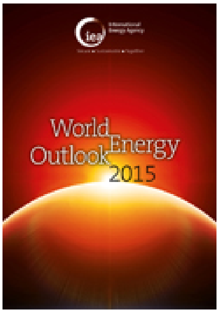


World Energy Outlook 2015
Chapter 2 Extract: Energy Access

Access to modern energy[21]

The need to improve access to modern energy has moved into the mainstream of international policy-making in 2015. The G7 has committed to "accelerate access to renewable energy in Africa and developing countries in other regions with a view to reducing energy poverty", while the G20 has launched the first phase of its Energy Access Action Plan. As long-advocated by the IEA, the newly agreed post-2015 Sustainable Development Goals of the United Nations include a goal on energy, namely to "ensure access to affordable, reliable, sustainable and modern energy for all". In parallel, the UN Secretary-General's Sustainable Energy for All (SE4All) initiative continued to work to galvanise and enhance global efforts to increase energy access and the 2015 edition of the SE4All *Global Tracking Framework* – co-led by the IEA and the World Bank – has been published (IEA and World Bank, 2015). This reports progress against the three SE4All goals.

Access to electricity – current status

The latest data demonstrates efforts to improve electricity access, but progress is patchy rather than broad-based. An estimated 1.2 billion people – 17% of the global population – did not have access to electricity in 2013, 84 million fewer than in the previous year. Many more suffer from supply that is of poor quality (Box 2.3). More than 95% of those living

21. Estimates are based on 2013 data (when available) or on the latest available data. Data by country can be accessed at *www.worldenergyoutlook.org/resources/energydevelopment*.

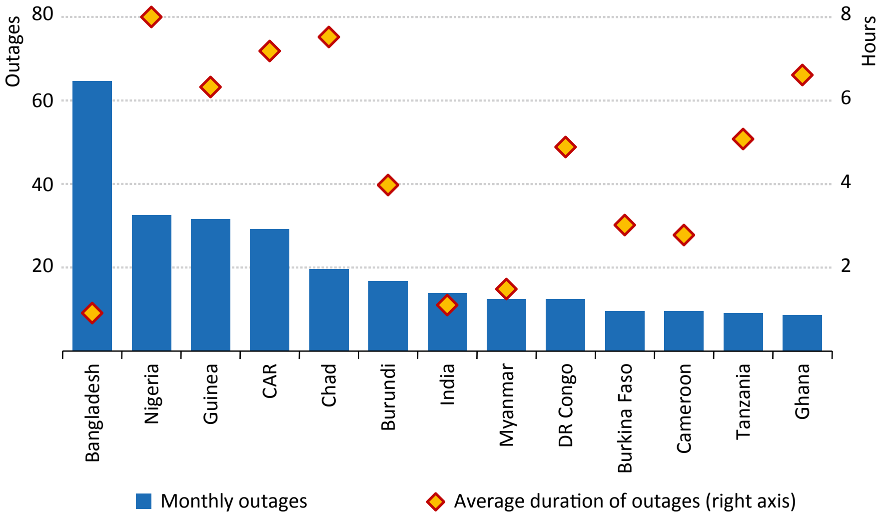
without electricity are in countries in sub-Saharan Africa and developing Asia, and they are predominantly in rural areas (around 80% of the world total). While still far from complete, progress in providing electrification in urban areas has outpaced that in rural areas two to one since 2000. As predicted last year in the IEA's *Africa Energy Outlook*, sub-Saharan Africa has now become the most electricity poor region in the world in terms of the total number of people (surpassing Asia), as well as the share of its overall population (IEA, 2014c). But the pace at which the picture in Africa has been deteriorating has slowed, and rapid population growth can conceal the efforts and results that are taking place.

Around one billion people have gained access to electricity in developing Asia since 2000. After accounting for population growth, this means that the number of people without electricity has halved to around 525 million people. The latest estimate reflects a trajectory that continues to improve, showing the share of the regional population now without access below 15% for the first time. Of any country in the world, India continues to have the largest population without electricity (accounting for one-fifth of the world total); but the latest survey data show a major advance, led by rural areas (see Part B for more on the energy access outlook for India). Indonesia has also made a substantial step forward, with electricity access levels reaching 80% for the first time (it is targeting 90% by 2020), reflecting the effectiveness of government actions. Several countries in developing Asia can boast universal or near-universal access to electricity, including China, Malaysia, Thailand, Singapore and Brunei Darussalam, while others have continued to make significant progress over the years, such as Viet Nam, Lao PDR, Pakistan and Bangladesh.

