



The State of Access to Modern Energy Cooking Services

Executive Summary

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The Energy Sector Management Assistance Program (ESMAP) is a partnership between the World Bank and development partners and private nonprofit organizations that helps low- and middle-income countries reduce poverty and boost growth through sustainable energy solutions. ESMAP's analytical and advisory services are fully integrated within the World Bank's country financing and policy dialogue in the energy sector. Through the World Bank Group (WBG), ESMAP works to accelerate the energy transition required to achieve Sustainable Development Goal 7 (SDG 7) to ensure access to affordable, reliable, sustainable, and modern energy for all. It helps to shape WBG strategies and programs to achieve International Development Association (IDA) policy commitments and the WBG Climate Change Action Plan targets.

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This report was prepared under the overall guidance of ESMAP's Program Manager, Rohit Khanna. The project team was led by Yabei Zhang and comprised Laurent Durix, Alisha Pinto, Caroline Adongo Ochieng, Jingyi Wu, and Yuhan Wang from ESMAP, Ed Brown and Simon Batchelor from Loughborough University, and Peter George and Donee Alexander from the Clean Cooking Alliance. Dalberg Advisors (www.dalberg.com) acted as the consultants for the report. The Dalberg team was led by Oren Ahoobim, Michael Tsan, and Marcos Paya and comprised Pooja Singhi and Scott Fanuzzi, with external consultant support from Brady Seals, Manuel Oviedo, and Jesse Lichtenstein.

The report relied on input from a wide cross-section of World Bank staff, as well as numerous industry experts, manufacturers, distributors, policy makers, and nongovernmental organizations. This input included interviews with a broad range of global players in the clean and improved cooking sector and across the modern energy spectrum. The project team extends special thanks to the following individuals for their valuable review and technical inputs: Shrikant Avi, Kip Patrick, and Amy Todd (Clean Cooking Alliance); Christine Eibs-Singer and Olivia Coldrey (Sustainable Energy for All); Kimball Chen and Alex Evans (Global LPG Partnership); Elisa Puzzolo (University of Liverpool); Frank van der Vleuten (Netherlands Ministry of Foreign Affairs); Marcel Alers (United Nations Development Programme); Minoru Takada (United Nations Department of Economic and Social Affairs); Marcel Raats and Bianca van der Kroon (Netherlands Enterprise Agency); Sheila Oparaocha (ENERGIA/Hivos); Nathalie Laure Roebbel, Heather Adair-Rohani, and Jessica Lewis (World Health Organization); and Seraphine Haeussling, Sandra Cavalieri, and Yekbun Gurgoz (Climate and Clean Air Coalition).

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CLARIFICATION OF KEY TERMS

Clean cooking solutions—Fuel-stove combinations that achieve emissions performance measurements of Tier 4 or higher following ISO/TR 19867-3:2018 Voluntary Performance Targets (VPTs), which refer to the World Health Organization’s 2014 guidelines for indoor air quality.

Modern Energy Cooking Services (MECS)—Refers to a household context that has met the standards of Tier 4 or higher across all six measurement attributes of the Multi-Tier Framework: convenience, (fuel) availability (a proxy for reliability), safety, affordability, efficiency, and exposure (a proxy for health related to exposure to pollutants from cooking activities).

Multi-Tier Framework (MTF) for cooking—Multidimensional, tiered approach to measuring household access to cooking solutions across six technical and contextual attributes with detailed indicators and six thresholds of access, ranging from Tier 0 (no access) to Tier 5 (full access). The aggregate MTF tier is the lowest tier rating across the six attributes (Annex 1).

Improved cooking services —Refers to a household context that has met at least Tier 2 standards of the MTF across all six measurement attributes but not all for Tier 4 or higher. Household contexts with a status of MTF Tier 2 or Tier 3 are considered in **Transition**.



INTRODUCTION

How we guide progress toward achieving access to modern-energy cooking solutions for all is more critical than ever before. To date, measurements of access have focused primarily on fuel penetration, overlooking many of the contextual factors that shape users' adoption of stoves and fuels. Over the past decade, much attention has focused on expanding access to “clean” cooking solutions, defined by the technical attributes of combustion and heat-transfer efficiency and emissions. However, the 2020 *Tracking SDG 7: The Energy Progress Report* finds that the annual increase in access to clean cooking fuels and technologies between 2010 and 2018 averaged just 0.8 percentage points. In Sub-Saharan Africa, population growth outpaced the annual growth in access. Most progress was in urban areas, with rural areas continuing to fall behind. Clearly, without a more complete understanding of the local context of cooking—including users' cooking experience, their physical cooking environment, and the markets and energy ecosystems in which they live—the uptake and sustained use of the stove technology-and-fuel solutions available today will remain limited.

