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LSMS GUIDEBOOK

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Measuring Energy Access

A Guide to Collecting Data Using
'The Core Questions on Household Energy Use'

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Prepared by

The World Bank and the World Health Organization (WHO)

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ABOUT LSMS

The Living Standards Measurement Study (LSMS), a survey program housed within the World Bank's Development Data Group, provides technical assistance to national statistical offices in the design and implementation of multi-topic household surveys. Since its inception in the early 1980s, the LSMS program has worked with dozens of statistical offices around the world, generating high-quality data, developing innovative technologies and improved survey methodologies, and building technical capacity. The LSMS team also provides technical support across the World Bank in the design and implementation of household surveys and in the measurement and monitoring of poverty.

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ABOUT THIS SERIES

The LSMS Guidebook series offers information on best practices related to survey design and implementation. While the Guidebooks differ in scope, length, and style, they share a common objective: to provide statistical agencies, researchers, and practitioners with rigorous yet practical guidance on a range of issues related to designing and fielding high-quality household surveys. The series draws on experience accumulated from decades of LSMS survey implementation, the expertise of LSMS staff and other survey experts, and new research using LSMS data and methodological validation studies.

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ABBREVIATIONS AND ACRONYMS

CO	Carbon monoxide
DECPM	Development Data Group's Data Production and Methods Unit
EEA	European Environment Agency
ESMAP	Energy Sector Management Assistance Program
HAP	Household Air Pollution
IEA	International Energy Agency
kWh	Kilowatt-hour
LPG	Liquid petroleum gas
LSMS	Living Standards Measurement Study
MICS	Multiple Indicator Cluster Survey
MTF	Multi-Tier Framework
NGO	Non-Governmental Organization
PAHO	Pan American Health Organization
SDGs	Sustainable Development Goals
SEforALL	Sustainable Energy for All
UN	United Nations
UNDP	United Nations Development Program
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization

EXECUTIVE SUMMARY

Energy access, characterized by access to electricity and clean household energy services, is a critical determinant of growth and development. Energy usage permeates the lives of individuals in many ways, such as lighting, cooking, and communication, to name just a few. As such, any deficit in energy access will likely have a significant impact on welfare, as recognized by Sustainable Development Goal (SDG) 7, which calls for access to affordable, reliable, sustainable and modern energy for all. Access to electricity and clean household energy has the added benefit of catalyzing actions geared towards meeting the other SDGs, including poverty eradication, gender equality, mitigation of and adaptation to climate change, food security, health, education, sustainable cities and communities, clean water and sanitation, jobs, innovation, and transport.

Energy access impacts the lives of individuals and communities in myriad ways. Reliable electricity supply can enhance economic activities within a household, resulting in improved household and individual wellbeing. Reliable access to electricity in the evening can lead to improvements in educational outcomes, as lighting aids studying, and thereby learning. Clean cooking solutions play a major role in improving global health outcomes by minimizing household air pollution and its harmful impact on health. Studies have shown that reliance on traditional polluting stoves negatively impacts socioeconomic development, gender equality, education, and climate; clean cooking solutions help to reduce these impacts.

Energy modules in multi-topic household surveys typically include only broad questions on household access to a national electricity grid and the main cooking fuel used by the household. In our review of 78 household surveys in low-income and lower-middle-income countries, only a third collected information about the main source of energy used for lighting the dwelling. Moreover, less than eight percent of the surveys collected information about household expenditures on electricity (Appendix 5). The oversimplified questions in these surveys do not take into account other variables of energy access, such as the use of multiple fuels and devices, varying levels of access and use, quality and safety of the energy source, or the importance of other household energy activities (such as space heating and lighting).

Tracking progress towards Sustainable Development Goal 7.1 to “ensure universal access to affordable, reliable, and modern energy services” provides a unique opportunity for understanding energy access and its impacts. SDG 7.1 consists of two indicators: 7.1.1 “Proportion of population with access to electricity” and 7.1.2 “Proportion of population with primary reliance on clean fuels and technology”.

To track these indicators and in response to the key recommendation from the UN High-Level Dialogue on Energy for improved availability and quality of energy data, a household energy access questionnaire, the **Core Questions on Household Energy Use** (Appendix 1), has been developed by the World Health Organization (WHO) and the World Bank’s Energy Sector Management Assistance Program (ESMAP), in close collaboration with the World Bank’s Living Standards Measurement Study (LSMS) and other contributors. The household energy access questionnaire consists of a series of cohesive modules that can be incorporated into existing household surveys. The questions include those essential for the measurement of household access to electricity and clean household energy, allowing for monitoring SDG indicators 7.1.1 and 7.1.2 as well as conducting a detailed analysis on the limits of and barriers to access. An additional set of recommended questions for fully assessing household energy use and its corresponding health impacts is also provided (Appendix 2), as well as a manual for training enumerators (Appendix 3), and a photo guide containing visual and descriptive examples of cooking, heating, and lighting energy options (Appendix 4). A comprehensive multi-tier framework for assessing household access to cooking services is included in Appendix 6.

