TRACKING SDG 7

THE ENERGY PROGRESS REPORT 2020

A joint report of the custodian agencies

International Energy Agency

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International Renewable Energy Agency

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Statistics Division

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World Health Organization

1818 H Street NW
Washington DC 20433
Telephone: 202-473-1000
Internet: www.worldbank.org

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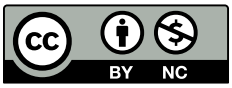

Report designed by: Duina Reyes
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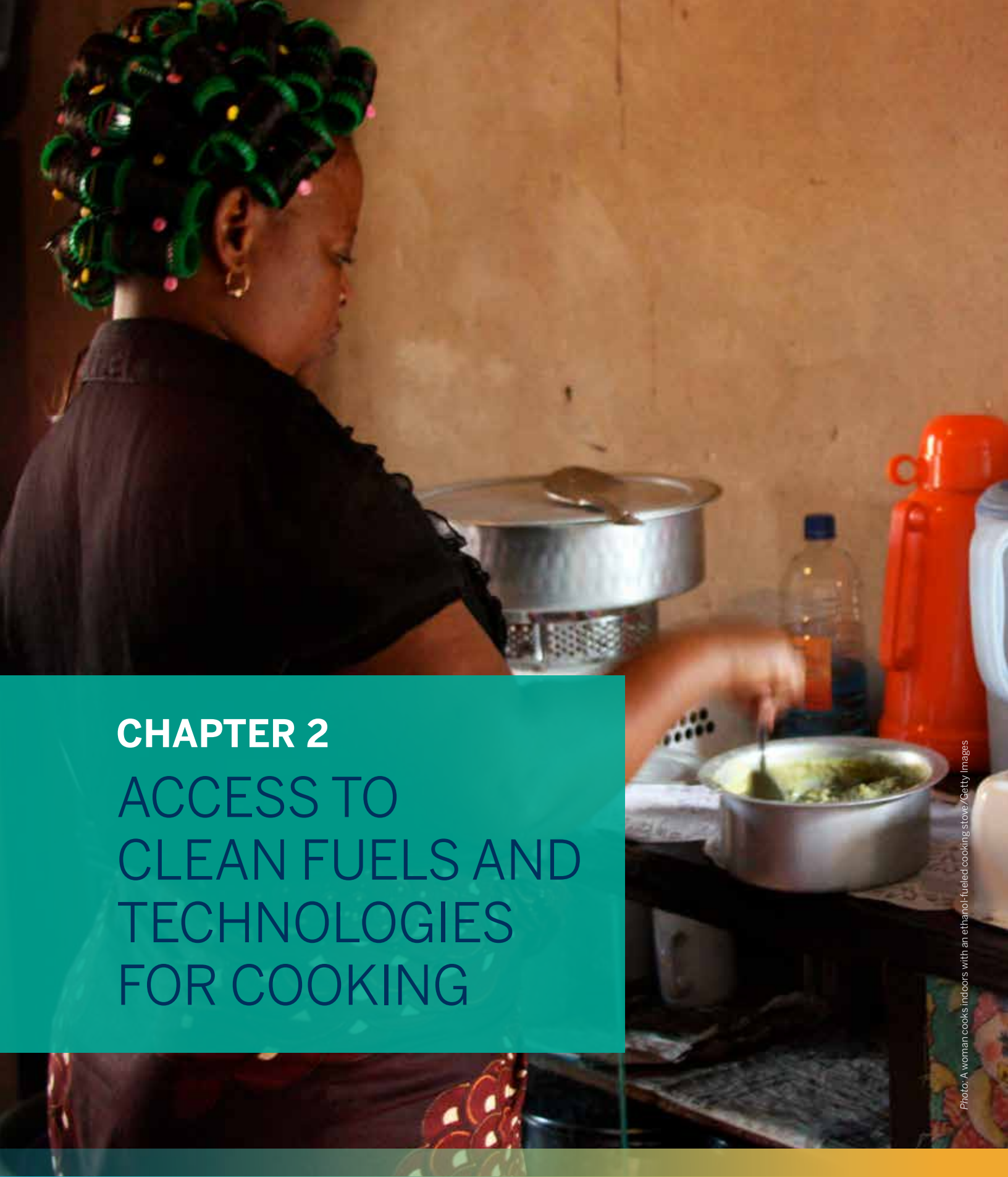


CHAPTER 2

ACCESS TO CLEAN FUELS AND TECHNOLOGIES FOR COOKING

Photo: A woman cooks indoors with an ethanol-fueled cooking stove/Getty Images

MAIN MESSAGES

- **Status of access:** In 2018, 63 percent (56–68 percent[16]) of the global population had access to clean cooking fuels and technologies; the global population without access was 2.8 billion (2.4–3.3) people. Without prompt action, universal access will fall short of SDG goals by almost 30 percent. Meanwhile, exposure to household air pollution will continue to contribute to millions of deaths from noncommunicable diseases (including heart disease, stroke, and cancer) and pneumonia. Household air pollution will continue to worsen climate change.
- **Access and the 2030 target:** The annual rate of access to clean cooking fuels and technologies from 2010 to 2018 increased by less than one percentage point (pp) as population growth outpaced the number of those with access. In the decade leading up to 2030, increases in excess of 3pp per year are required to achieve the goal of universal access to clean fuels and technologies by 2030.
- **Regional highlights:** Greater access to clean cooking was achieved largely in two regions of Asia. From 2010 to 2018, Eastern Asia and South-eastern Asia saw annualized increases in access of 1.6pp—while the numbers of people lacking access fell from 1.0 billion (0.8–1.2) to 0.8 billion (0.5–1.1). Central Asia and Southern Asia also saw improved access to clean cooking, with annualized increases of 1.5pp. The 1.11 billion (0.9–1.3) people without access dropped to 1.0 (0.7–1.3) billion. In Sub-Saharan Africa, meanwhile, a stagnant access rate (annualized increase of 0.4pp) combined with rapid population growth have meant that the numbers of people without access have risen from 750 million (730–750) people to 890 million (870–910) people.
- **Urban-rural divide:** There are urban-rural discrepancies worldwide in access to clean cooking fuels and technologies: 83 percent of urban dwellers have access to clean fuels and technologies, compared with 37 percent of those living in the countryside. These discrepancies have been shrinking since 2010 owing, first, to increased access in rural areas, and, second, to population growth in the cities that is beginning to outpace access.
- **The top 20 countries with access deficits:** From 2014 to 2018, 20 countries accounted for more than 80 percent of the global population without access to clean cooking fuel.[17] In terms of the percentage of the national population lacking access, 19 of the 20 countries with the lowest percentage of the population having access were least-developed countries in Africa. Of these, 15 had annualized increases in access over the same period of less than 0.1pp, with some of these displaying potential decreases in access.
- **Fuel trends:** In low- and middle-income countries of Central Asia and Southern Asia, Eastern and South-eastern Asia, Latin America and the Caribbean, Oceania, Sub-Saharan Africa, and Western Asia and Northern Africa, the use of gaseous fuels (liquefied petroleum gas [LPG], natural gas, and biogas) continues to increase. Since 2010, gas has overtaken unprocessed biomass fuels as the dominant fuel worldwide. (Unprocessed biomass, charcoal, coal, and kerosene are considered polluting fuels.) In urban areas, the use of electricity for cooking has risen, but gas remains the most common fuel. In rural areas, meanwhile, a decline in the use of polluting fuel, particularly raw coal, has been accompanied by increased use of gas, though unprocessed biomass fuels remain dominant. Finally, the global proportion using charcoal is low, but charcoal has overtaken unprocessed biomass in Sub-Saharan cities.

16 Parenthetical figures appearing after estimates throughout the chapter are 95 percent uncertainty intervals, as defined in the methodology section at the end of this chapter.

17 The top 20 access-deficit countries are the 20 countries with the highest access-deficit population. Among them are Afghanistan, Bangladesh, China, Democratic People's Republic of Korea, Democratic Republic of Congo, Ethiopia, Ghana, India, Indonesia, Kenya, Madagascar, Mozambique, Myanmar, Nigeria, Pakistan, Philippines, Sudan, Uganda, United Republic of Tanzania, and Viet Nam.

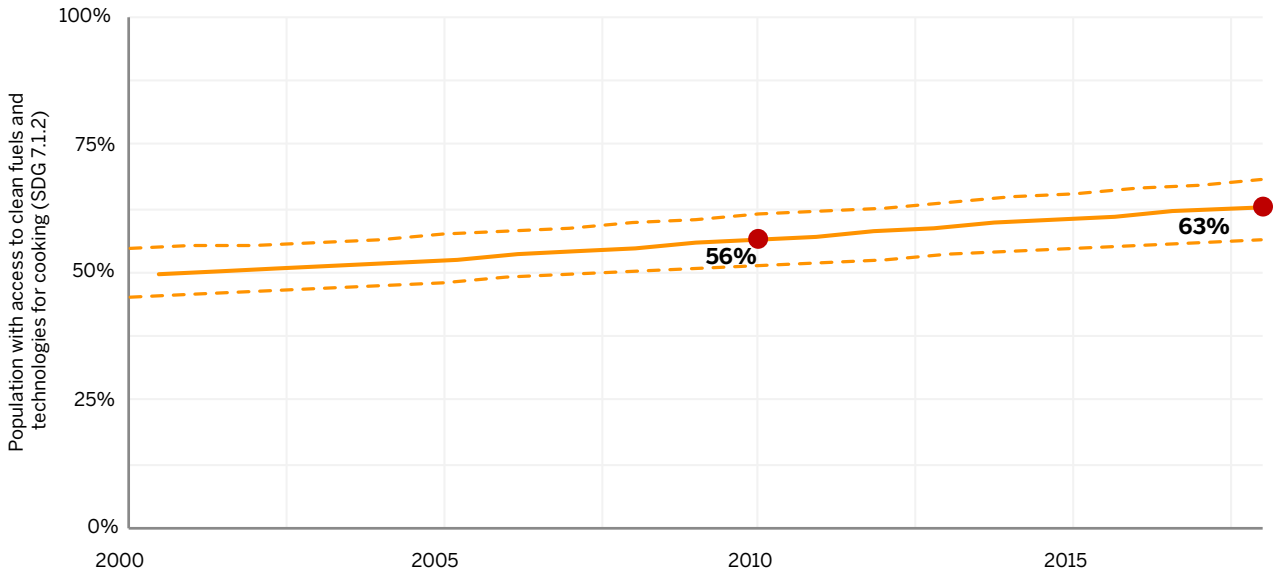
- **Survey harmonization:** Current data collection on household fuel use from national surveys offers a clear picture of access to clean cooking. Historically, however, these surveys typically ask only about the primary cooking fuel, eliciting little information on secondary household stoves or sources of air pollution (i.e., fuels and technologies used for lighting and heating). Improved survey questions regarding household fuel use will allow for a fuller understanding of the health, climate, and social impacts of household energy use, and attributes leading to more sustained adoption of clean cooking.
- **Outlook:** Since 2010, only small improvements in access to clean fuels and technologies for cooking have been realized. Although Asia has made notable gains, stagnant growth in access, combined with rapid population growth, have brought progress in Sub-Saharan Africa to a standstill. If this trend continues, any hope of achieving universal access rates by 2030 will be quashed, leaving a third of the global population vulnerable not only to adverse health effects but also to social and economic disadvantages. The latter is especially true for women and children, who shoulder time-consuming household tasks of gathering fuel and tending smoky stoves. These tasks take them away from remunerative work on the one hand while on the other subject them to adverse environmental conditions. That said, universal access remains achievable if serious efforts were made toward accelerating the transition to clean cooking worldwide, and particularly in Sub-Saharan Africa.

ARE WE ON TRACK?

In 2018, 63 percent (56–68) of the global population had access to clean cooking fuels and technologies, comprising electric, liquefied petroleum gas (LPG), natural gas, biogas, solar, and alcohol-fuel stoves. (Technical recommendations defining what can be considered "clean" fuels and technologies are set out in WHO guidelines for indoor air quality: household fuel combustion (WHO 2014). Yet there remain some 2. 8 billion (2.4, 3.3) people who rely on polluting fuels and technologies for cooking, including traditional stoves paired with charcoal, coal, crop waste, dung, kerosene, and wood. Due to limitations in the underlying data, analyses use types of cooking fuel rather than cookstove and fuel combinations. (The methodology section at the end of the chapter provides additional details.)