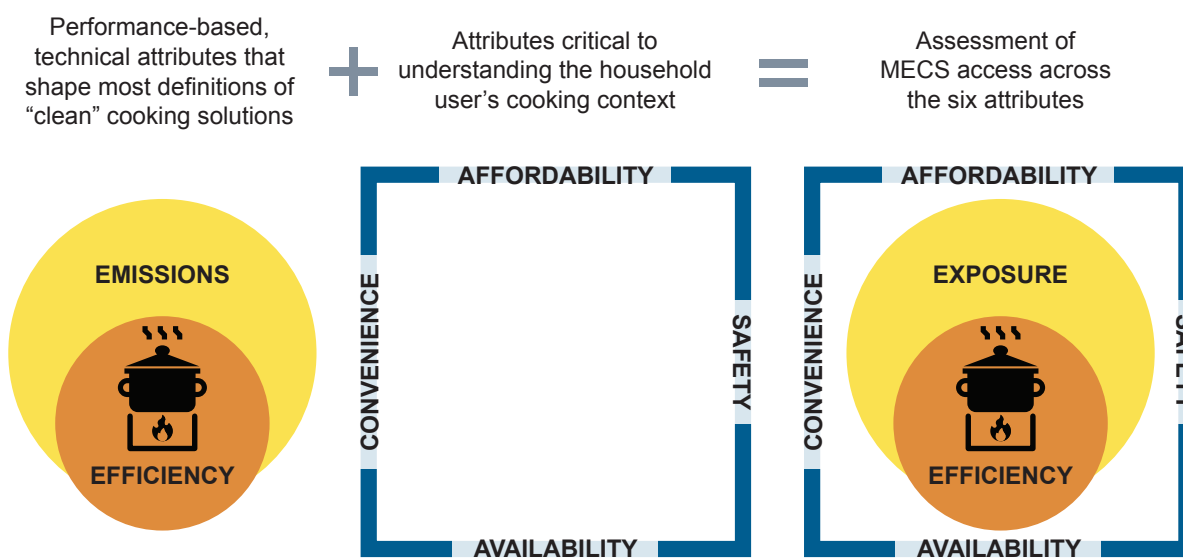
Not progressing beyond the status quo is costing the world more than US\$2 trillion each year. The recent outbreak of the coronavirus disease (COVID-19) underscores the interlinkages between traditional cooking, gender, health, and the environment. Exposure to air pollution is a known risk factor for underlying chronic diseases that are predictive of the severity and outcome for COVID-19 patients. This linkage suggests a heightened risk for women across all age groups who cook using traditional technologies and fuels. Because the UN Sustainable Development Goals (SDGs) are cross-cutting, slow progress in meeting the 2030 SDG 7.1 target—ensuring universal access to affordable, reliable, and modern energy services—hinders progress toward meeting the SDG targets for health, gender equality, and climate, among others. Women and children account for most of the estimated 4 million premature deaths that occur each year from household air pollution (HAP) linked to cooking with traditional stoves and fuels.¹ The health-impact portion alone is estimated at US\$1.4 trillion per year. Women bear a disproportionate share of the cost of inaction in the form of poor health and safety, as well as lost productivity, which is estimated at US\$0.8 trillion annually. In addition, cooking with high-emissions stove technologies with fuels sourced from non-renewable biomass contributes to environmental degradation and adverse climate impacts, estimated at US\$0.2 trillion per year.

FROM BINARY TO CONTEXTUAL ACCESS MEASUREMENT

To date, the Sustainable Development Goal (SDG) 7.1.2 indicator, access to clean fuels and technologies for cooking, has been measured using a proxy of whether households cook primarily with “clean” fuels. While this binary approach has remained the official method for tracking SDG 7 and is also used in this report to estimate the cost of inaction (chapter 2), the growing consensus among practitioners is that measurement of access should reflect a continuum of improvement that focuses not only on fuels but also other attributes of the cooking system that reflect the user’s context and cooking experience. The approach of the International Organization for Standardization (ISO), for example, goes beyond the efficiency and emissions attributes of the World Health Organization’s guidelines for indoor air quality,² providing guidelines for cookstove safety and durability. While an important step forward, the ISO approach is technocentric and does not integrate the cookstove user’s experience. Yet, users’ needs and preferences, along with their context while cooking, can have a large impact on cookstove uptake and should therefore be integrated into the design of cooking interventions.

Accelerating progress requires rethinking how households access modern cooking energy so that solutions are better aligned with users’ priorities. To break the impasse, the World Bank’s Energy Sector Management Assistance Program (ESMAP), in collaboration with Loughborough University and in consultation with multiple development partners, including the Clean Cooking Alliance (CCA), has developed and applied a comprehensive way of measuring progress toward access to modern cooking energy for all. Its broadened, contextual definition of access, termed *Modern Energy Cooking Services (MECS)*, draws on the approach of the World Bank’s Multi-Tier Framework (MTF) for cooking, which offers a formal tool for integrating holistic criteria on users’ needs and preferences into the measurement of access (figure ES.1).

FIGURE ES.1 Holistic Criteria to Measure Access to Modern Energy Cooking Services



Note: “Exposure” considers the contextual factors of ventilation and contact time, in addition to the technical attribute of “emissions.”

The MTF captures detailed, indicator-level data for tracking stepwise progress across tiers of access.

This information encompasses various individual and multiple cooking solutions (i.e., “stacking”), user behavior, and cooking-environment conditions, as well as convenience and safety aspects. Based on the MTF’s multidimensionality, a household that meets the standards of Tier 4 or higher across all six measurement attributes can be considered to have gained access to MECS, while one that scores at least Tier 2 but not Tier 4 or higher across all six attributes is considered in transition, with access to improved cooking services (box ES.1).

BOX ES.1 Key Definitions for Measuring Access

Modern Energy Cooking Services (MECS)—Refers to a household context that has met the standards of Tier 4 or higher across all six measurement attributes of the Multi-Tier Framework (MTF) (figure BES.1.1):

Exposure Personal exposure to pollutants, which depends on both stove emissions and ventilation (higher tiers indicate lower exposure)