Box 2.3 ▷ With great power comes great opportunity

Even for those with relatively high and improving rates of electricity access, quality of supply continues to be an issue that holds back consumers and the economy from realising the full benefits of electricity access. Business surveys point to around thirty electrical outages per month in Nigeria and the Central African Republic, and more than sixty per month in Bangladesh (Figure 2.23), with each outage varying in length from minutes to hours (World Bank, 2015a). The fact that these outages are often unexpected, of unpredictable duration and at times of greatest inconvenience (during waking hours and at times of peak electricity demand), only serves to magnify their negative impact. Our special report, *Africa Energy Outlook,* found that for every additional $1 of power sector investment in sub-Saharan Africa, incremental GDP could be boosted by around $15 (IEA, 2014c). The underlying reasons for outages include insufficient generation capacity, fuel shortages, excess strain on the system and shutdowns for repairs and maintenance. Whatever the reason, the result is essentially the same: an economy that is unable to operate at its full potential.

Figure 2.23 ▷ Number and duration of monthly electrical outages by selected countries



Note: CAR = Central African Republic; DR Congo = Democratic Republic of Congo.

Sources: World Bank Group Enterprise Surveys; IEA analysis.

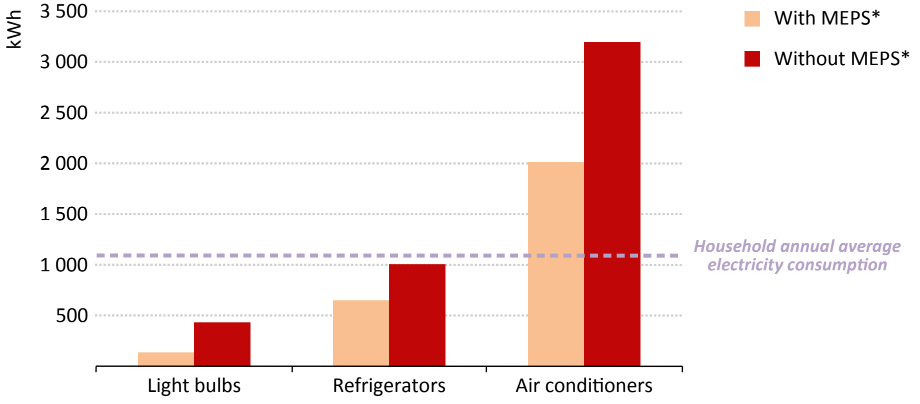
In sub-Saharan Africa, around 150 million people are estimated to have gained electricity access since 2000, but this has lagged population growth, resulting in a worsening picture overall – the latest estimates reveal that over two-thirds of the sub-Saharan population (634 million people) are without access to electricity. Half of these people are located in just five countries – Nigeria, Ethiopia, Democratic Republic of Congo, Tanzania and Kenya. However, the lowest electrification rates are often found in other countries, such as South Sudan, Malawi, Burundi and Sierra Leone (all below 10%). In the latest data, notable improvements have been observed in Guinea, Liberia, Mauritania and Congo, while Ghana stands out as an example where energy efficiency policies are playing a positive role (Box 2.4). South Africa's Integrated National Electrification Programme has electrified over six million households over the last two decades, but the pace of progress has slowed at an electrification level of around 85% (South African Department of Energy, 2015). While most countries in the Middle East have attained universal electricity access, those in the midst of conflict have (unsurprisingly) seen the situation worsen, due to damage to supply infrastructure or fuel shortages. In Latin America, the electrification rate has improved considerably since 2000 and now stands around 95%, with notable progress in countries such as Brazil, Columbia, Peru and Bolivia. While the overall level of access to electricity in Latin America is high, there are still some countries that have relatively low rates, such as Honduras, Guatemala and Haiti.

Box 2.4 ▷ Energy efficiency and electricity access – the case of Ghana

Electricity consumption is projected to more than treble in sub-Saharan Africa by 2040. Bringing electricity access to a fast-growing population, while also maintaining the quality of supply, is an immense challenge. It is one that energy efficiency policies can help to ease. Energy efficiency measures can help to reduce peak-load consumption and thereby make it possible to increase access at lower cost, in terms of investment in supply. In Ghana, electricity consumption is growing at 6-7% per year and, with seven million people yet to get access, Ghana's energy efficiency programme is an important element in the plan to expand supply and meet future demand growth. It stands as a positive example to other countries in the region.