These refined survey questions not only establish whether a household has electricity access and the main cooking fuel, but go a step further by highlighting the type of electricity access, the quality of access, impediments to access, the type of fuels and devices used for cooking, heating and lighting, and important safety and livelihood impacts of household energy use. This detailed understanding will facilitate designing and implementing policies that lead to improved health outcomes and contribute to accomplishing other SDGs related to gender equality, economic opportunities, and other measures of wellbeing. Presenting rigorous and credible evidence of the broad and significant benefits of clean energy transition policies and programs not only demonstrates commitment to meeting the SDGs but can also help countries secure support from donors and stakeholders with diverse priorities.

The central goal of the questions presented in this guide is to fill the data gaps enumerated above as well as to enable the comparison and validation of data across countries through a harmonized administration of these questions worldwide. Ultimately, we hope that the resulting data will contribute to effective policies in addressing the global health crisis posed by the proliferation of polluting household energy sources and other negative development impacts that stem from reliance on inefficient household energy sources.

This guidebook provides survey practitioners with the requisite tools and technical support to successfully integrate the new energy access questions into existing national household surveys. It also provides support on the computation of data collected to track the progress toward SDG 7.1, towards informing more effective policies and programs.

The document is organized as follows: the first section establishes the need for improving survey questions intended to capture household energy use. Section 2 focuses on tracking SDG 7.1.1 on the proportion of population with access to electricity. Section 3 presents the methodology to track SDG 7.1.2 on the proportion of population with primary reliance on clean fuels and technology. Finally, Section 4 provides guidance on integrating the Core Questions on Household Energy Use into existing surveys. The survey module is presented in full in Appendix I.

I. Introduction

Access to clean household energy is fundamentally tied to universal health and development. Unfortunately, millions of households across the globe still lack access to electricity and clean energy for cooking, heating, and lighting. To fully understand energy access and its impact on the welfare of a country, two critical areas must be measured: 1) electricity access and 2) the fuels and technologies used for cooking, heating, and lighting.

Low-income countries suffer disproportionately from a lack of access to electricity and clean energy for cooking, space heating, and lighting, leading to poor health and adverse economic impacts. While national electricity grids have been expanded to add more than 1.7 billion people in the last 20 years, most of this expansion covered people in urban areas. Meanwhile, rural areas continue to suffer disproportionately from a lack of access to electricity, attributable in part to the higher costs of reaching remote areas. For example, in Africa, unsubsidized electricity connection costs tend to be greater than the average monthly income per person, making electricity access less of a priority for some families. In sub-Saharan Africa and South Asia, the percentage of the population without access to electricity is 63.5 and 20 percent, respectively (World Bank 2017).

Similarly, there are enormous gaps in access to clean fuels and technologies for household cooking, space heating, and lighting. While the percentage of people with access to clean fuels and technologies for cooking has increased globally, some 3 billion people still rely on polluting fuels and technologies for cooking (IEA *et al.* 2020). Polluting fuels combined with inefficient cooking devices are a deterrent to growth and improved welfare, as they create dangerous levels of household air pollution, which is associated with a wide range of adverse health impacts including acute lower respiratory infections, chronic obstructive pulmonary disease, lung cancer, cataract, stroke, and ischemic heart disease (WHO 2018). A growing body of evidence links household air pollution

exposure from cooking to an increased risk for adverse pregnancy outcomes and tuberculosis (UNDP and WHO 2009; World Bank 2011; WHO 2016). The WHO (2018) estimates that 3.8 million people die each year from household air pollution due to cooking alone, not including pollution from lighting and heating.

The international community has recognized the importance of household access to electricity and clean household energy (cooking, space heating, and lighting solutions), and the need to capture a comprehensive picture of user experience, health impacts, and barriers to the adoption of improved sources. The global commitment to this issue is most evident in the inclusion of energy access in the Sustainable Development Goals agenda, where Goal 7 is “ensure access to affordable, reliable, sustainable and modern energy for all” and includes Indicators 7.1.1 ‘Proportion of population with access to electricity’ and 7.1.2 ‘Proportion of population with primary reliance on clean fuels and technology’. To complement the SDG 7 binary indicators, The Energy Sector Management Assistance Program’s (ESMAP) developed Multi-Tier Framework (MTF) approach with more nuanced measures of energy access, including the affordability and reliability aspects that Governments and stakeholders can use to inform policy and investment decisions (Bhatia and Angelou, 2015).