Efficiency Combination of combustion and heat-transfer efficiency

Convenience Time spent collecting/purchasing fuel and preparing the stove

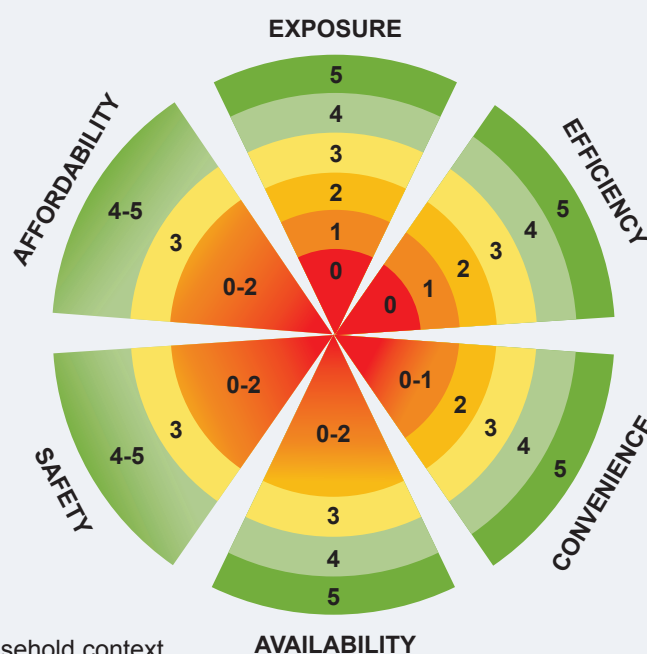
Safety Severity of injuries caused by the stove over the past year

Affordability Share of household budget spent on fuel (higher tiers indicate lower share of spending)

Availability Readiness of the fuel when needed by the user

Improved Cooking Services Refers to a household context that has met at least the Tier 2 standards of the MTF across all six measurement attributes but not all for Tier 4 or higher (figure BES.1.1). Household contexts with a status of MTF Tier 2 or Tier 3 are considered in **Transition**.

FIGURE BES.1.1 MTF Attributes, Showing Tiered Progress toward MECS Access



Source: World Bank.

Note: Each attribute is scored across six tiers (0–5), and the tiers are measured using one or more indicators, each spanning a lower and upper threshold.

The framework allows for disaggregate and aggregate analyses that can yield detailed information about various parameters and indexes that facilitate comparison over time and across geographic areas. Thus, it not only enables tracking of progress toward access to MECS to complement the current approach of tracking SDG 7.1.2.³ It also provides sufficient detail for understanding contextual household-level impact and setting sectorwide aspirations.

Utilizing these analytical tools, this report presents newly compiled evidence and in-depth insights.

These can contribute to better-informed sector decision-making and the design and delivery of more effective solutions that accelerate progress toward meeting the aspirations of the SDG 7.1 target.

WHAT HAVE WE LEARNED?

Using the MECS definition and a more detailed, household-level dataset, this report estimates for the first time that 4 billion people are without access to MECS. Based on a 71-country sample of 5.3 billion people representing 90 percent of lower- and lower-middle-income countries, this report finds that some 4 billion people—about half of the global population—lack the ability to cook efficiently, cleanly, conveniently, reliably, safely, and affordably. Sub-Saharan Africa has the smallest share of people with access to MECS, at 10 percent, while Latin America and the Caribbean and East Asia have the highest shares, at 56 percent and 36 percent, respectively (figure ES.2).

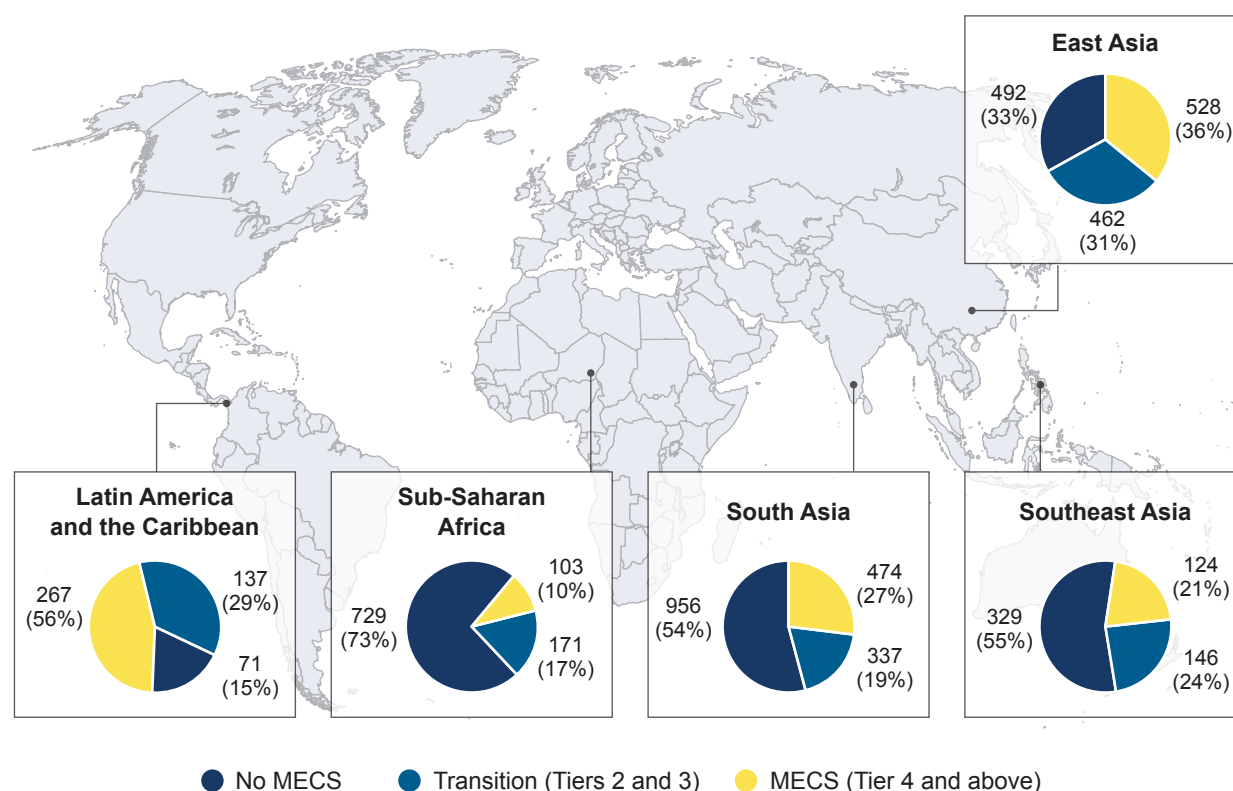
Among those without access to MECS in the study sample, 1.25 billion are considered in transition, while the rest face significant access barriers (figure ES.2). Households in transition are defined as those that currently meet at least the Tier 2 MTF standards across all six measurement attributes, but not all for Tier 4 or higher. Deploying targeted investments and support to those in transition could jump-start progress across this spectrum of access and lead more quickly and effectively toward the achievement of access to MECS by 2030.