Global access is tracked by surveying proportions of the population that rely primarily on clean cooking fuels and technologies. The global access rate has been improving over the past few decades, albeit slowly (Figure 2.1).[18] By 2030, if trends continue, only around 70 percent of the population worldwide will have access to clean cooking fuels and technologies (IEA 2019).This means nearly a third of the global population will be exposed to harmful household air pollution from cooking with polluting fuels and devices, and many will still devote huge amounts of time to gathering fuel instead of on remunerative work, schooling, and other productive or leisure activities.

FIGURE 2.1 • The global population with access to clean cooking (in percentages)



Labels represent access-rate point estimates for 2010 (left) and 2018 (right)

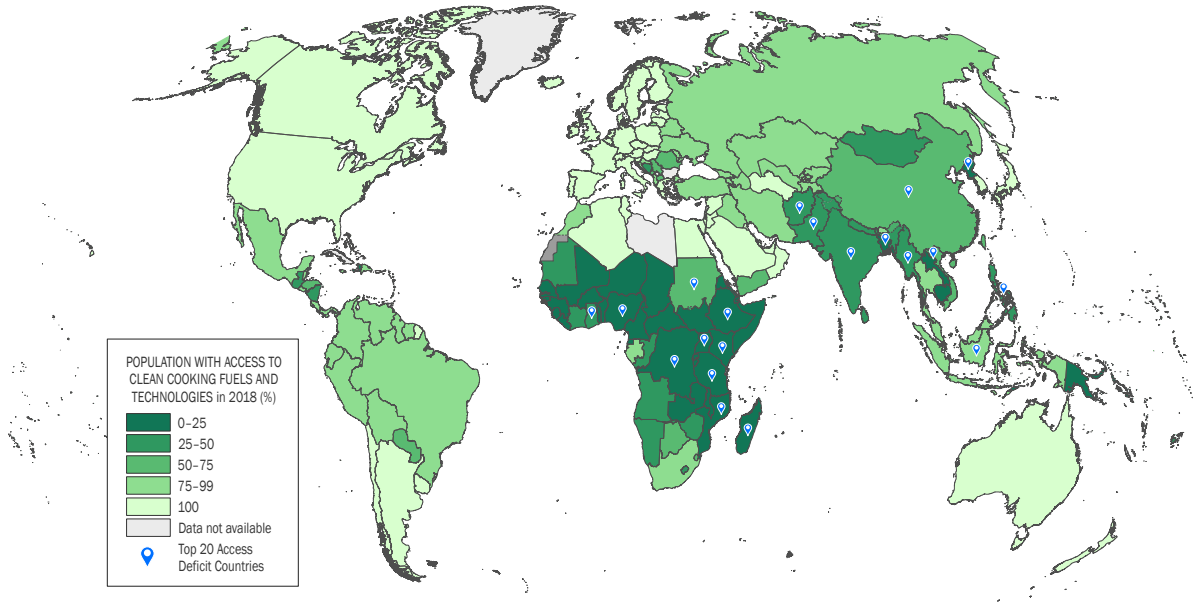
Source: WHO.

Note: The estimates published this year rely on statistical modeling and are in accordance with previous estimates published within the confidence intervals. Progress through 2018 was estimated by modeling survey data and UN population estimates (see methodology section at the end of the chapter).

SDG = Sustainable Development Goal.

18 Except as otherwise indicated, the data underlying the figures in this chapter were drawn in January 2020 from WHO's Household Energy Database, https://www.who.int/airpollution/data/household-energy-database/en/.

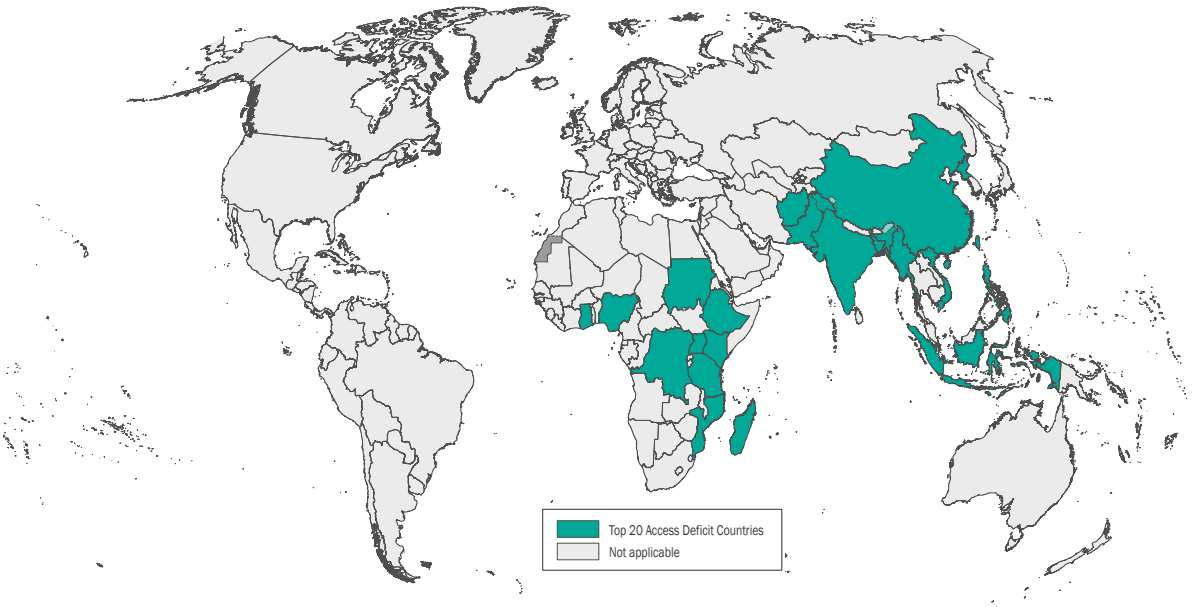
FIGURE 2.2 • Regional populations, by rate of access to clean cooking fuels and technologies, 2018



Source: WHO.

Deficient access rates dominate in the developing countries of Sub-Saharan Africa and Asia (figure 2.2). When considering the average access-deficit for the five-year period between 2014 and 2018, the 20 countries with the largest populations lacking access to clean fuels and technologies are concentrated in these regions (Figure 2.3).

FIGURE 2.3 • Top 20 access-deficit countries, 2014–18

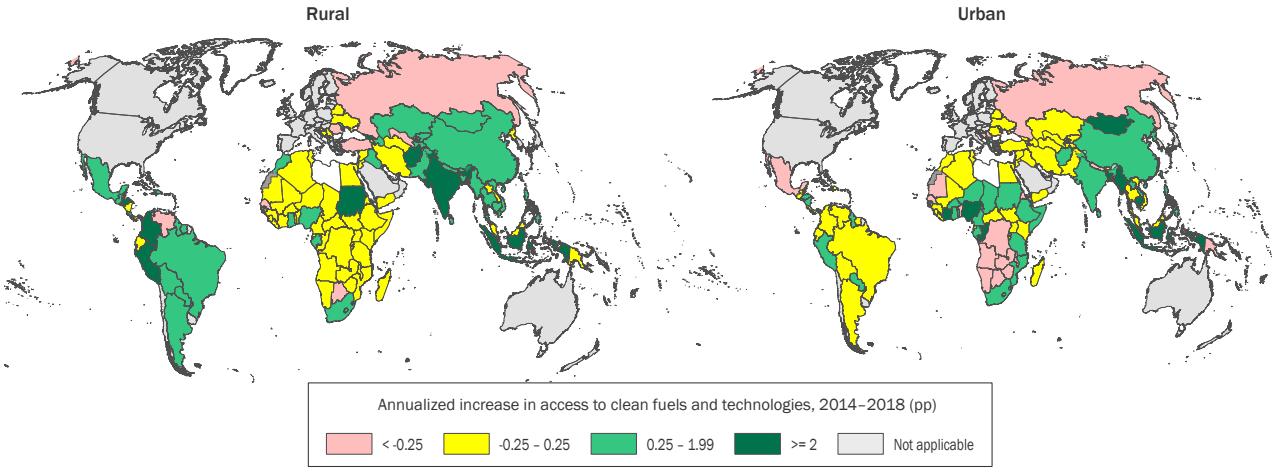


Source: WHO.

Between 2010 and 2018, the regions with the greatest progress in access to clean cooking were Eastern Asia and South-eastern Asia, with annualized increases of 1.6pp, and Central Asia and Southern Asia, with annualized increases of 1.5pp. In Sub-Saharan Africa, however, the access rate was stagnant, with annualized increases of only 0.4pp over this period.

Over the five-year period from 2014 to 2018, rural areas in Latin America, Central Asia and Southern Asia, and Eastern Asia and South-eastern Asia broadly benefited from modest increases in the access rate (Figure 2.4). Meanwhile, Latin American cities saw little change. Urban areas in many Asian countries displayed slower increases in access than their rural counterparts. With a few exceptions, most countries in Sub-Saharan Africa saw little change in rural areas, while country performance in urban areas showed a clear split between countries that improved access over this period and those that did not.

FIGURE 2.4 • Average annual increase (percentage points) in the clean cooking access rate, by urban/rural classification, over the period 2014–18



Source: WHO.
pp = percentage points.

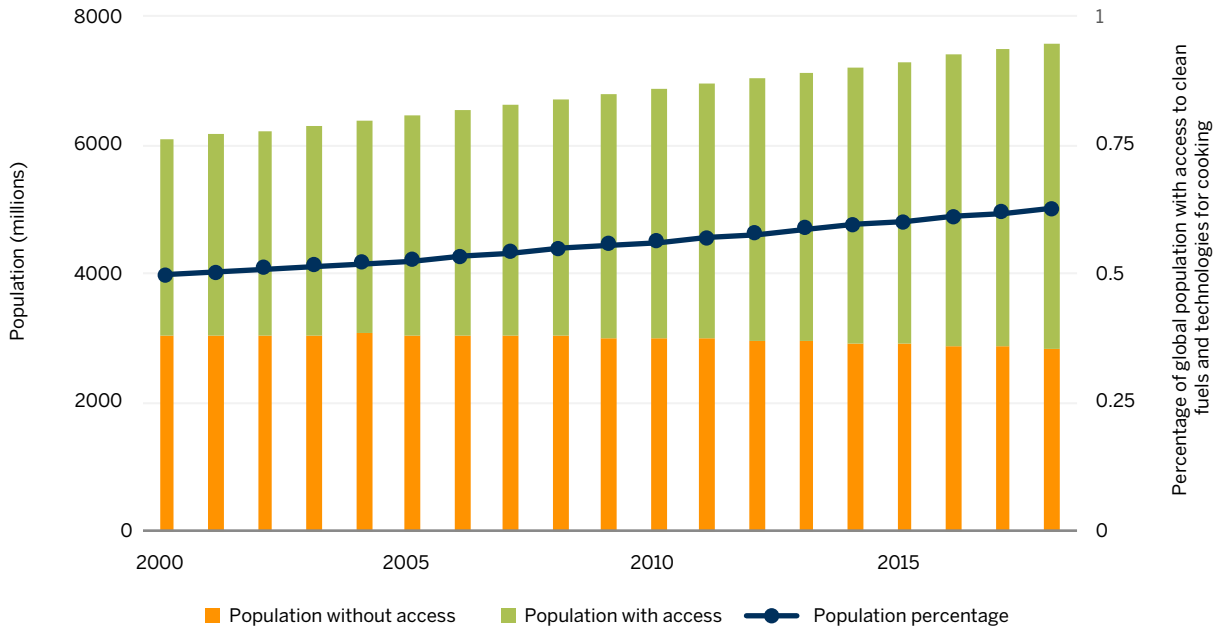
LOOKING BEYOND THE MAIN INDICATORS

ACCESS AND POPULATION

The global access rate to clean cooking fuels and technologies reached 63 percent (56–68) in 2018. As seen in Figure 2.5, the access rate has been steadily rising between 2000 and 2018, with an annualized increase in access to clean cooking of 0.8pp (–0.2, 1.7) between 2010 and 2018. As shown in Figure 2.6, progress in access has decelerated since 2012, dropping from just below 0.8pp per year between 2000 and 2015 to 0.7pp from 2017 to 2018. Even discounting potential slowing of progress, such increases are not enough to reach SDG target 7.1.2 by 2030. Moreover, as seen in previous years, population growth continues to outpace the annual increase in the number of people with access to clean fuel and technologies in Sub-Saharan Africa: Figure 2.7 shows the annualized increase in the number of people with access to clean fuels and technologies (orange), compared to the annualized population increase (green), by region, over the period 2014–18.