Ghana developed the first standards and labelling programme in sub-Saharan Africa in 2000 to solve a situation of repeated rolling blackouts. Minimum energy performance standards (MEPS) were implemented for air conditioners, compact fluorescent lamps (CFLs) and refrigerators. These have resulted both in considerable energy savings (Figure 2.24) and an estimated saving of $840 million in new power capacity investments (CLASP, 2015). The promotion of efficient lighting has proven to be particularly successful, with the free distribution of 6 million CFLs to replace incandescent light bulbs (all installed within three months). The penetration of CFLs increased from 20% in 2007 to 79% in 2009, while the penetration of incandescent lamps fell to just 3% (Ghana Energy Commission, 2013). In 2011, the government took another step by removing import duty and value-added tax on light-emitting diode (LED) lamps, so as to support their adoption.

Figure 2.24 ▷ Household average electricity consumption of selected equipment in Ghana with and without energy efficiency standards, 2013



*MEPS = minimum energy performance standards.

Access to clean cooking – current status

In 2013, more than 2.7 billion people – 38% of the world's population – are estimated to have relied on the traditional use of solid biomass for cooking, typically using inefficient stoves in poorly ventilated spaces. This is an increase of around 40 million since 2012.[22] Developing Asia and sub-Saharan Africa once again dominate the global totals. While the number of people relying on biomass is larger in developing Asia than in sub-Saharan Africa, their share of the population is lower: 50% in developing Asia, compared with 80% in sub-Saharan Africa. Overall, nearly three-quarters of the global population living without clean cooking facilities (around 2 billion people) live in just ten countries. This deteriorating global picture dispels any notion that the transition to cleaner cooking fuels and appliances is straightforward. Economic development and income growth do not automatically lead to the adoption of clean cooking facilities, meaning that specific government policies have an important role to play. Despite this, clean cooking features much lower on government priorities than promoting access to electricity.

A population similar to that of the European Union and the United States combined lives without clean cooking facilities in India (840 million people), by far the largest national population of any country in the world. Around one-third of China's population have no clean cooking facilities, illustrating the disconnect that can exist between rising incomes, improving electricity access and clean cooking. Viet Nam is another example. Indeed, it is a common story across much of developing Asia, with the number of people without clean cooking facilities tending to track population growth more closely than incomes. Against this general trend, Indonesia continues to make major efforts to promote clean and safe cooking, following the success of its kerosene to LPG conversion programme.

In sub-Saharan Africa, the overall picture is deteriorating, with the number of people without clean cooking facilities now above 750 million. Positive progress has been achieved in Ghana through its programme to promote the uptake of LPG; and, Equatorial Guinea, among the richest countries in Africa in per-capita terms, is another – one of few – to register an improvement in the latest data. Nigeria, where households rely heavily on solid biomass for cooking despite the country's abundant fossil-fuel resources, has set a national goal of helping 20 million households to switch to clean cooking facilities by 2020. Countries in Latin America see a generally improving picture, although the pace varies and the regional total without clean cooking facilities remains above 60 million. The latest data reveals notable improvements in Brazil, Columbia, Peru and Argentina.

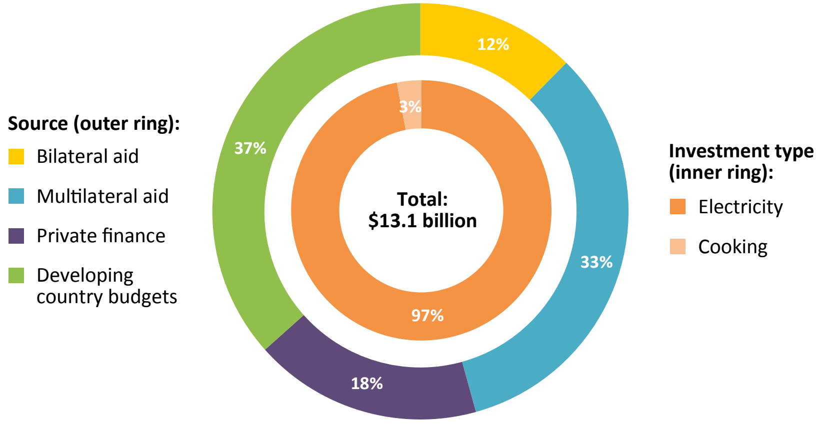
Financing energy access

Worldwide in 2013, an estimated $13.1 billion in capital investment was directed to improving access to electricity and clean cooking facilities (Figure 2.25). Overwhelmingly, these energy access investments went to the power sector, either to increase generation