New in-depth datasets from the MTF household surveys and multi-country studies, including attitudinal questions, allow sector stakeholders to dig deeper into the “hows” and “whys” of adoption of modern cooking services. In-depth data makes it possible to understand stacking behavior (i.e., use of multiple stoves and fuels in the same household) and thus be able to distinguish between the negative trend of “dirty” stacking with polluting, traditional stoves and fuels and the high potential of “clean” stacking. Even in countries where clean-fuel penetration is relatively strong, affordability and availability factors may drive users, particularly in rural areas, toward less clean, secondary solutions. In Nepal, for example, this report finds that 58 percent of rural households that use liquefied petroleum gas (LPG) as their primary cooking fuel supplement its use with a traditional stove. In rural Myanmar, up to 57 percent of rural electricity users stack with three-stone fires. That said, clean-stacking behavior, which occurs when traditional stove users try modern fuels, can potentially yield positive near- and longer-term results. Specifically, stacking with cleaner stove-fuel combinations—even for such small cooking tasks as boiling water for tea or refrying—represents less use of a lower-tier alternative. And experimentation with lower-emissions solutions may facilitate learning and increase the likelihood of adoption over the longer term.

FIGURE ES.2 Population Access to MECS, by Developing Region

Millions of people and tier %

N = 71 countries



Sources: World Bank MTF country datasets, Demographic and Health Surveys (DHSs), Multi-Indicator Cluster Surveys (MICSs), and Task Team analysis.

OBSTACLES TO PROGRESS

This report finds that progress toward universal access to MECS has been hindered by a lack of interventions and solutions that are fully responsive to the underlying needs of lower-income and rural households. In many countries, this situation is driven by a combination of higher up-front capital costs, low household awareness, and low availability of fuels, owing, in part, to underdeveloped infrastructure. While the number of households accessing such fuels as LPG and electricity has grown over the past decade, the absolute number of people cooking with wood fuels, charcoal, and coal has also increased. This is due, in part, to access interventions not keeping pace with population growth in communities that primarily use biomass and charcoal in traditional stoves that burn fuels inefficiently. While the use of wood as a primary fuel has declined significantly, it remains a major source of household energy across the world (35 percent in this 71-country sample). Most clean-fuel gains can be attributed to large, government-driven fuel transition programs, but the continued availability, perceived affordability, and accessibility of biomass fuels exacerbates the access challenge. Even in rapidly urbanizing settings, users continue to make behavioral trade-offs with their time, health, and safety in order to use the accessible and affordable traditional cooking alternatives.

Slow progress also reflects the fact that the cooking ecosystem—for both supply and demand generation—is complex and fragmented. Based on the Clean Cooking Alliance (CCA) database, the number of fully-dedicated, active manufacturers and distributors in the cooking-operations chain across the world totals 400–500, with approximately 10 percent of enterprises collectively responsible for upwards of 40 percent of stove sales. Across the cooking space, it is difficult to find businesses that have reached volumes that enable economies of scale. In Sub-Saharan Africa, for example, only 15 alternative biofuel businesses (e.g., ethanol and pellets)—less than 18 percent of the estimated active number—consistently supply more than 5,000 households with cooking fuel; just 7 businesses (less than 8 percent) reach over 20,000 households, while only 1 claims to reach more than 100,000 customers on a regular basis (2017 figures). Across other cooking-solution categories, only a handful of players have successfully cracked the 200,000 stove mark, largely as a result of integrating production (e.g., through an owned factory). A variety of demand-stimulation interventions continues to drive the uptake of clean cooking solutions. However there remains a dearth of knowledge and a lack of consensus on what behavior-change approaches can spur adoption of clean cooking solutions once the supply-side challenges are tackled.

Lack of an enabling environment—along with the absence of “champions” and intergovernmental coordination—has also hindered progress. For example, for cooking industry suppliers looking to achieve greater penetration of clean fuels and high-efficiency, low-emissions technologies, the fiscal and trade environment is a significant, ongoing obstacle. High taxes and misaligned tariff codes, in particular, are hindering industry growth and dampening product adoption. In the early stages of market development when local supply is inadequate, poorly calibrated tax and tariff regimes make it especially difficult to import fuel-production equipment, quality stoves and components, and clean fuels. In many contexts, LPG is stored as a liquid, but taxed as a gas, which limits the opportunity for more efficient global value chains and impedes players from adequately storing and reliably supplying fuel. In addition, clean biofuels like ethanol and formally distributed pellets and briquettes nearly always face sales taxes (i.e., value-added tax) and, in many cases, high levels of import duty. For example, in many African countries, denatured ethanol faces duties in a range of 5–25 percent.

Moreover, the lack of coordination within and between institutions in country contexts has stymied cooking interventions from becoming high-impact policy priorities. Multiple countries in Sub-Saharan Africa—where financing could potentially have the greatest impact—have seen financing commitments more than halved. This challenge is exacerbated by the cross-cutting nature of cooking policy and interventions; that is, truly holistic solutions require the participation of stakeholders across multiple sectors, ranging from energy, health, climate, industry, and finance to rural and urban development, gender, and social protection, among others. In addition, many countries are still without clear access targets for cooking. While governments may include accelerating access to modern cooking energy in their policy agendas, they often lack the required institutional leadership and incentives for making major progress. Furthermore, a lack of integrated energy planning often isolates electrification programs from cooking policies and interventions.