Over this period, population growth in Sub-Saharan Africa outstripped growth in the number of people with access to clean cooking—by around 18 million people each year. Thus, in this region 894 million (874–911) people, or around 85 percent of the population, lack access to clean fuels and technologies for cooking.

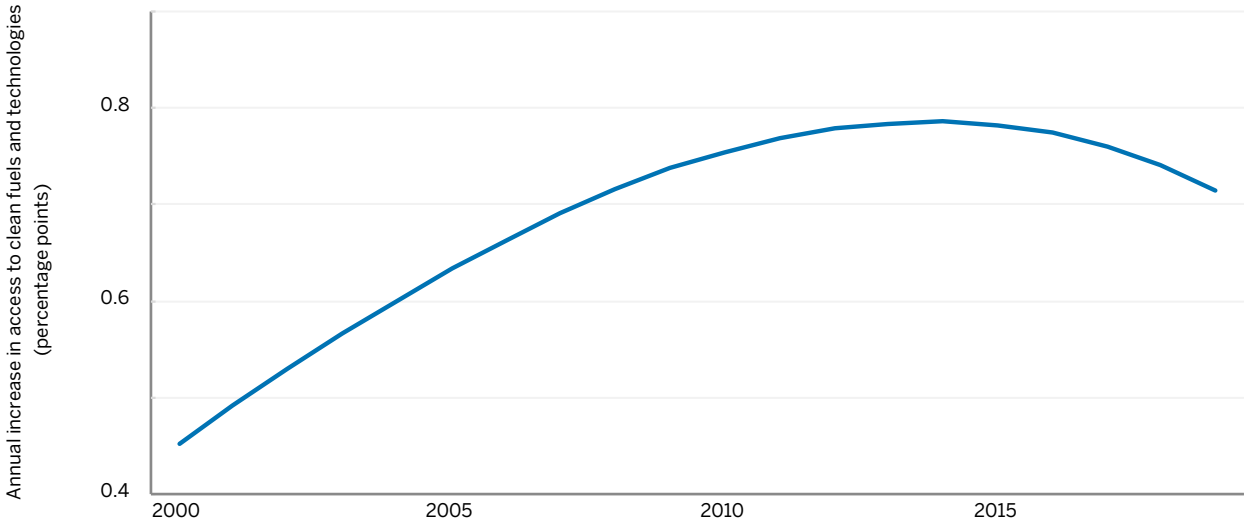
FIGURE 2.5 • Change over time in the absolute number of people (left axis) and percentage of the global population (right axis) with access to clean cooking



Source: WHO.

As a result, in 2018, around 3 billion people lacked access to clean fuels and technologies for cooking. Furthermore, if trends continue without changes in policy, the access deficit will shrink from 2.8 to 2.7 billion people (2.0–3.5) by 2030, about half of them in Sub-Saharan Africa and a quarter of them in Central Asia and Southern Asia. Using IEA's Stated Policies Scenario, 2.3 billion people will still lack access in 2030 under current and planned policies (IEA 2019). Action is urgently needed.

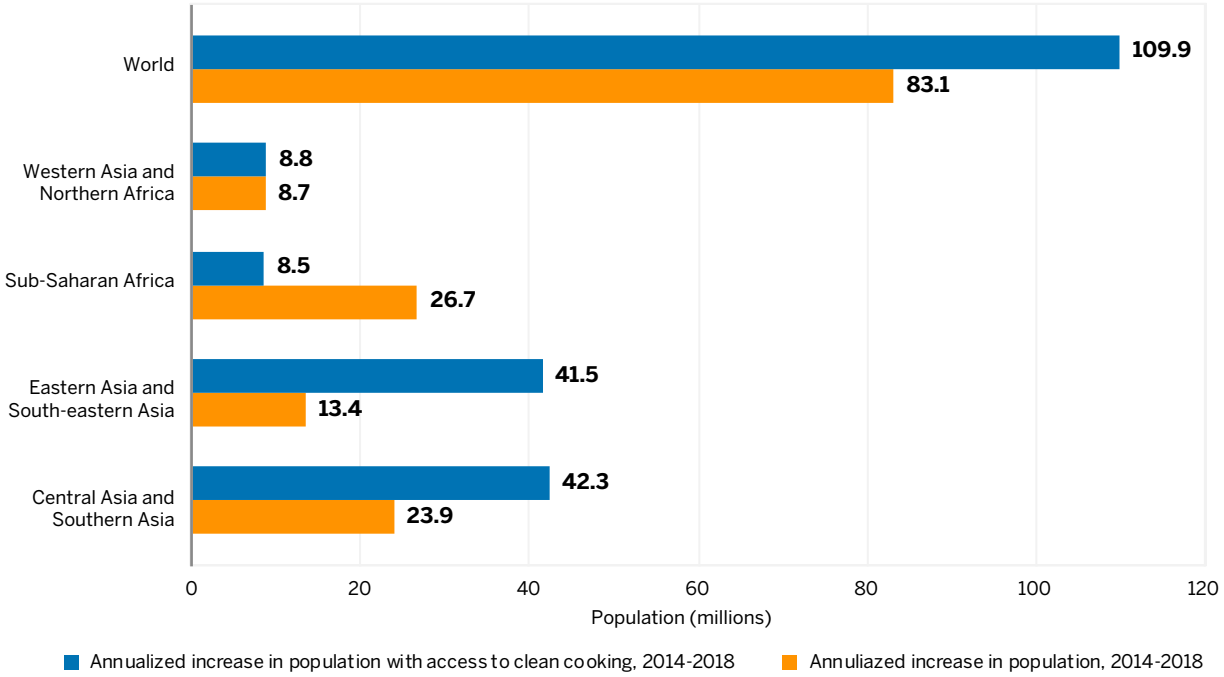
FIGURE 2.6 • Average annual increase (percentage points) in the global clean cooking access rate (the percentage of people with access)



Source: WHO.

In 2010, we estimated that average annual increases of 2pp would be necessary to achieve the goal of universal access to clean cooking. To make up for lax progress over the period 2010–18, however, the necessary annual increases in access rate now exceeds 3pp, nearly four times higher than the 0.8pp seen in the period 2010–18. The longer only marginal improvements are made, the more challenging the goal of universal access by 2030.

FIGURE 2.7 • Annualized increase in population and in the number of people with access to clean cooking over the period 2014–18, by region



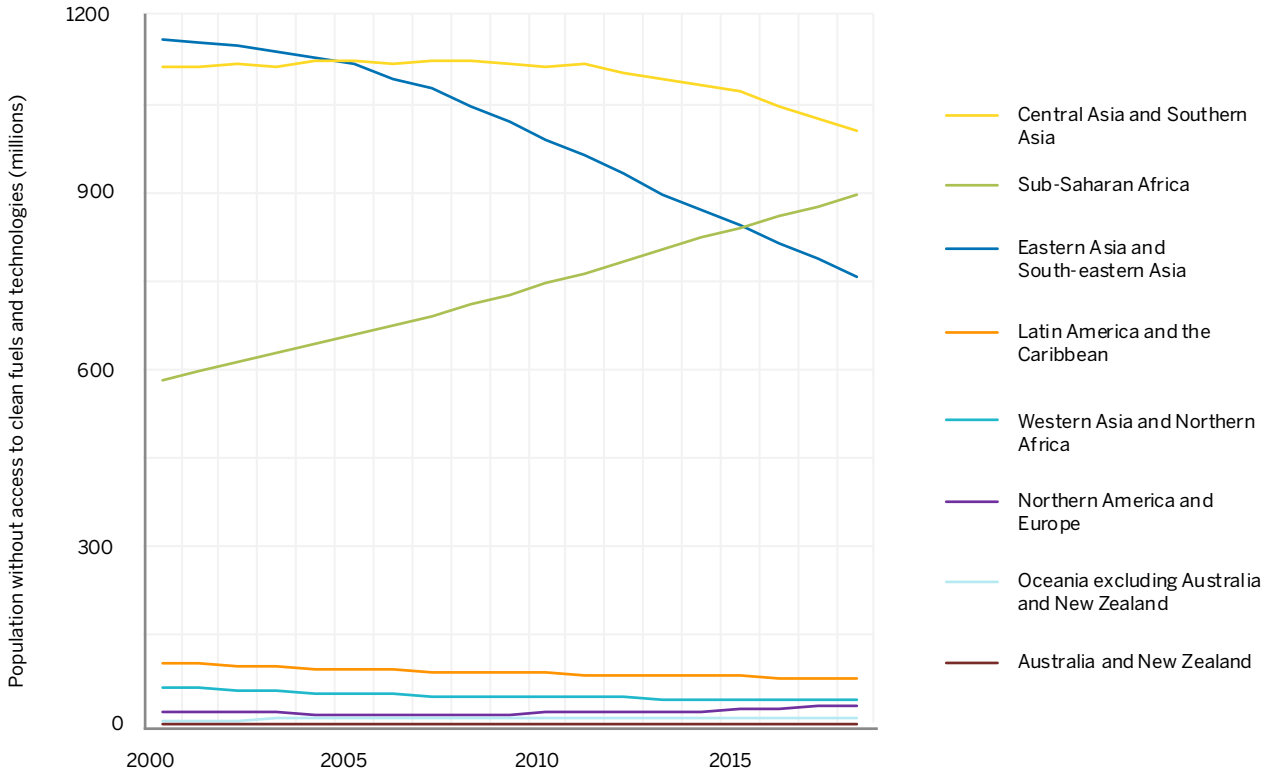
Source: WHO; UN population estimates.

THE ACCESS DEFICIT

While the human cost from polluting cooking is gradually easing in most regions, the trend is being overtaken by alarming population increases in Sub-Saharan Africa: On a global scale, gains in the percentage of population having access to clean cooking have been matched by population growth. These developments have caused a decades-long stagnation in the numbers of people without access to clean cooking, referred to here as the "access deficit." Estimates suggest this number has hardly deviated from 3 billion people in any year since 2000, as illustrated in Figure 2.1, with the 2018 estimate of 2.8 billion people (2.4, 3.3) being equal to the 1990 value of 2.8 billion people (2.4, 3.1).

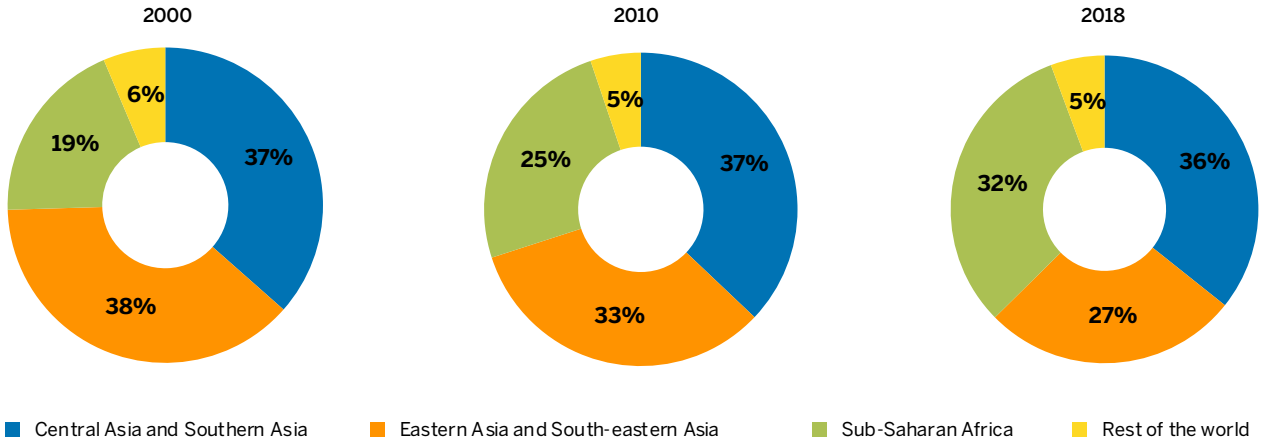
Stagnation in the global access deficit disguises key regional trends. As illustrated in Figure 2.8, the access deficit has decreased consistently in Eastern and South-eastern Asia since 2000 and in the regions of Central Asia and Southern Asia since 2010. In Sub-Saharan Africa, meanwhile, the access deficit is growing and has risen by around a factor of 50 percent since 2000.