22. This text focuses on the traditional use of biomass for cooking, but there are also 200-300 million people who rely on coal for cooking and heating purposes, which can potentially have serious health implications when used in primitive stoves.

capacity or to extend transmission and distribution networks, with only 3% being directed at increased access to clean cooking facilities. This figure of $13.1 billion is an increase, relative to previous *WEO* estimates ($9.1 billion in 2009), but the estimate is tentative – it may well be an under-estimate (IEA, 2011).[23]

Figure 2.25 ▷ World energy access investment by type and source, 2013



This capital comes to the energy sector from a variety of sources: self-financing by the energy investor; by an allocation from the state budget; or external financing, via bank lending and the capital markets, but the information available is poor, particularly on private sector investments, south-south investment flows (which can, as in the case of China, be significant) and the financing of mini- and micro-scale projects. Our tentative estimate is that the proportionate reliance on different sources is as follows: developing countries' own budgets, 37%; multilateral organisations, 33%; private investors, 18%; and, bilateral aid 12%. While governments remain a critically important source of financing for energy access, many have also opened up their energy sectors in full or in part to private investors in recent years. The need for capital and expertise has made public-private partnerships (PPPs) an important area of focus. The African Energy Leaders Group, launched in January 2015, is working towards universal energy access through PPPs and commercially viable regional power pools, and SE4All is working with countries to develop energy investment prospectuses, often including PPPs.

Development assistance (through bilateral or multilateral channels) continues to be an essential source for many energy access investments, typically in the form of loans at

23. The estimate includes capital investment made to provide households with electricity access and clean cooking access. For on-grid electricity access, it includes the costs of the first connection, grid extension and the capital cost to sustain an increased supply over time. For mini-grid and off-grid systems, the estimate includes capital costs and the cost of distribution lines. Operating costs, such as fuel costs and maintenance costs, are not included. Broader technical assistance, such as policy and institutional development advice, is also not included. Further information regarding the methodology used in this analysis can be found at *www.worldenergyoutlook.org/resources/energydevelopment*.

concessional rates or loans to projects deemed too risky by the commercial banking sector. The African Development Bank has contributed to financing around 2 GW of new generation capacity and over 15 000 km of transmission lines since 2009 (African Development Bank, 2015), while the OPEC Fund for International Development has turned a $1 billion pledge to alleviate energy poverty, made in 2012, into a revolving fund. The European Union has committed €3.5 billion ($3.9 billion) with the intention that it should leverage €30 billion ($33 billion) in power sector investments; and the US Power Africa initiative has achieved financial closure on 4 GW worth of projects, involving $9 billion of commitments from government and aid sources, and $20 billion from the private sector (USAID, 2015). The Global Alliance for Clean Cookstoves (a PPP) remains a key source of funding for clean cooking facilities, drawing on grants and investments from governments, corporations, civil society and others to support its goal of providing clean cooking facilities to 100 million households by 2020.

Increasing investment to the levels required to achieve universal access to modern energy cannot be achieved without the private sector as a key contributor. To enable this to happen, governments need to take steps to establish a supportive investment climate, implementing strong governance and regulatory reforms, improving the creditworthiness of the power sector and identifying and working with large anchor customers. This is particularly important in those regions where the private sector is least involved today; levels are reported to be particularly low in Africa (just 1%) (World Bank, 2015b).

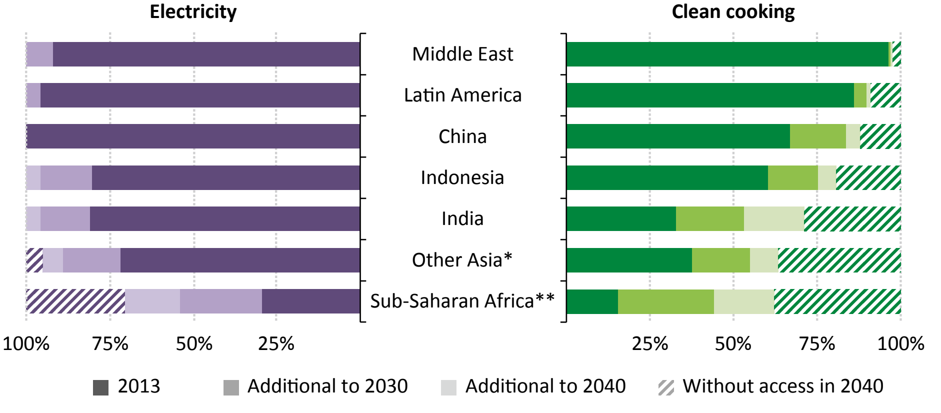
Outlook for energy access in the New Policies Scenario