ENCOURAGING TRENDS

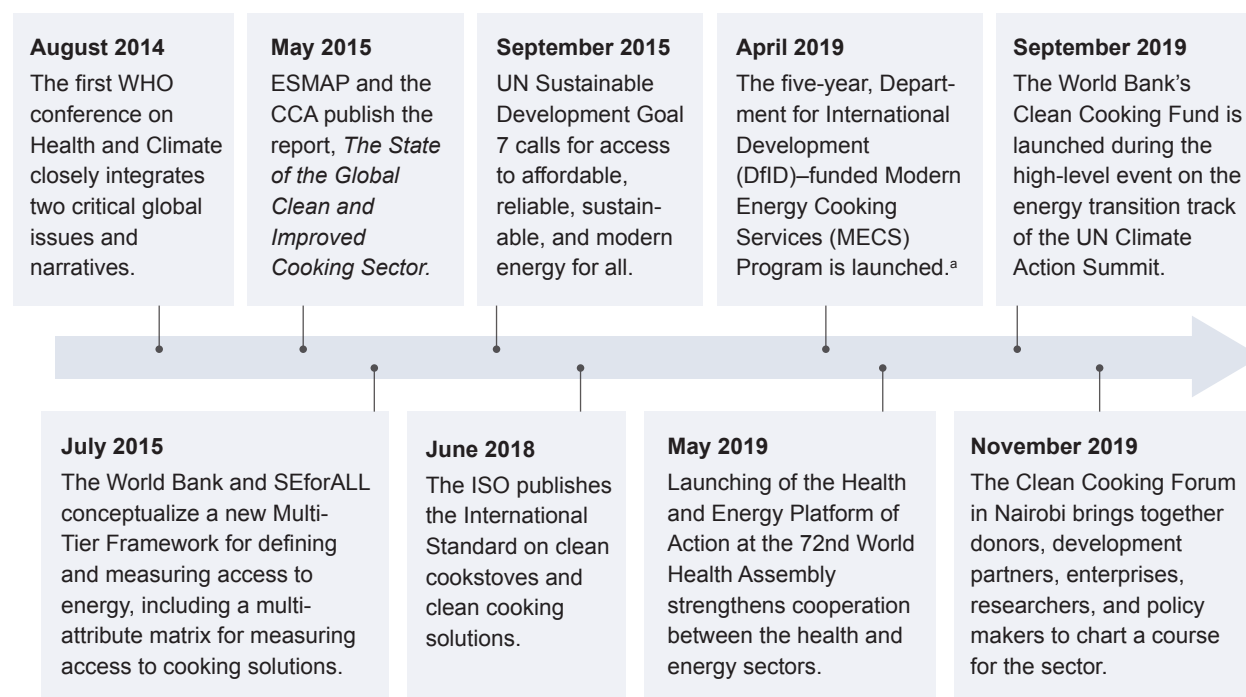
Accounting for and leveraging the “bright spots” identified in this report are urgently needed to overcome the slow and, in some regions, stagnant progress to date. Positive trends include greater penetration of clean fuels and clean stacking patterns. Within this report’s 71-country study sample, electricity accounts for 10 percent of the global share of cooking fuels, while LPG, natural gas, and biogas comprise another 37 percent. These gains for clean fuels have come at the expense of coal and kerosene, which have seen relative declines. Increasing levels of urbanization and generationally-linked behavior change (a younger demographic showing higher preference for clean cooking solutions) are likely to accelerate the use of both primary and secondary clean fuels within households, which can facilitate the transition away from harmful and

gradually price-uncompetitive options, such as charcoal. Urban households across income quintiles are facing higher charcoal prices, while the affordability of LPG, electricity, ethanol, and biomass pellets is improving. New business models, including decentralized ethanol distribution, pay-as-you-go (PAYGo) models for LPG distribution, and microcredit, have seen growing success, particularly in urban and peri-urban settings; these are opening up channels for increased accessibility, reliability, and affordability of MECS.

In addition, greater institutionalization development in the cooking space and a growing commitment to increasing sector financing are encouraging trends for expanding MECS access. The progression of sector dialogue since the establishment of the SDGs points to a space where donors, development partners, policy makers, and enterprises, among many players, are brought closer together with a more consistent focus on outcomes (figure ES.3).

Among the players long involved in funding cooking interventions, financial resources are moving in the direction of access to MECS. High-profile, results-based financing (RBF) programs include the World Bank's recently announced US\$500 million Clean Cooking Fund, housed under the Energy Sector Management Assistance Program (ESMAP). The Clean Cooking Fund will offer RBF grants, primarily at national and subnational scale, to help countries incentivize the private sector to deliver MECS. The World Bank's Carbon Initiative for Development (Ci-Dev) Facility and the Netherlands Enterprise Agency's RVO SDG 7 Partnership Facility also aim to attract private-sector financing to deliver MECS or improved cooking services. In the United Kingdom, the Foreign, Commonwealth and Development Office's MECS Challenge Fund supports early-stage research to stimulate innovation in modern-energy cooking technologies and systems, as well as the

FIGURE ES.3 Key Sectorwide Milestones, 2014–19



Source: World Bank.

a. On September 2, 2020, the Department for International Development (DfID), which functioned as a ministerial department since May 1997, merged with the Foreign and Commonwealth Office to create the Foreign, Commonwealth and Development Office (FCDO).

advancement of technology-based cooking-energy products, processes, and services in low-income countries. The Clean Cooking Alliance's Cooking Industry Catalyst program provides seed funding and capacity building to increase the pipeline of investment-ready companies that design, manufacture, and sell clean cooking solutions in developing countries around the world. Beyond the traditional cooking space, but critical to accelerating modern energy uptake, the consolidation and expansion of funds focused on climate-change mitigation and renewable-energy access, including the Green Climate Fund and the Africa Climate Change Fund, among many others, can help open new avenues for better integration of cooking objectives within broader energy policy. The potential for integration also exists within governments and with donors allocating resources to health, gender-equality, and social-protection interventions.