FIGURE 2.8 • Access deficits by region (population without access to clean fuels and technologies), 2000–18



Source: WHO.

FIGURE 2.9 • Proportion of the total global access deficit in the three largest deficit regions and the rest of the world, 2000, 2010, and 2018



Source: WHO.

As illustrated in Figure 2.9, from 2000 to 2018, the proportion of the global access-deficit population residing in Central Asia and Southern Asia has shown minimal change, remaining at just over a third lacking access. But the proportion living in Sub-Saharan Africa has increased from approximately one-fifth to one-third of the total; meanwhile, the proportion residing in Eastern Asia and South-eastern Asia has decreased 11 percentage points. As a result, in 2018 more people without access to clean fuels and technologies reside in Sub-Saharan Africa than in Eastern Asia and South-eastern Asia. If observed trends in access and population continue, it can be estimated that in 2030 Sub-Saharan Africa will have the greatest access deficit, at around 44 percent of the region's total population. This represents a substantial geographic redistribution of the global access deficit and associated health, economic, and societal burdens. Future policies should take these trends into account.

ANALYSIS OF THE TOP 20 ACCESS-DEFICIT COUNTRIES

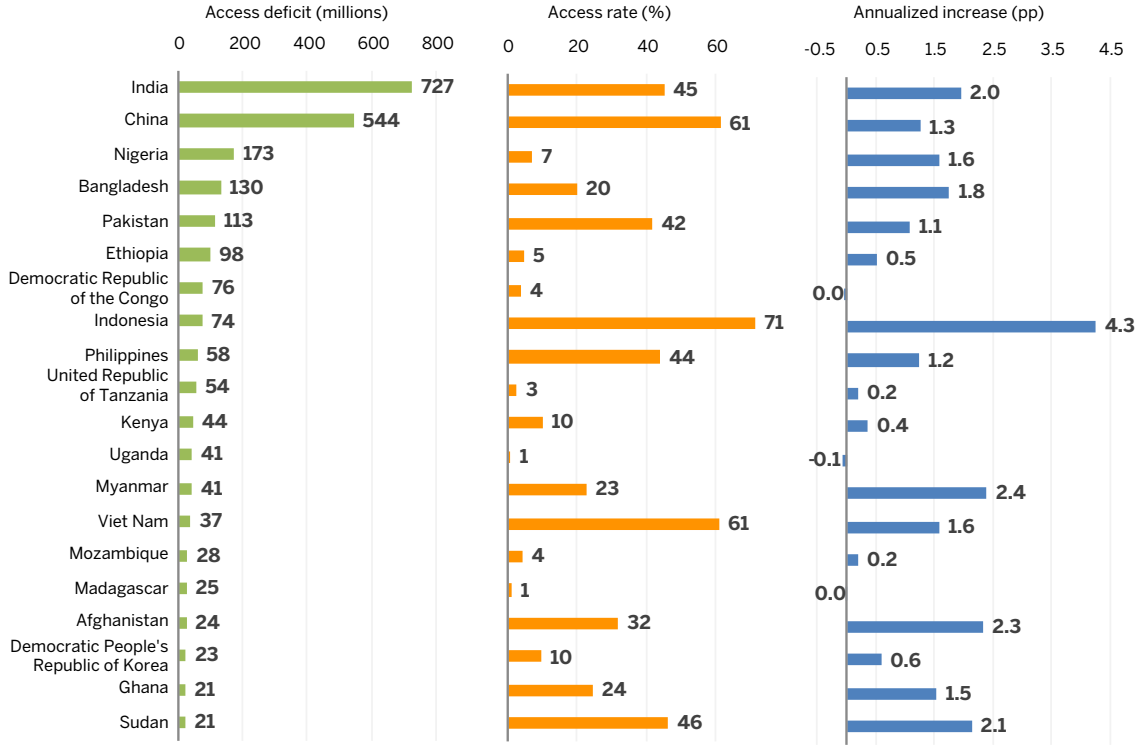
The top 20 access-deficit countries (Figure 2.10) accounted for 82 percent of the global population (2014–18 average) lacking access to clean cooking.[19] India alone still accounts for the largest share of the access deficit at 25 percent, followed by China at 19 percent.

Six out of the 20 countries have proportions of their respective populations with access to clean fuels less than or equal to 5 percent, including Democratic Republic of Congo, Ethiopia, Madagascar, Mozambique, Uganda, and Tanzania. Seventeen out of the 20 countries have access rates under 50 percent.

The 20 countries with the lowest access rates have shown little to no sign of improvement, represented by near-zero annualized increases (2014–18). Rapid annual gains in access (more than 2 percentage points) can, however, be seen in several countries between 2014 and 2018, including Indonesia (4.3 points), Myanmar (2.4 points), Afghanistan (2.2 points), Congo, and Sudan (both at 2.1 points, see Figure 2.13).

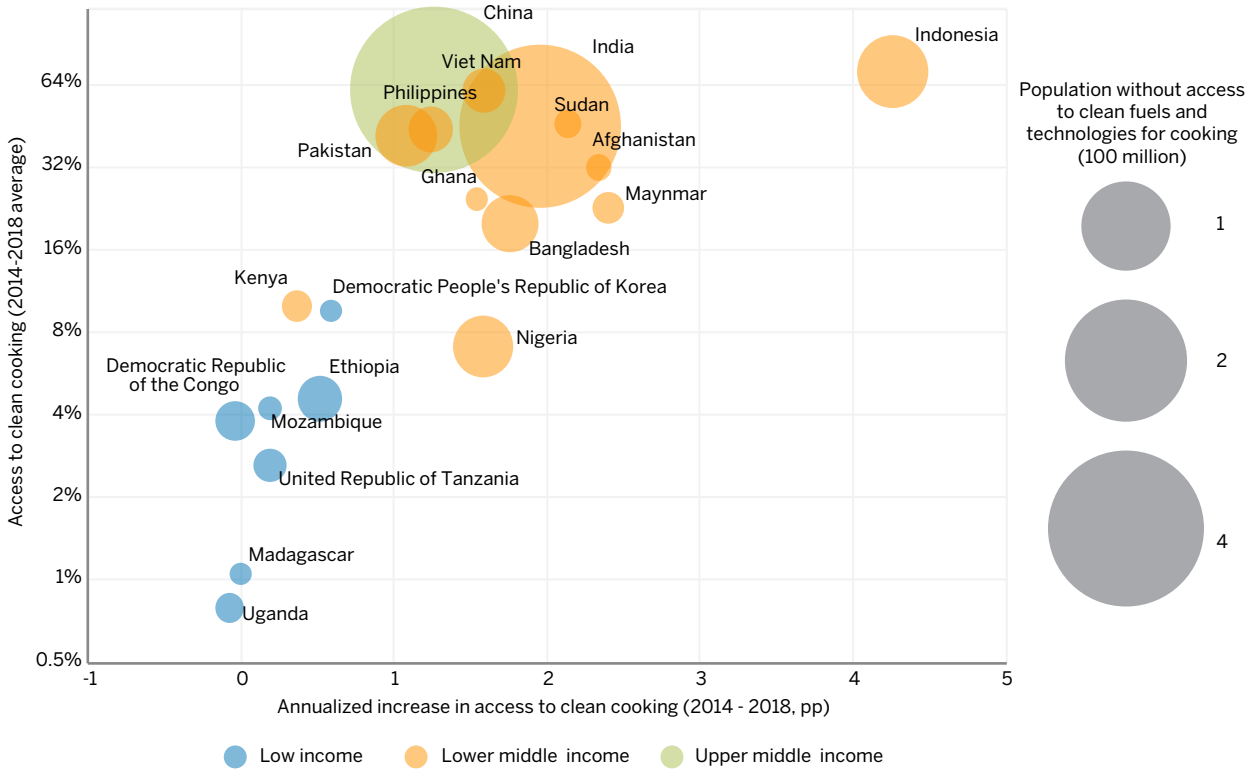
19 The top 20 access-deficit countries are the 20 countries with the highest access-deficit populations. These are Afghanistan, Bangladesh, China, Democratic People's Republic of Korea, Democratic Republic of Congo, Ethiopia, Ghana, India, Indonesia, Kenya, Madagascar, Mozambique, Myanmar, Nigeria, Pakistan, Philippines, Sudan, Uganda, United Republic of Tanzania, and Viet Nam.

FIGURE 2.10 • The 20 countries with the largest populations lacking access to clean fuels and technologies, 2014–18 average



Source: WHO.

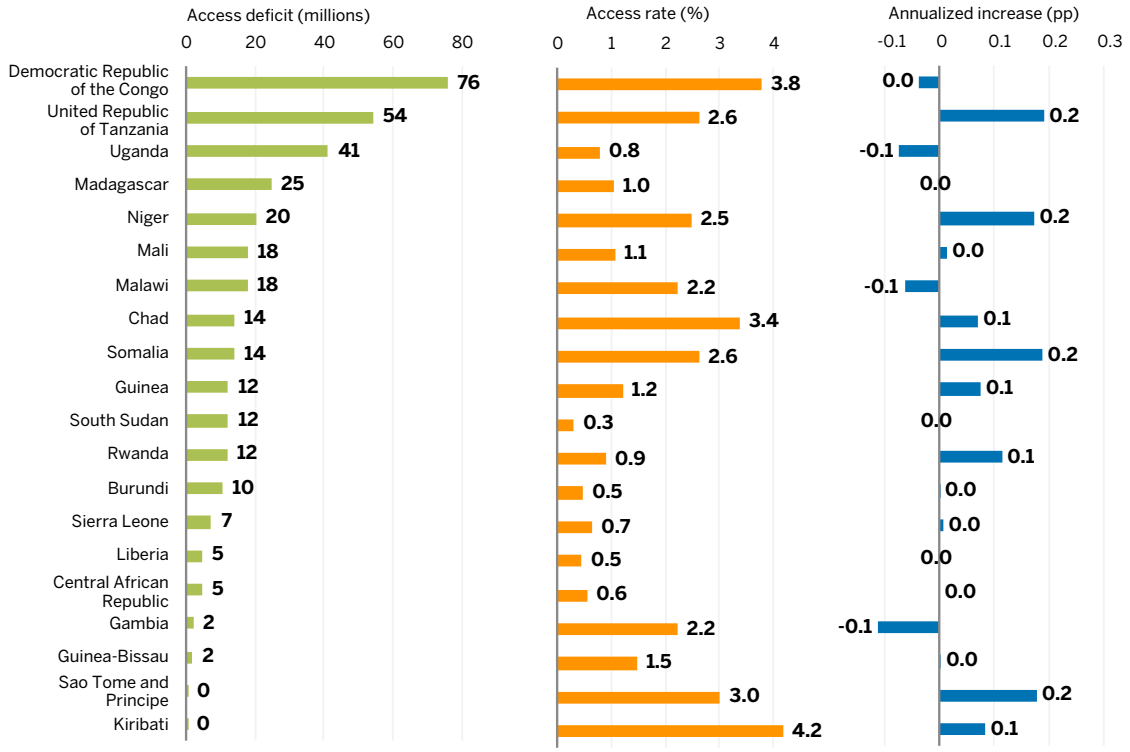
FIGURE 2.11 • The 20 countries with the largest access deficits to clean cooking, 2014–18



Source: WHO.

pp = percentage points.