In the New Policies Scenario, the number of people without access to electricity declines to around 810 million in 2030 and 550 million in 2040 (6% of the global population at that time). The population growth that occurs in parallel masks the fact that around 1.8 billion people gain access through to 2030, and that this increases to 2.7 billion by 2040. Global progress continues to take place at a dual speed. Nearly one billion people in sub-Saharan Africa gain access to electricity through to 2040, and yet half a billion remain without it at that time, while in developing Asia, the number of people without electricity falls by around two-thirds by 2030 (185 million) and stands at 50 million in 2040, just 1% of the Asian population at that time (Figure 2.26). Electricity access investments increase over time, and average $30 billion per year over the *Outlook* period. The additional global electricity demand in 2040 resulting from new access is around 640 TWh reflecting the low levels of per-capita consumption of many of those gaining access.

Sub-Saharan Africa starts to turn the corner around the mid-2020s, with the number of people without access to electricity beginning to decline. Over time, the remaining population without access becomes more concentrated in rural areas (around 90% of the total in 2040). Renewables (led by hydro) and natural gas are projected collectively to provide more than three-quarters of the additional on-grid electricity supply in 2040 for those who have gained access. Renewables alone account for two-thirds of the mini- and off-grid supply in 2040 having become increasingly competitive against diesel generation.

The scale of hydropower projects (though the date of their entry into service is particularly uncertain) means that they can have a huge impact on electricity access when they do come online if suitable arrangements have been made to deliver the additional power generation to households. Sub-Saharan Africa currently has a number of such projects underway – such as the Grand Ethiopian Renaissance Dam, Gilgel Gibe III and IV, Inga III and the Mambilla dam – and has huge remaining hydropower potential. However, large hydro projects alone will not solve energy poverty in rural areas: small-scale solutions, such as solar PV, mini-hydro and small biogas, are also needed.

Figure 2.26 ▷ Share of the population with access to electricity and clean cooking facilities by region in the New Policies Scenario



* Includes rest of developing Asia. ** Excludes South Africa.

In the New Policies Scenario, around 260 million people gain access to electricity in the countries of Southeast Asia, led by Indonesia, where universal access is attained by 2040. Full electrification is achieved in urban areas of Southeast Asia by 2030 and the region reaches almost universal access by 2040. India's high level of economic growth and large (and growing) population are strong influences on the pace of energy access. In the New Policies Scenario, India's national electrification rate reaches more than 95% by 2030 and universal access is achieved by 2040 (see Part B for more on the energy access projections for India). China is already reported to be very close to attaining universal access. In Latin America, Brazil has achieved good progress through its Light for All programme, which aims to achieve universal electricity access by 2018. Universal electricity access is reached in Latin America by the mid-2020s. In the Middle East, most countries have already reached electrification levels above 98%, but Syria and Yemen are lagging behind, with war and conflicts even reversing earlier progress.

The number of people in the world without access to clean cooking decreases by one-third to 1.8 billion in 2040 in the New Policies Scenario. Developing Asia still hosts the biggest population in this category at the end of the projection period, with half a billion people relying on the traditional use of biomass in India alone. In China, although universal access to electricity is achieved early in the projection period, the picture on access to clean cooking facilities looks very different, with around 10% of the population still lacking access in 2040. In sub-Saharan Africa, the switch to cleaner solutions is expected to happen in parallel with rapid urbanisation. The price of charcoal, which is widely used in urban areas of Africa today, is also expected to increase with higher demand and forest depletion, and more efficient cooking solutions then provide fuel (and monetary) savings to users, as well as better energy quality.

Globally, an average annual investment of $980 million is made in clean cooking technologies through to 2040. The largest portion is in LPG stoves in urban areas. LPG is also adopted in rural areas, but improved biomass cookstoves also represent an attractive solution for poor households, as capital and fuel costs are typically lower.

Part A: Global Energy Trends

Chapter 2: Global energy trends to 2040

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