NEED FOR LEAST-COST, BEST-FIT APPROACH TO ACCELERATE MECS ACCESS

A more in-depth, user-centered understanding of cooking contexts, underpinned by recent structural advances and technology innovations, should inform a least-cost, best-fit approach. National roadmaps for MECS access should reflect transition pathways based on users' needs and local market realities. A more detailed understanding of households' local cooking context (e.g., fuel-and-stove usage and spending/purchasing patterns, product functionality, and cooking location, among other factors) must be used to inform the development of services and infrastructure that help accelerate progress toward MECS access.

This means using granular household cooking data as an input for broader, national-level energy decision-making—a process that capitalizes on energy-system investments, incentives for clean energy consumption, and trade and energy investment policies that best leverage national comparative advantages. In geographies where broad-based electrification programs are already under way, this may mean accelerating the transition to electric cooking. In the context of enhanced LPG access, it may mean a push toward efficient gas cooking. In still other settings, where incentives for producing and distributing ethanol or highly efficient gasification technologies are in place, it may mean spurring alternative biofuel use. In short, a least-cost, best-fit approach can best address the urgent challenge of achieving access to MECS as 2030 quickly approaches.

With this more complete understanding of cookstove users comes a recognition of the inherent and potential limits of purely market-based solutions. While private sector-driven innovation should be encouraged, taken alone, current stove and fuel services, which remain subscale and underfinanced, will not ensure universal access to MECS by 2030. Most businesses in the space remain unprofitable and have yet to reach scale. An analysis of the current industrial stove market, limited to those supplying clean stove-and-fuel combinations, reveals that the cooking space currently features approximately 50 consistently profitable and stable, cooking-focused businesses or approximately 10 percent of the total formalized industry. In addition, total financing levels remain critically low. Investors and funders have been unwilling to provide a critical mass of capital to the modern-energy sector owing, at least in part, to the perceived riskiness of these enterprises. Grant volumes are small, and a critical share of the non-grant financing in the cooking space is poorly adapted to the volumes or financial structures needed by businesses in the sector. Moreover, innovative financing instruments (e.g., carbon finance) fail to reach their beneficiaries at the right time.

Despite these industry challenges, advances in technology and commercial innovation have made sector scalability and growth a potential reality. Recent advances across a range of technologies, aided by the introduction of new payment and financing approaches, are helping to make MECS more affordable for many more households. While not exhaustive, pellet-gasifier stoves, electric pressure cookers, and bottled ethanol are all examples of important innovations in making MECS increasingly accessible. Equally significant, such business models as PAYGo for LPG and biogas/gasification, microfinancing for LPG, and distribution

partnerships/bundling with off-grid solar companies are transforming the way that end-user consumers are progressing toward MECS access.

Given the nascent state of market-based solutions, steep affordability gaps, and high negative externalities associated with limited access to MECS, a good case can be made for public support to underserved populations. A combination of enabling policies, including results-based incentives and targeted infrastructure investments (notably in the generation, transmission, and distribution of clean energy), will prove essential for accelerating access to MECS, particularly in rural settings, as nascent product and fuel markets develop. These should be supplemented by expansive behavior-change campaigns that take a systemwide approach to MECS adoption and adherence (e.g., by underscoring the benefits of improved ventilation and the lifetime value and impact of using highly efficient stove-and-fuel combinations). Ultimately, public support, in the form of policies, incentives including direct subsidies, and infrastructure investments, can pave the way for market-based approaches where access gaps are largest and market failures are most acute.

MOVING THE SECTOR FORWARD

Without evolving beyond the status quo, the goal of universal access to MECS will remain out of reach for 4.5 billion people by 2030. Based exclusively on expected population growth and urbanization over the next decade, a majority of the populations in Sub-Saharan Africa, South Asia, and Southeast Asia would be expected to remain below Tier 2 in 2030. In Sub-Saharan Africa, for example, this would amount to nearly 400 million more people without access to improved or modern cooking solutions. This disappointing potential reality not only points to the size of the 2030 access challenge; it also underscores the need to intentionally mobilize solutions at significant scale.

TRANSITIONING TO GREATER ACCESS

This analysis estimates the total cost of transitioning to universal MECS access by 2030 at approximately US\$1.5 trillion, or US\$148–156 billion annually over the next 10 years. This analysis, the MECS Scenario, builds on a 2030 forecast and segmentation of the population not expected to reach MTF Tier 4 or higher, based on current policies. Achieving universal access implies a significant transformation of the current energy systems to meet the requirements needed to lift all households currently at Tiers 0–3 to at least Tier 4. Of this cost, it is expected that approximately 26 percent (US\$39 billion per year) will be shouldered by governments and development partners, in part, to ensure that affordability criteria are met; 7 percent (US\$11 billion per year) by the private sector to cover the installation of downstream infrastructure essential to the functioning of modern-energy cooking markets; and the remaining 67 percent (US\$103 billion per year) by households' direct contributions for stoves and fuels (figure ES.4). As large as the required investment commitment appears, the avoided cost of inaction for health, gender, and climate/environment is 16 times greater over the same 10-year period.