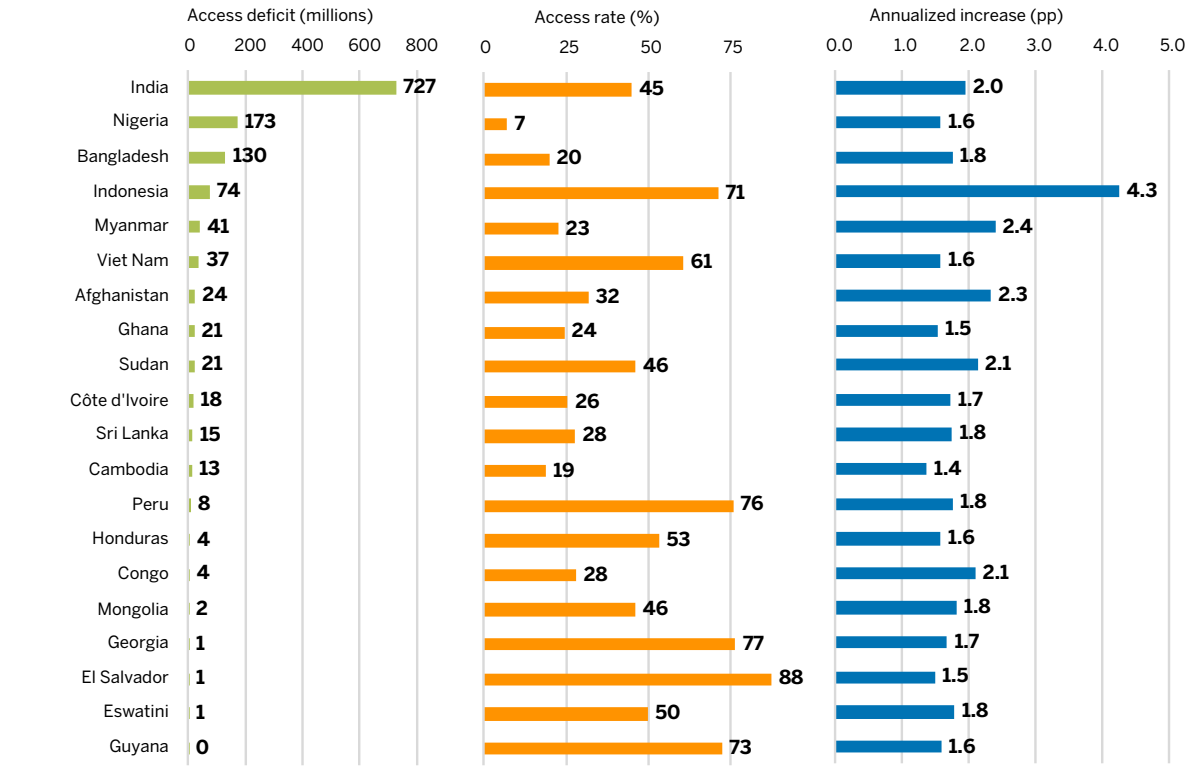
FIGURE 2.12 • The 20 countries with lowest percentage of the population with access to clean fuels and technologies, 2014–18 average



Source: WHO.
pp = percentage points.

Overall, in the 20 countries with lowest percentages of the population having access to clean fuels and technologies (Figure 2.12), the annualized access increase between 2014 and 2018 was small (always less than 0.3 percent); data suggests that a few countries experienced decreases in access to clean cooking fuels during the same period. These 20 countries are all least-developed countries and, with the exception of Kiribati, are all in Africa, highlighting the increasingly important need to address access deficits in Africa. Figure 2.13 shows the 20 countries with the fastest annualized increase (2014–18) in access to clean cooking. Despite relatively steep increases in access, the population lacking access is still significant in some of the larger countries. These countries with the largest deficits also receive disproportionately limited financing (SEforAll 2019) and thus face challenges for scaling up clean fuels and technologies.

FIGURE 2.13 • The 20 countries with the fastest increasing percentage of population with access to clean cooking fuels and technologies, 2014–18 average

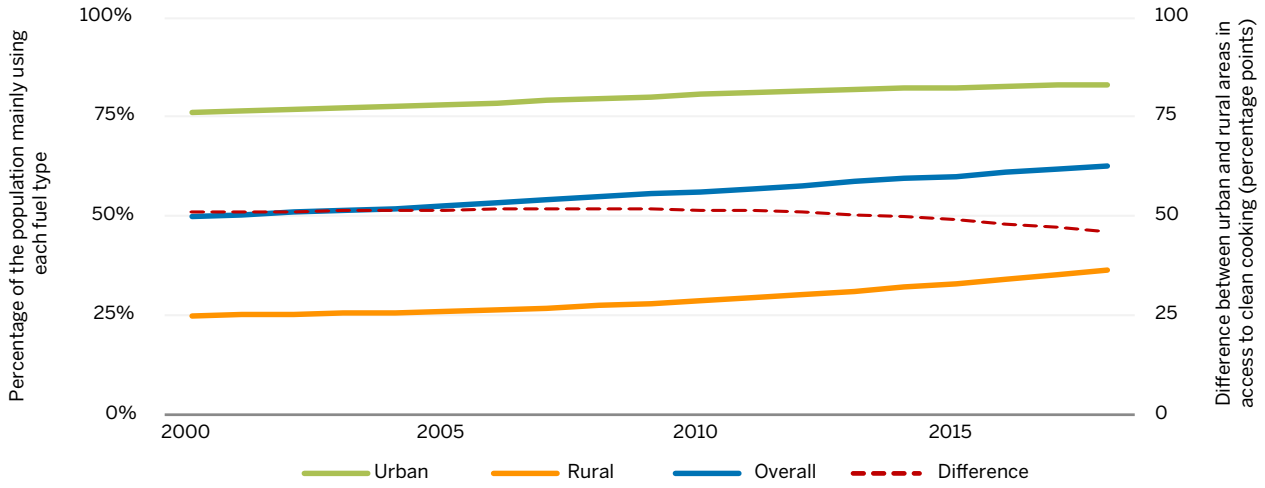


Source: WHO.

URBAN-RURAL DIVIDE

A vast urban-rural disparity persists in access to clean cooking solutions. Urban areas enjoy greater access because of infrastructure and availability of cleaner fuels and technologies. Figure 2.14 shows the percentage of the global population with access to clean fuels and technologies in urban areas, in rural areas, and overall from 2000 to 2018. In 2018, the access rate was 83 percent (76–87) in urban areas and 37 percent (30–45) in rural areas.

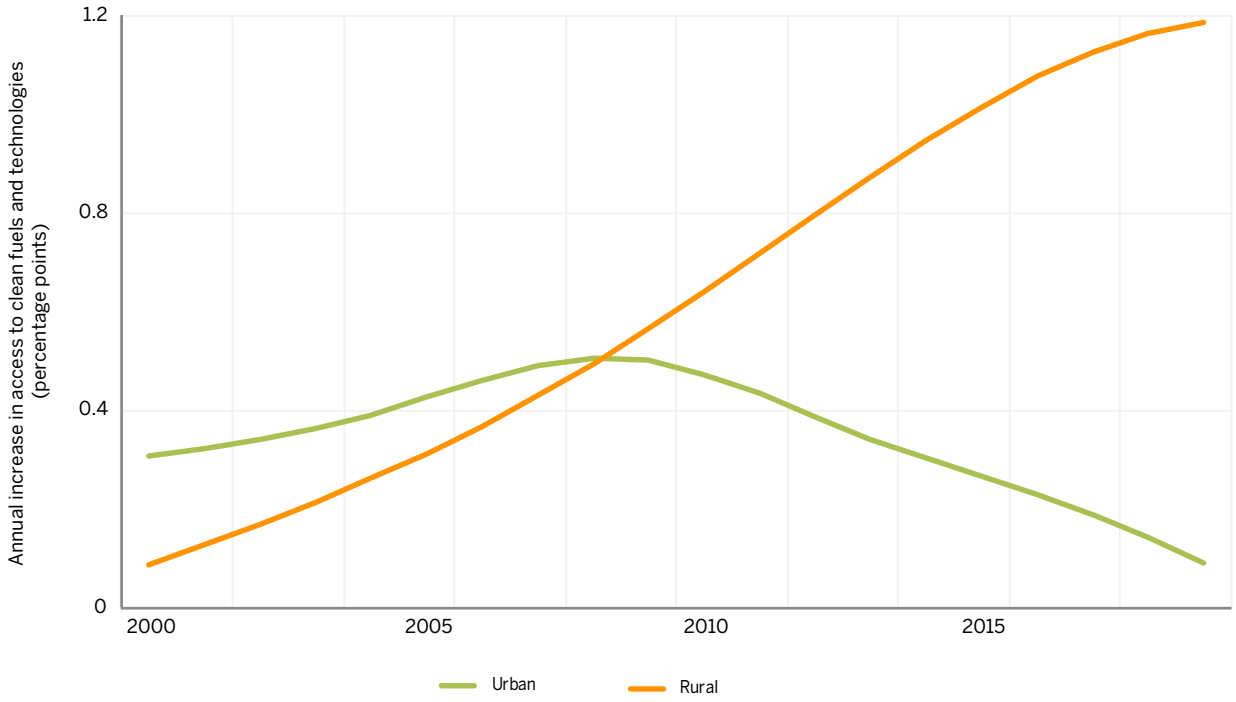
FIGURE 2.14 • Percentage of people with clean cooking access in urban areas, rural areas, and overall (solid lines), and discrepancy in access between urban and rural areas (dashed line)



Source: WHO.

Between 2000 and 2010 the disparity between urban areas and rural areas in access to clean cooking was fairly constant at just over 50 percentage points (52pp [45–57] in 2010), but this has steadily fallen over the past decade, as illustrated in Figure 2.14, to 46pp (36–55) in 2018. This is explained by trend changes in the annual increase in access to clean fuels and technologies for urban and rural areas (Figure 2.15). In rural areas, the annual increase has risen consistently, from only 0.2pp between 2000 and 2001 to 1.2pp between 2017 and 2018. In contrast, the annual increase in urban areas has fallen consistently over the past decade, from a high of 0.6pp between 2007 and 2008 to only 0.2pp between 2017 and 2018. This means that while access has accelerated in the countryside, it has been decelerating in urban areas. In fact, if observed trends continue and population growth outpaces access to clean fuels, the proportion with access to clean cooking is projected to decline in urban areas as the new decade begins. Meanwhile, some countries with rapid access growth will reach near-universal access, from which point increased access is no longer possible.

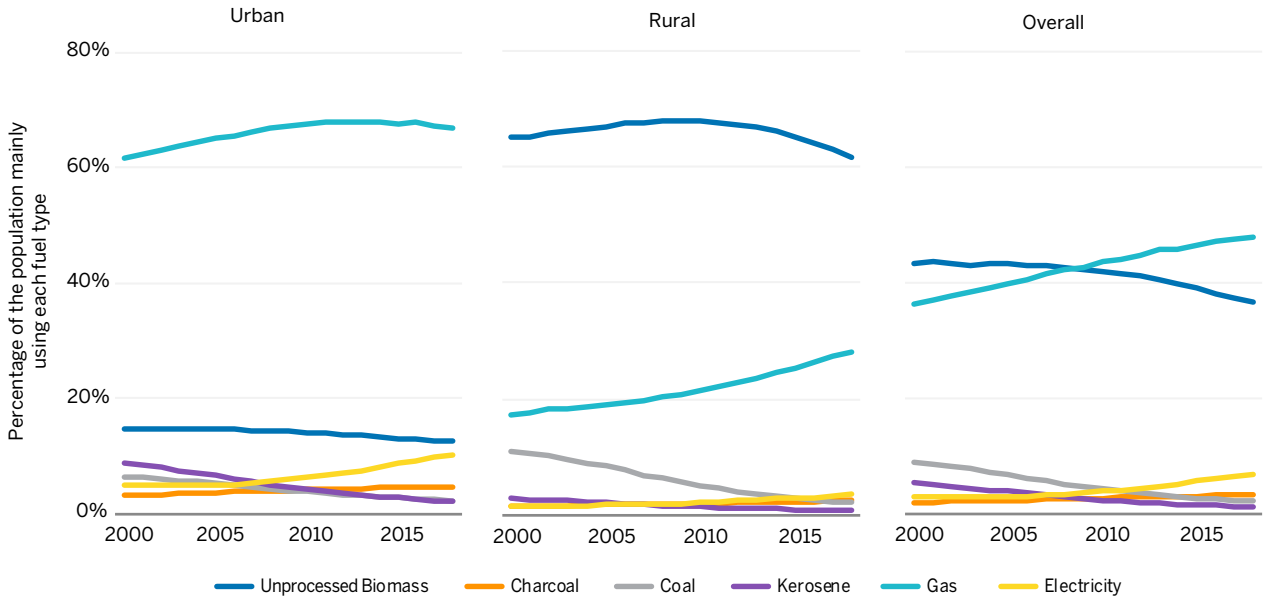
FIGURE 2.15 • Annual increase in access to clean fuels and technologies for urban and rural areas



Source: WHO Global Household Energy Model (Stoner and others 2019).

