increase a household's costs, erode consumer confidence and spoil new markets.

Energy storage: Many stand-alone renewable solutions typically only offer four hours of limited service (light bulbs, mobile charging, small TV in the evening). To offer higher levels of services, greater generation requires more storage capacity, representing significant additional costs, particularly in a solar PV-battery system. End users can move up the tiers of electrification over time, as their ability to pay increases. At current prices, this makes the systems that include storage uncompetitive in most cases. However, a clear cost reduction trajectory, based on technology learning curve dynamics, is emerging for various storage technologies, and that is likely to continue making these solutions more affordable.

Harness the potential of energy efficiency: This has the potential to improve not only the economics of energy access, but also the reliability and performance of a system. Efficient appliances such as LEDs, low-power TVs, and various types of machinery enable access to energy services at lower levels of power consumption. However, developing countries are often the recipients of second-hand, inefficient appliances, which while more affordable to buy, and in an off-grid system limit the level of energy services a consumer can attain. Pairing off-grid systems with super-efficient appliances can substantially reduce the lifetime cost of a new connection; however, financing is needed to overcome the additional upfront cost burden. Many policies and programmes to improve energy access should broaden to focus on demand technologies and regulate the import of less efficient goods.

Address affordability: This remains a particularly critical barrier to scaling up these solutions. Even though people without electricity access often pay a lot for conventional energy sources, such as kerosene and candles, the upfront costs for off-grid systems may still be higher than most consumers are willing or able to pay. The IDCOL approach and the PAYG business models, which bundle services and appliances, offer scope for overcoming the upfront cost barriers by spreading out payments. In addition to consumer affordability, policies need to ensure that utilities can recover costs and operate sustainably. Governments can help lower the cost of electricity access to consumers and utilities by creating sound policies and institutions, discussed above, by subsidizing decentralized connections to ensure affordability and equity between rural and urban households. Targeted subsidies and financing could be aimed at lowering connection fees, or the upfront costs of equipment and appliances. Also, communities need to have an active voice in the design and implementation of energy access policies.

REFERENCES

IDCOL (Infrastructure Development Company Ltd.) (2017), "IDCOL SHS Installation under RE Program," Available online at http://www.idcol.org/old/bd-map/bangladesh_map/.

IEA (International Energy Agency) (2017), Energy Access Outlook: World Energy Outlook Special Report, OECD/IEA, Paris.

IEA, IRENA, UN Statistics, World Bank and WHO (2018, forthcoming), "Tracking SDG 7: Progress Towards Sustainable Energy. A Joint Report of the Custodian Agencies".

IFC (International Finance Corporation) (2018), "Off-grid solar market report 2018", Dalberg Advisors and Lighting Global, Washington D.C.

IRENA (International Renewable Energy Agency) (2018, forthcoming), Measurement and estimation of off-grid solar, hydro and biogas energy, Abu Dhabi.

IRENA (2017a), Rethinking Energy: Accelerating the Energy Transition, Abu Dhabi.

IRENA (2017b), Accelerating Off-grid Renewable Energy: Key Findings and Recommendations from IOREC 2016, Abu Dhabi.

IRENA (2017c), Renewable Energy Statistics, Abu Dhabi.

IRENA (2017d), Renewable Energy and Jobs. Annual Review 2017, Abu Dhabi.

IRENA (2016), Policies and regulations for private sector renewable energy mini-grids, Abu Dhabi.

Kojima, M and Trimble, C (2016), "Making Power Affordable for Africa and Viable for Its Utilities". World Bank, Washington, D.C. https://openknowledge.worldbank.org/handle/10986/25091.

Practical Action 2013 (2013), Poor People's Energy Outlook, Bourton on Dunsmore, UK.

REN21 (Renewable Energy Policy Network for the 21st Century) (2017), Renewables Global Status Report, REN21 Secretariat, Paris.

WHO (World Health Organization) and World Bank (2014), Access to Modern Energy Services for Health Facilities in Resource-Constrained Setting. A Review of Status, Significance, Challenges and Measurement.

World Bank/ESMAP (2015), "Beyond Connections, Energy Access Redefined".

World Bank (2016), "Making Power Affordable for Africa and Viable for its Utilities".

Published by the United Nations

For further information, please contact:
Division for Sustainable Development Goals
Department of Economic and Social Affairs
United Nations
https://sustainabledevelopment.un.org/contact/
Email: salame1@un.org

HIGH-LEVEL POLITICAL FORUM
ON SUSTAINABLE DEVELOPMENT