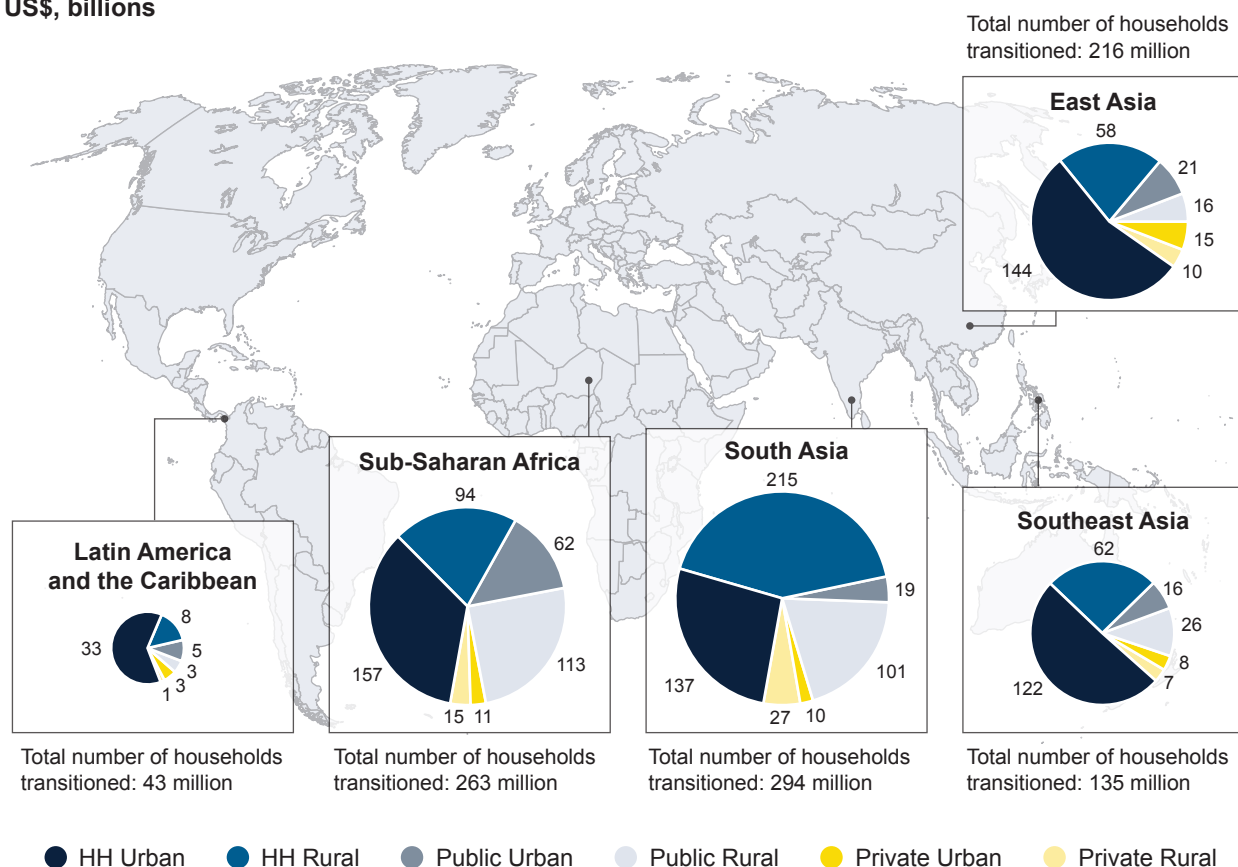
A more pragmatic, though less ambitious, scenario considers universal access to improved cooking solutions by 2030, at an estimated total cost of approximately US\$100 billion. This alternative Improved Cooking Scenario uses similar assumptions as the MECS Scenario for population growth and urbanization, but focuses costing on only a Tier 2 + 3 migration using improved cookstoves; that is, the cost of transitioning all households expected to fall into Tiers 0 or 1 to at least Tier 2 (the lowest transition tier). At a much lower cost than the MECS Scenario, the Improved Cooking Scenario raises the baseline for future Tier 4 (and higher)

transitions, putting into play a sufficiently disruptive technology that can eliminate the most polluting and unhealthy cooking solutions. Its aim is to migrate millions of lowest-access households along a continuum of access—giving priority to supporting the poor with much less public-funding commitment to ensure no one is left behind. From a regional standpoint, the majority of expenditure for the Improved Cooking Scenario, like the MECS Scenario, would be concentrated in the Sub-Saharan Africa and South Asia regions, which feature large rural populations (figure ES.5). Of the US\$10 billion in annual cost, the public sector would invest US\$6 billion per year, with households contributing the other US\$4 billion.

Any future pathway to universal access to MECS will require strong collaboration between public and private sectors in order to develop robust modern-energy markets for households. While both scenarios account for high levels of public-sector commitment (potentially with donor support), especially in the lowest-income countries, a significant share of the MECS reality will depend on private-sector investment. This is notably the case for the core capital infrastructure necessary to get the supply chains up and running for clean cooking fuels.

FIGURE ES.4 MECS Scenario: Total Cost to Transition over 10 Years, Disaggregated by Region, Locality, and Contributor