A deeper analysis of individual fuel access, at country and region levels, can help gauge the effects of current policies on household energy use and inform future policies and programs. Using estimates derived from household surveys and advanced modeling techniques, a few notable trends can be seen across regions and countries.

FIGURE 2.16 • Percentage of people using each cooking fuel type, for urban areas, rural areas and overall in low- and middle-income countries



Source: WHO Global Household Energy Model (Stoner and others 2019).

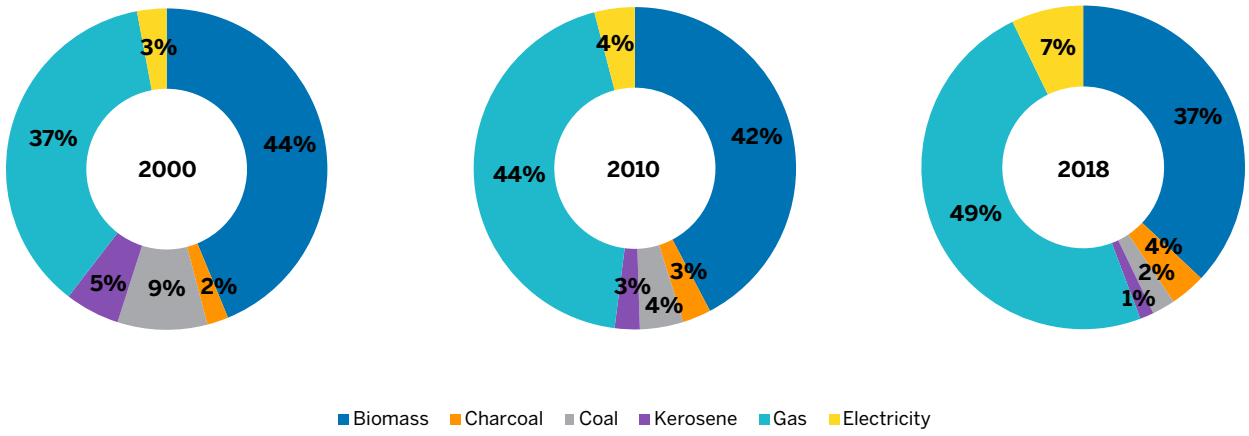
Among low- and middle-income countries, the use of gaseous fuels[20] increased consistently from 30 percent (23–40) in 1990 to 48 percent (42–56) in 2018, overtaking unprocessed biomass fuels[21] as the dominant type of cooking fuel over the past decade (figures 2.16 and 2.17). Use of electricity for cooking has also risen, from 3 percent (2–4) in 2000 to 7 percent (4–12) in 2018, though the increase was far more notable in urban areas (Figure 2.16). Between 2000 and 2010, increases in the use of clean fuels appear to be explained by steep declines in the use of coal, particularly in rural areas where the use of coal dropped from 11 percent (6–17) in 2000 to 2 percent (1–6) in 2018, and also in the use of kerosene, particularly in urban areas, where use dropped from 9 percent (7–10) in 2000 to 2 percent (1–3) in 2018. But from around 2010 onwards, the use of unprocessed biomass fuels (wood, crop waste, and dung) has shown persistent declines, primarily in rural areas, where use of unprocessed biomass fuels dropped from 68 percent (63–72) in 2010 to 62 percent (54–69) in 2018.

Although the use of kerosene has dwindled worldwide (figures 2.16 and 2.17), it remains prominent in urban areas of low- and middle-income countries in both Oceania (16 percent [8–35] in 2018) and in Sub–Saharan Africa (9 percent [6–11] in 2018). Globally the proportion using charcoal is low (4 percent [3–4] in 2018), but in Sub-Saharan urban areas its use has overtaken unprocessed biomass (29 percent [26–33] in 2018).

20 Gaseous fuels, or simply "gas," refer to liquefied petroleum gas, natural gas, or biogas.

21 Biomass fuels consist of raw/unprocessed biomass fuels (wood, crop waste, and dung), but not charcoal, which is presented separately.

FIGURE 2.17 • Comparison of the percentage of people using each fuel type among low- and middle-income countries in 2000, 2010, and 2018



Source: WHO Global Household Energy Model (Stoner and others 2019).

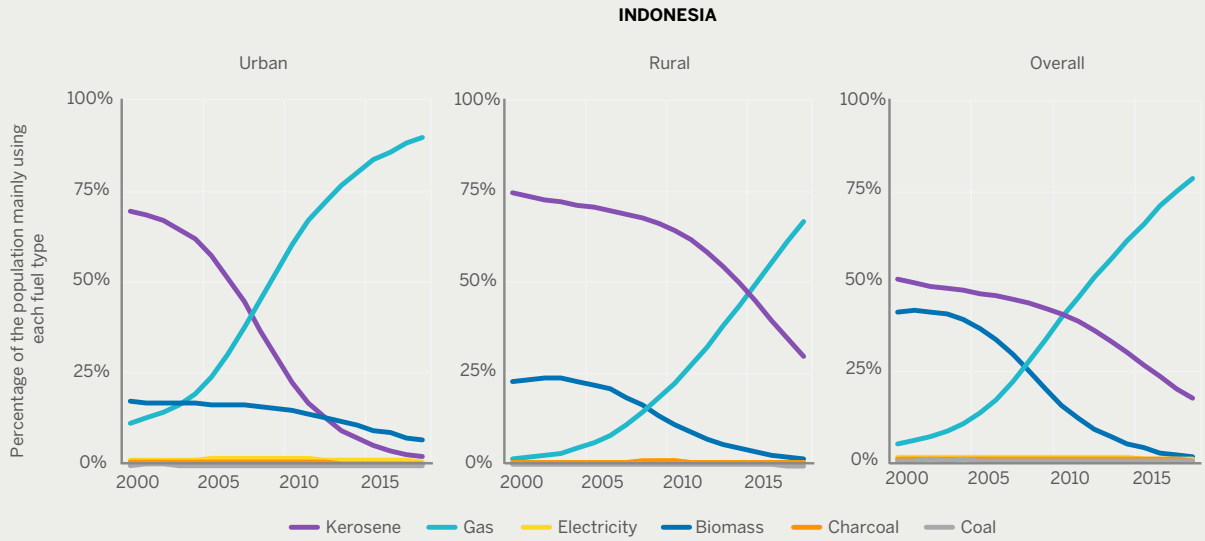
BOX 2.1 • SPECIFIC FUEL USE IN INDONESIA

Between 2000 and 2018, Indonesia saw the fastest growth in the percentage of people using clean fuels and technologies of any country, as illustrated in Figure B2.1.1. Here, the use of gaseous fuels—liquefied petroleum gas (LPG), natural gas, and clean biogas—rose considerably from 5 percent (1–13) in 2000 to 79 percent (65–88) in 2018.

In 2007, Indonesia launched an ambitious program to replace kerosene use with LPG in households and micro-businesses. The government had subsidized kerosene for decades, but the decline in domestic supply combined with rising oil prices (and the consequent increase in the subsidy) motivated an initiative to replace it. Indonesia planned and executed its transition to LPG in several SDG 7 efforts, including feasibility studies, field tests, distribution of conversion packages, strategic execution based on infrastructure readiness, and identification of areas of high consumption potential and follow-up surveys to assess user satisfaction. Continuity of the program is influenced by household income, infrastructure readiness, and access to sales points (Thoday and others 2018).

Consequently, in urban areas, the rise in LPG use has come overwhelmingly at the expense of kerosene, the use of which has dropped from 70 percent (53–83) in 2000 to 2 percent (0–11) in 2018. The use of kerosene also fell considerably in rural areas, from 22 percent (12–36) in 2000 to 1 percent (0–9) in 2018. However, the use of unprocessed biomass fuels also fell overall, dropping about 10pp between 2000 and 2010, after which the decrease accelerated considerably, dropping a further 35pp between 2010 and 2018.

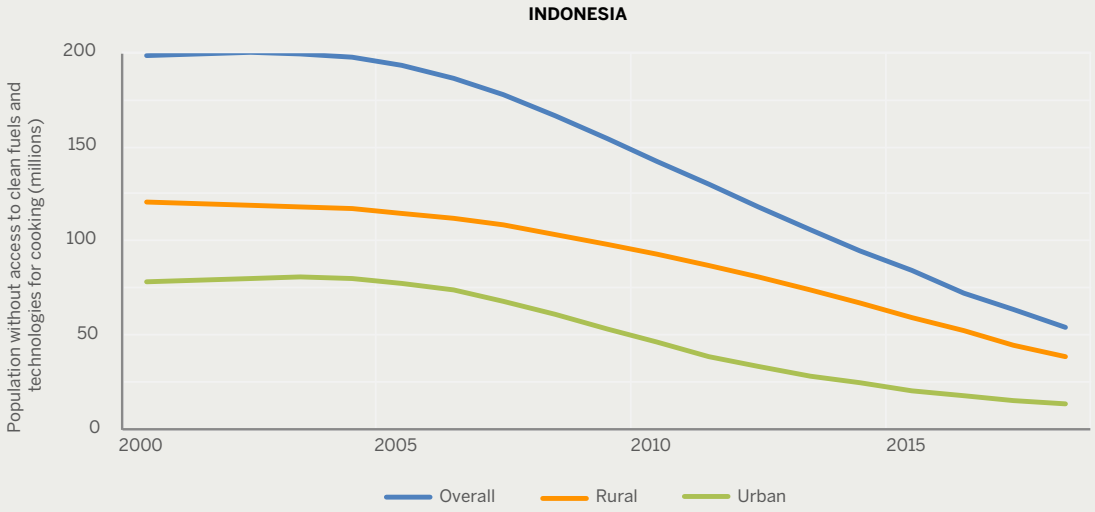
FIGURE B2.1.1 • Estimates of the population (percentages) in Indonesia relying on individual fuels for cooking (2000–18), with associated 95 percent confidence intervals



Source: WHO Global Household Energy Model (Stoner and others 2019).

The effect of these efforts is illustrated in Figure B2.1.2. In 2000, 199 million (179–208) Indonesians did not have access to clean fuels and technologies—78 million (64–86) in urban areas and 121 million (115–122) in rural areas. In 2018, about a quarter as many people did not have access to clean cooking—54 million (31–88), 13 million (4–32) of whom live in cities, and 38 million (23–57) in rural areas—leading to greatly diminished health outcomes and increased economic and social burdens for Indonesia.

FIGURE B2.1.2 • Population without access to clean fuels and technologies in Indonesia: urban, rural, and overall



Source: WHO Global Household Energy Model (Stoner and others 2019).

POLICY INSIGHTS

Lack of access to clean fuels and technologies for cooking contributes to 4 million deaths each year in low and middle-income countries. It has been linked to heart disease, stroke, chronic obstructive pulmonary disease, pneumonia, adverse pregnancy outcomes, and cancer. This pollution is not restricted, however, to the household environment alone, as it contributes as well to localized pollution, disrupting regional environments. Household air pollution affects climate change: cooking and heating account for some 25 percent of black carbon emissions worldwide (Bond and others 2013), and around 30 percent of the wood fuel harvested globally is unsustainable, which results in climate-damaging emissions equivalent to 2 percent of emissions worldwide (Bailis and others 2015).

These facts make a compelling case for policies on universal access to clean cooking fuels and technologies. These policies should be informed by data and integrated into the national agenda, while taking regional variations into consideration. More detailed national and regional data on cooking fuels will provide a more accurate picture of the situation and furnish policy makers with more information (box 2.2).

BOX 2.2 • ENHANCED MONITORING: CORE QUESTIONS ON ELECTRICITY ACCESS AND HOUSEHOLD ENERGY FOR HOUSEHOLD SURVEYS FINALIZED

National household surveys are an essential tool in monitoring household energy use and producing better understanding of the impacts on health and sustainable development. The data currently collected on household energy use offer us a snapshot of access. In the end, however, they provide insufficiently detailed information on patterns of household energy use and the diverse effects of these patterns on health and the environment across the globe. In recognition of these shortcomings, the World Health Organization and the World Bank's Energy Sector Management Assistance Program have developed a new set of household survey questions. These questions were refined through a collaborative process involving a diverse set of policy makers, researchers, and program implementation professionals through a series of expert consultations. These questions have also been extensively piloted in the field.

Shortcomings in previous surveys

Historically, national surveys and censuses often included only a single question: Was the household connected to a national electricity grid? This simplistic approach does not consider the quality and quantity of the service, such as potential breakdowns, voltage fluctuations, and hours of supply. To fully capture the varieties of household access, the survey must include questions about off-grid options.

Similarly, national surveys and censuses have historically asked only about the use of the primary fuel used for cooking. Other energy-intensive household activities (for example, heating and lighting or supplementary cooking) also produce emissions with adverse impacts. It is essential to collect data on all fuels and technologies used for household cooking, heating, and lighting to fully capture the exposure to health-damaging household air pollution. To account for fuel stacking and more accurately measure household exposure to air pollution, surveys need to ask about all types of fuel and stoves used for household activities—both main and supplemental fuels. Response options in the new core questions tie in directly to the WHO guidelines for indoor air quality: household fuel combustion (WHO 2014), so survey results will be able to classify households according to evidence-based and consistent definition of clean or polluting fuels and technologies.

New core questions

The new core questions on electricity access and household energy for household surveys capture national data on SDG 7, to "ensure access to affordable, reliable, sustainable, and modern energy for all," specifically indicator 7.1.1 on the proportion of the population with access to electricity, and indicator 7.1.2 on the proportion of the population with primary reliance on clean fuels and technologies.

The core questions are available for download: https://www.who.int/airpollution/household/survey-harmonization/en/. Supporting materials such as a guidebook for use by statistical offices are forthcoming.

Household exposure to air pollution and the household burden of fuel collection have been shown to disproportionately affect women and children. In order to assess the existence and magnitude of this trend on a global scale across diverse cultures and populations, the core questions capture data on the time burdens of collecting fuels and cooking, linked to identifying information on the age and sex of the primary cook and fuel collector.

Stronger data can lead to stronger policies

Designing and implementing successful national and subnational strategies to promote cleaner and safer household energy require a detailed understanding of current energy use. The questions presented in this guide have a central goal: to fill the data gaps enumerated above and, by standardizing survey questions, to enable cross-national comparison and validation of data. Better data will assist in the design of policies that encourage uptake and sustained use of clean household fuels and technologies.

GEOGRAPHIC VARIATIONS

The global transition from polluting to clean household energy use is proceeding too slowly. But more rapid progress is possible with the right mix of national policies, programs, and targeted interventions. For example, since 2001 Indonesia has prioritized the transition to clean cooking fuels, reducing the number of people using polluting fuels for cooking by almost 75 percent. In 2016, India launched Pradhan Mantri Ujjwala Yojana scheme, which prioritizes LPG connections to rural households to benefit women living below India's poverty line. Nigeria launched a campaign in Lagos and Abuja to disseminate information about LPG and encourage the switch to this fuel for cooking. In Bangladesh the government has worked to create awareness among users and promoted LPG as the cooking fuel for households; it has also reinforced monitoring systems to ensure safety and security. These countries, together with Myanmar, Viet Nam, and Afghanistan, were among the 20 countries with the largest populations lacking access to clean cooking during the period 2014–18. But because of efforts to transition, they were also among the 20 countries with the fastest-increasing access to clean fuels for the same period.

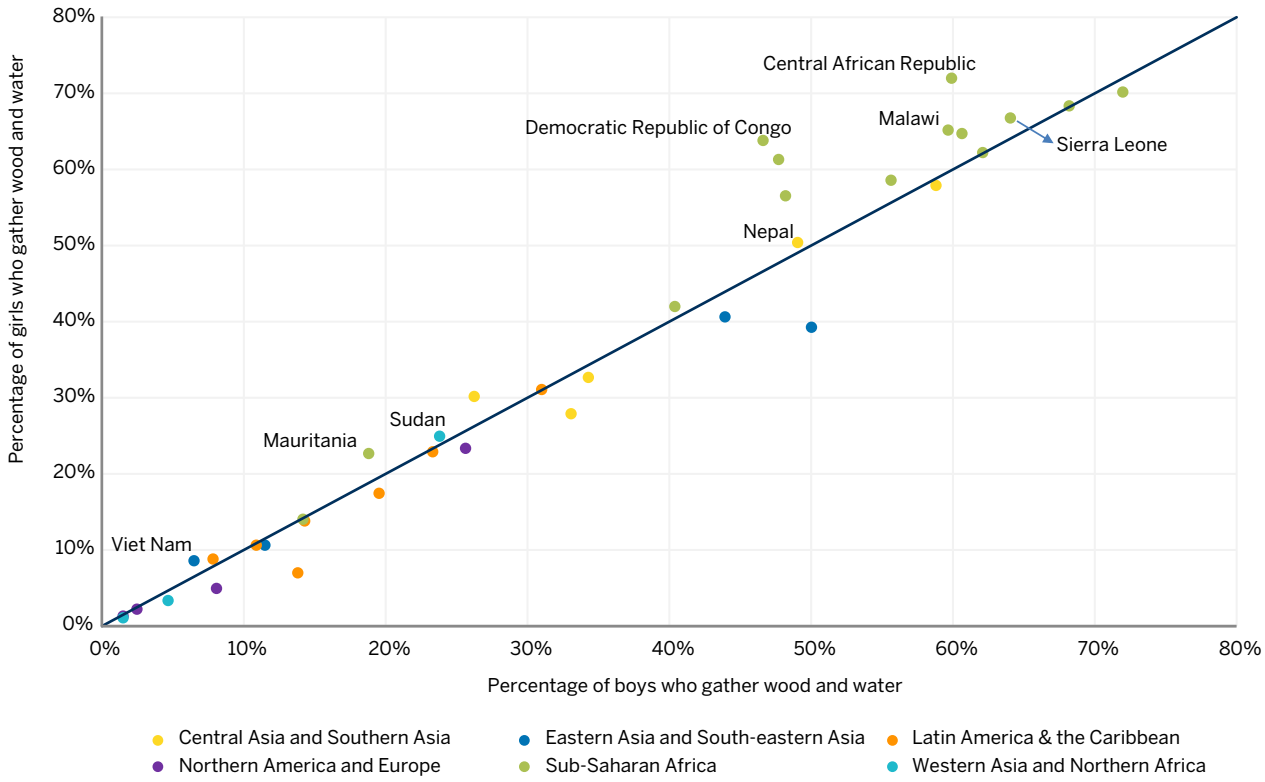
Rural areas across the globe have seen vast improvements: more than a quarter of a billion people have gained access to clean cooking fuels since 2010. Despite increasing rural access to clean cooking fuels, urbanization is outpacing the expansion of access. Furthermore, slum populations are often not captured in surveys. People living in densely populated settings, including humanitarian camps and slums, often rely on polluting fuels to meet their daily energy needs. Access to clean cooking fuels and technologies, while more readily available in urban areas, are still hindered in slums. Policymakers need to focus on this shortfall in access.

YOUTH, GENDER, AND HEALTH IMPLICATIONS

During 2018, 2.8 billion people were exposed to household air pollution. This exposure has been previously linked to high blood pressure and respiratory and cardiovascular disease (Ezzati and others 2007; McCracken and others 2007). The use of polluting fuels increases the risk of burns, injuries, poisoning, chronic headaches, and many other ills. The most vulnerable group thus exposed are women and children, as they are traditionally the procurers and users of polluting household fuels.

In access-deficit countries in Sub-Saharan Africa, a sizable percentage of children spend time gathering fuels. In addition, based on WHO statistics, the procurement of fuels is predominantly done by girls over boys (Figure 2.18). This imbalance creates a bias from an early age as girls spend more time procuring fuels instead of other activities, for example, receiving education.

FIGURE 2.18 • Percentages of girls and boys who gather wood and water[22] among all children in a given country, by WHO region, for the period 2010–17



Source: WHO.

Note: The World Health Organization categorizes the world into six regions: African Region (AFRO), Eastern Mediterranean (EMRO), European (EURO), The Americas (PAHO), South-East Asia (SEARO), and the Western Pacific (WPRO). A list of the countries in each region is available here: https://www.who.int/about/who-we-are/regional-offices

The degradation of household air quality because of polluting cooking fuels affects all household members. Some studies show, however, that the concentration of particles in the air increases drastically during meal preparation. This has an outsized effect on women and children because they are traditionally tasked with cooking.

Universal access to clean cooking fuels and technologies would also help attain other SDGs. The benefits of access to clean fuels and technologies include: better health and well-being (SDG 3), education (SDG 4), fewer gender inequalities (SDG 5), affordable and clean energy (SDG 7), economic growth (SDG8), sustainable cities and communities (SDG 11), and climate action (SDG 13).

22 Due to limitations in data collection methods, specific data on fuelwood collection cannot be disaggregated.

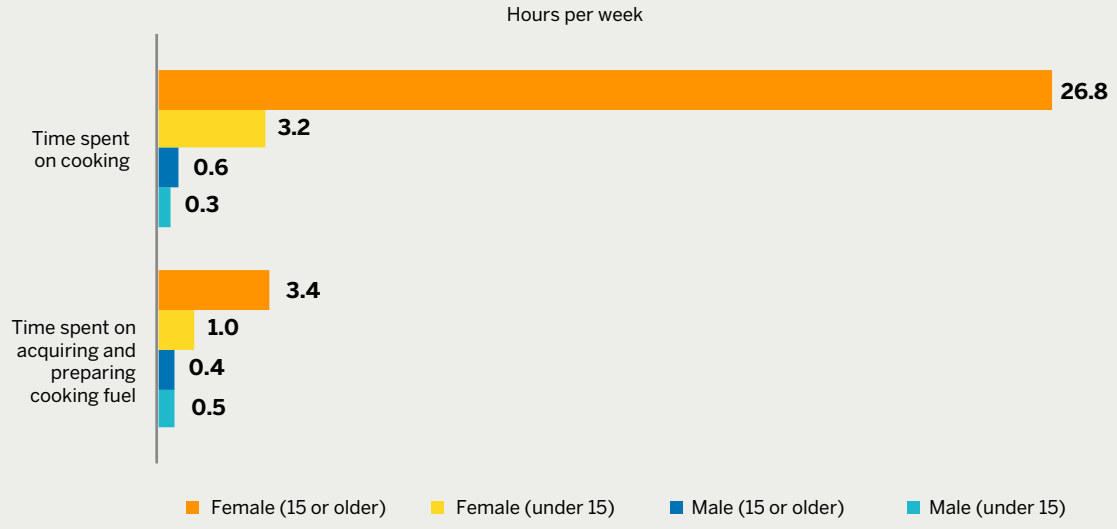
BOX 2.3 • CLEAN COOKING AND GENDER

In developing countries around the world, millions of women and girls live in energy poverty, risking their lives every day by working long, arduous hours to secure the energy needed by their households to cook their family's meals. The time spent cooking over inefficient stoves and procuring fuel restricts women's ability to partake in paid, as well as educational, political, and social activities, thereby perpetuating gender inequality, economic poverty, and a persistent drudgery trap. In addition to cooking, women also endure incredible hardships for fuel acquisition—walking long distances searching for fuel and carrying heavy loads of firewood and water. Displaced women have even worse burdens, in many cases having to walk for hours to find firewood, sometimes spending the night outside of camps set up for displaced people, and thus increasing their vulnerability to physical and sexual attack, dehydration, and other injuries. As the primary cooks in most developing-country households, women are more susceptible than men to household air pollution, as they are more likely to inhale toxic smoke from inefficient cooking fires.

Analyses of access to cooking fuels and technologies based on gender of head of household in Cambodia and Nepal show significant variability between countries and between urban and rural areas in-country. For example, the World Bank Multi-tier Tracking Framework (MTF) reports find that in Nepal (ESMAP 2018a), 43.6 percent of households run by women use clean-fuel stoves, compared to 36.1 percent of households headed by men. In Cambodia, meanwhile, no significant difference by gender exists in stove type for urban households (ESMAP 2018b); in the countryside, improved cooking stoves are less common among households headed by women (33.6 percent) than among households headed by men (41.7 percent). A common denominator in these countries: women are in charge of cooking, regardless of fuel and technology.