US\$, billions

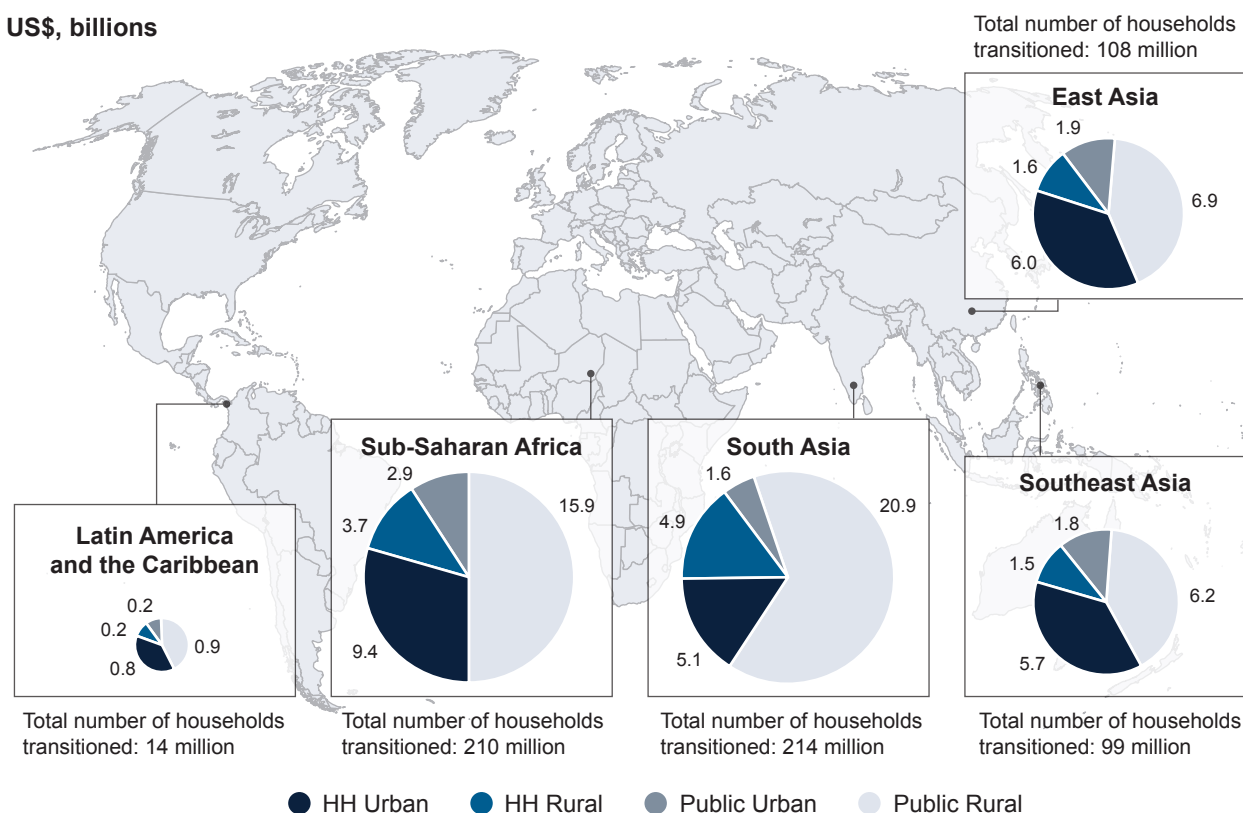


Sources: ESMAP access to MECS costing model; World Bank MTF data; Task Team fuel-mix database.

Note: The sizes of the pies represent the respective regional contributions to the total transition cost. HH = household contributions, Public = government and development-partner contributions, and Private = private-sector contributions.

FIGURE ES.5 Improved Cooking Scenario: Total Cost to Transition over 10 Years, Disaggregated by Region, Locality, and Contributor

US\$, billions



Sources: ESMAP access to MECS costing model; World Bank MTF data; Task Team fuel-mix database.

Note: The sizes of the pies represent the respective regional contributions to the total transition cost. HH = household contributions and Public = government and development-partner contributions.

PRIORITY ACTIONS FOR THE SECTOR

Charting a course to meet the aspirations of SDG 7.1 will prove challenging; but targeted actions that expand MECS access can guide the sector forward. Driving progress forward requires mobilizing financial and analytical resources to improve the overall cooking ecosystem, as well as innovative technologies and partnerships. In particular, the sector needs to adopt several priority actions:

- **Create high-profile coalitions of political leaders to prioritize MECS access in global and national arenas.** The United Nations' Health and Energy Platform of Action (HEPA); the proposed High-Level Coalition of Leaders for Clean Cooking, Energy and Health; and other coalitions are critical for raising the stakes for implementing measures to achieve SDG 7.1 and affirming cooking as an essential component of energy policy. Such coalitions generate the political will and incentives needed to embed cooking within cross-cutting, national policy making and create a context for countries in transition to learn from each other and ensure coordinated action.
- **Formalize cooking energy demand in national energy planning and development of strategies for achieving universal access.** Such energy planning and strategy development require expanded implementation of the MTF and other national household-level surveys, combined with the sharing of lessons

and insights through open-data platforms and consultation with a full range of stakeholders, to undertake more evidence-based decision-making, with households as the key unit of analysis. The transition pathways of national roadmaps to universal access should be guided by a least-cost, best-fit strategy that reflects diverse users' needs, local market conditions, and national comparative advantages on energy resources.

- **Dramatically scale up public and private financing for MECS.** To reach universal access to MECS, investment needs to be scaled up from the tens of millions to tens of billions, along with dedicated policies. Such investment includes not only the initial capital costs of stoves and deposit/connection fees, but also the energy infrastructure costs and additional subsidies required to make the clean-fuel costs affordable to the poorest consumers. Large-scale grant resources for MECS are particularly needed to scale up the availability, diversity, and volume of capital in the sector, as well as stimulate product and business-model innovations. Integrating the envisioned progress toward universal access to MECS with that of electrification as part of energy-access efforts is also critical to underpinning the scale and impact of allocated public resources and private-sector capital.

NOTES

1. One should note that deaths attributable to household air pollution (HAP) are greater among males than females because the underlying burden of disease is higher for men; see World Health Organization (WHO), *Guidelines for Indoor Air Quality: Household Fuel Combustion* (Geneva: World Health Organization, 2014).
2. World Health Organization (WHO), *Guidelines for Indoor Air Quality: Household Fuel Combustion* (Geneva: World Health Organization, 2014).
3. International Energy Agency, International Renewable Energy Agency, United Nations Statistics Division, World Bank Group, World Health Organization (IEA, IRENA, UNSD, WBG, WHO), *Tracking SDG 7: The Energy Progress Report* (Washington, DC: World Bank Group, 2018, 2019, 2020).