An in-depth analysis using data from Uganda shows that although female- and male-headed households show similar rates of access to clean cooking (at the country level, as well as in urban and rural areas), female-headed households tend to have better access to clean cooking than male-headed households as household expenditure level increases. Among the richest 40 percent of households, women have greater access to improved cookstoves (Bhojvaid and others 2014) and clean-fuel stoves (WLPGA 2014) than men. In terms of household time spent on cooking, women and girls spend much more time than men and boys. In Uganda, women (15 years and older) spend on average 3.8 hours per day cooking, and girls spend close to 30 minutes. In contrast, men and boys are virtually not involved in cooking. Similarly, female household members will often spend much more time acquiring and preparing fuel than men and boys. In Uganda, women spend 3.4 hours per week in cooking fuel acquisition and preparation—over 7.5 times more time than men (Figure B2.3.1).

FIGURE B2.3.1 • Time spent acquiring fuel and preparing food, by gender



Source: Multi-Tier Framework, World Bank (https://mtfenergyaccess.esmap.org/), accessed in March 2020.

The introduction of clean cooking fuels can drastically reduce the time women spend on unpaid household meal preparation; clean cooking also promotes more cost-efficient fuels and thus financial savings in the long term. The time and income recovered from these household activities free up space and opportunities for women and girls, helping to lift them out of energy poverty. Time spent collecting fuelwood can be intensive: in India, time spent collecting firewood ranges from three to ten hours per week (Jagoe and others 2014). Nigerian households spend an average of 1.7 hours per day gathering firewood (WHO 2019). In Kenya, households working with improved cookstoves saw the time spent collecting fuel drop from an average of 12 hours per week to 5 hours—and most participants reported using the time saved for economically productive tasks (WLPGA 2014).

Case studies have shown that when women receive empowerment training to sell stoves, they can dramatically increase sales. For example, in Nepal and Kenya women doubled sales after training. In a pilot project supported by the Clean Cooking Alliance with the Girl Guides in Ghana, 200 girls received training in empowerment, entrepreneurship, and cooking technologies and fuels. Afterwards, each household purchased efficient cookstoves. As a result, the girls reported a 50 percent reduction in cooking time, as well as two hours saved per firewood collection trip. In 2014, a research study commissioned by the Clean Cooking Alliance in Kenya found that women cookstove entrepreneurs sold three times as many cookstoves as their male peers when given the same training and support. Additionally, women's networks provide access to consumers in hard-to-reach markets, and women distributors better understand the needs of women and more easily approach their clients.

When women are positioned as the critical stakeholders they are—both as users who will benefit from cleaner, more efficient stoves and fuels, and as entrepreneurs and employees in the value chain—their efforts clearly spur widespread adoption. Women have a role to play in every segment of the cooking value chain, and their involvement can scale adoption of cooking products and services, while boosting their livelihoods. Women's involvement in the clean cooking sector can spur widespread distribution and delivery of cooking fuels and technologies that will contribute to a thriving global industry.

Sources: Clean Cooking Alliance; Multi-Tier Framework, World Bank (https://mtfenergyaccess.esmap.org/).

LOOKING AHEAD

Universal access to clean fuels and technologies remains feasible if serious policy efforts are made to expand access. Action is most urgently needed in Sub-Saharan Africa, given the stagnation of access levels in this region. All but one of the countries with the greatest deficit (people without access) are in Sub-Saharan Africa. In order to achieve universal access by 2030, efforts must include a focus in this area.

Cooking is multisectoral, and it demands multisectoral solutions. These include the Health and Energy Platform of Action (HEPA), a multisectoral platform launched in 2019. Aiming to strengthen the political and technical cooperation between the health and energy sectors at both global and country levels to accelerate the transition to clean energy, HEPA's initial focus is on clean cooking and electrification of health care facilities. To achieve universal access to clean fuels and technologies, governments, civil society organizations, private sector, academia, and the financial sector all must step up actions.

Major initiatives are needed to drive progress. Increased investment is key to encourage the uptake of clean cooking solutions. Encouraging progress includes the recent formation of the Clean Cooking Fund under ESMAP, and action by the Green Climate Fund and other bilateral programs promoting clean cooking. Governments need to set clear goals to transition away from polluting fuels such as unprocessed biomass and charcoal used in inefficient stoves.

In order to ensure that programs distributing new household energy technologies deliver the desired results, new programs should ensure that fuels and technologies are clean for health as defined by the WHO guidelines for indoor air quality: household fuel combustion. Some of the more-advanced biomass stoves do achieve the emission rate targets spelled out in the guidelines; if national programs intend to distribute these stoves, the adoption of national cookstove standards is valuable (WHO 2019). Standardization of cookstoves will support manufacturers, consumers, and policy makers by improving clarity about the benefits of clean cooking solutions.

To demonstrate the viability of clean and sustainable cooking solutions, governments and donors should consider providing supplemental funding for projects focused on electric stoves and biogas. Recent reports have highlighted the versatility and feasibility of mini grids and solar panels (Couture and Jacobs 2019). The cost of cooking with electricity, either via mini grids or solar panels has decreased significantly, putting this alternative well within the cost range of other cooking alternatives. This cost reduction is viable due to a combination of two effects: first, the cost of solar modules and batteries has decreased by 30 to 50 percent since 2016. Second, more energy-efficient cooking appliances, induction stoves, pressure cookers, and slow cookers decrease the electric power consumed per person. For example, over a one-hour period a pressure cooker uses approximately one-quarter of the electricity needed to operate an electric hot plate. In off-grid areas like slums, humanitarian camps, and rural areas, mini grids and solar panels can also provide electricity for cooking and other household activities.

There is encouraging progress in the promotion of clean fuels, including LPG. Stoves that rely on LPG and pay-as-you-go financing schemes are scaling up in Tanzania, Kenya, and Rwanda, with pilots in Nairobi; Uganda, India, and Guatemala have plans to expand. Biogas systems offer an advantageous solution to smallholders with ample access to agricultural and animal waste by integrating fertilizer supply, sanitation, and electricity, in addition to cooking fuel. Policy models that integrate stoves and fuel sales are gaining attention from the private sector (Clean Cooking Alliance 2019). In Rwanda and Zambia private initiatives combine biomass pellets with gasifier stoves to achieve high-quality combustion. Viable alternative fuels such as agricultural waste from local farms or neighboring countries could help reduce fuel costs.

Incentives to use clean fuels and efficient technologies must be both user-centered and suited to cooking practices in the community while featuring technical performance, practicality, and safety (Shan and others 2017). Failures here will likely defeat long-term adoption and exclusive use. Policies and programs tailored to surmount barriers are also needed. They need to focus on local cooking practices, affordability, and end-user preferences. As ever, women are an untapped resource for reaching the community. They also stand to benefit the most from transitions to clean cooking.

The WHO guidelines for indoor air quality: household fuel combustion (WHO 2014) include a good practice recommendation calling for governments to consider investing in clean household energy interventions to achieve climate change mitigation. Scaling up clean cooking is also a way for countries to achieve their nationally determined contributions while delivering meaningful health benefits.

METHODOLOGY

DATA SOURCES

The WHO Household Energy Database keeps regularly updated nationally representative household survey data (https://www.who.int/airpollution/data/household-energy-database/en/). It relies on a number of sources (see table 2.1) and serves in this report as the basis for all modeling efforts (Bonjour and others 2014; Stoner and others 2019). The database has 1,356 surveys taken in 170 countries (including high-income countries) between 1960 and 2018; 21 percent of the surveys cover the years 2013 to 2018 and 99 new surveys cover 2016 to 2018. Modeled estimates for low- and middle-income countries are provided only if there are underlying survey data on cooking fuels, so there are no estimates for Bulgaria, Cuba, Lebanon, and Libya.

Population data are from United Nations Population Division.

MODEL

As household surveys are conducted irregularly and reported heterogeneously, the WHO (in collaboration with the University of Exeter, UK) has developed the WHO Global Household Energy Model (GHEM) to estimate trends in household use of six fuel types:

- unprocessed biomass (e.g., wood)
- charcoal
- coal
- kerosene
- gaseous fuels (e.g., LPG)
- electricity

Trends in fuel use by population proportions are identified through a Bayesian hierarchical modeling for each fuel type, both urban and rural, drawing on country survey data. Smooth functions of time were the only covariate. Estimates for overall "polluting" fuels (unprocessed biomass, charcoal, coal, and kerosene) and "clean" fuels (gaseous fuels, electricity, as well as an aggregation of any other clean fuels like alcohol) are produced by aggregating estimates of relevant fuel types. Estimates produced by the model automatically respect the constraint that the total fuel use equals 100 percent.

The GHEM is implemented using the R programming language and the NIMBLE software package for Bayesian modeling with Markov chain Monte Carlo (MCMC). Summaries can be taken to provide both point estimates (e.g., means) and measures of uncertainty (e.g., 95 percent credible and 95 percent prediction intervals). The GHEM is applied to the WHO Household Energy Database to produce a comprehensive set of estimates, together with associated measures of uncertainty, of the use of four specific polluting fuel groupings and two specific clean fuel groupings for cooking, by country, for each year from 1990 to 2018. Further details on the modeling methodology and validation can be found in Stoner and others (2019).

Only survey data providing individual fuel breakdowns and with less than 15 percent of the population reporting "missing" and "no cooking" and "other fuels" were included in the analysis. Countries with no household fuel data but classified by the World Bank as high income (37 countries) were assumed to have transitioned to clean household energy. They are therefore reported as having greater than 95 percent access to clean technologies and fuels; no fuel-specific estimates were reported for high-income countries. In addition, no estimates were reported for low- and middle-income countries without data (Bulgaria, Cuba, Lebanon, and Libya). Modeled specific-fuel categories estimates were reported for 135 low- and middle-income countries and estimates of overall clean fuel use were reported for 190 countries.

UNCERTAINTY INTERVALS

Many of the point estimates we provide here are accompanied by 95 percent uncertainty intervals, which imply a 95 percent chance that the true value lies within the given range. Small annual changes in the point estimate may be statistical noise arising from either the modeling process or survey variability, and may therefore not reflect a real variation in the numbers relying on different fuels between years. The uncertainty intervals should therefore be taken into account when assessing changes in the access rate, or in the use of specific fuels, between years.

GLOBAL AND REGIONAL AGGREGATIONS

Population data from the United Nations Population Division were used to derive the population-weighted regional and global aggregates. Low- and middle-income countries without data were excluded from all aggregate calculations; high-income countries were excluded from aggregate calculation for specific fuels.

ANNUALIZED GROWTH RATES AND FUTURE PROJECTIONS

The annualized increase in the access rate is calculated as the difference between the access rate in year 2 and that in year 1, divided by the number of years 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 rate.

Projected access rates, access deficits, and fuel use can be estimated using the GHEM, where uncertainty increases the further into the future estimates are calculated, reflecting how country trends may shift based on how unsettled they were during the data period.

Projections are hypothetical scenarios in which no new policies or interventions (positive or otherwise) take place, and as such are useful as baseline scenarios for comparing the effect of interventions.

TABLE 2.1 • Overview of data sources for clean fuels and technology

TYPE OF DATA	RESPONSIBLE ENTITY	NUMBER OF UNIQUE COUNTRIES	DISTRIBUTION OF DATA SOURCES (IN %)	QUESTION
Census	National statistical agencies	108	18.40	What is the main source of cooking fuel in your household?
Demographic and Health Survey (DHS)	Funded by USAID; implemented by ICF International	81	17.20	What type of fuel does your household mainly use for cooking?
Living Standard Measurement Survey, income expenditure survey, or other national surveys	National statistical agencies, supported by the World Bank	26	3.00	Which is the main source of energy for cooking?
Multi-indicator cluster survey	UNICEF	80	10.90	What type of fuel does your household mainly use for cooking?
Survey on global AGEING (SAGE)	WHO	6	0.40	
World Health Survey	WHO	50	3.80	
National survey		106	35.80	
Other		79	10.30	

UNICEF = United Nations Children's Fund; USAID = United States Agency for International Development; WHO = World Health Organization.

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