I.1 THE NEED FOR IMPROVED SURVEY QUESTIONS

There is a clear need to improve assessments of household access to electricity and clean energy solutions. While geographic coverage for energy access data has increased in recent years, most surveys that collect and report information on energy access provide very simplistic data, often reported as a binary metric. For electricity access, this typically takes the form of a question on whether the household is connected to a national electricity grid, with-

out considering the quality and quantity of the service received (ESMAP 2015). This approach is far too simplistic for a multifaceted issue like electricity access, which must be measured across a wide and comprehensive range of factors. For instance, in many developing countries, grid electricity suffers from irregular supply and timing, frequent breakdowns, and voltage fluctuations. A binary question on household electricity connection cannot adequately address all these important factors.

Electricity

Existing data on electricity often rely on binary questions concerning connection, minimum service and minimum consumption thresholds, or use of specific fuels. Determining household electricity access based on these common binary indicators collapses a continuous phenomenon into two discrete classifications, rendering the data insufficient for understanding the nuances of household energy use and barriers to access (ESMAP 2015). Another disadvantage is that these indicators use different thresholds that are dependent on external factors and cannot be captured in a single concise indicator (Day 2017). Indicators such as per capita consumption or energy supply vary based on household income and size, source reliability and capacity, and energy efficiency. Using a binary metric of household electricity connection as a sole measure of electricity access ignores issues of quantity, quality, reliability, duration, affordability, formality, and safety of the electricity supply. Nonetheless, a review of 78 existing household surveys and their coverage of energy-related questions (presented in further detail in Appendix 5) finds that almost two-thirds of the surveys included only a simplistic yes/no question on the existence of household electricity, while less than four percent of surveys asked why households are not connected to a grid – a critical question for informing policy.

Cooking, Heating and Lighting

Household surveys that assess cooking-related energy use typically include a single question on the primary cooking fuel as a binary indicator of whether the household relies on solid fuels for cooking. Solid fuels including wood, agricultural residues, animal dung, and coal, and are considered polluting and harmful to health. However, reporting only on “solid fuels” fails to capture the use of liquid fuels like kerosene, which is specifically discouraged by the 2014 WHO “Guidelines for Indoor Air Quality:

Household Fuel Combustion” (discussed in detail below). Additionally, data on the type of fuel used is insufficient without data on the appliance with which it is used. For example, some stoves that burn solid fuel (e.g., biomass pellets) can meet the emission rate targets for particulate matter recommended by the WHO Guidelines and be considered clean for health. Thus, it is critical to include survey questions that assess both the *technology* used for cooking, as well as the specific *type of fuel*. It is also useful to collect data on more than just the primary fuel and technology used for cooking since households often engage in fuel “stacking”, which involves the parallel use of multiple fuels and cooking devices in the same household (SEforALL 2014).

Historically, surveys have focused on questions about the primary fuel used for cooking without considering other important household energy uses, such as space heating and lighting. A household that uses a clean stove and fuel combination for cooking but still relies on an open fire to heat their home has not fully realized the benefits of reduced cooking emissions, since they are still exposed to polluted air. As the goal is an *overall* reduction in household air pollution, data on lighting and heating fuels and devices should be collected along with data on cooking solutions. SDG indicator 7.1.2 refers to the proportion of the population with primary reliance on clean fuels and technologies (without specific reference to cooking), and should be calculated based on the use of clean fuels and technologies for cooking, space heating, and lighting when this data is available – that is, as countries adopt the revised survey questions. Other factors, such as ventilation, fuel availability, safety, affordability, and convenience (such as the time involved in obtaining or preparing fuel) are also important to consider. ESMAP has developed a Multi-Tier Framework for assessing household energy access, which puts the users’ experience at the center, taking into account all of these attributes (see Appendix 6).

More granular household energy data can facilitate energy policy analysis and energy infrastructure planning. Currently, household energy data collected from national household surveys do not capture the dimensions needed to understand the role that energy services play in poverty reduction and, therefore, do not allow for extensive energy policy analysis. In turn, specialized stand-alone energy surveys do not have the breadth of topics and geographical scope of many national household surveys, such as LSMS surveys (O’Sullivan and Douglas 2006).

Integrating the recommended energy survey module into multi-topic household surveys can provide crucial empirical evidence for policy makers to make informed decisions on energy policy and investments.

In order to effectively measure progress towards the SDGs and inform energy sector policy beyond SDG tracking, it is essential to implement sound methodology for measuring SDG 7.1.1 and 7.1.2 as well as the many dimensions of household access to electricity and clean household energy. To this end, the World Bank (the custodial agency for indicator 7.1.1) and the WHO (the custodial agency for indicator 7.1.2), in consultation with a wide range of partners and stakeholders, have developed a comprehensive set of new household energy survey questions related to cooking, heating, lighting, and electrification. **These questions capture the relevant data needed to track progress towards SDG 7.** The questions also capture information on household electricity access and use of clean energy solutions far beyond the scope of previously used limited approaches.

1.2 DEFINING CLEAN

Given that SDG indicator 7.1.2 estimates the proportion of population with primary reliance on clean fuels and technology, it is important to provide a definition of ‘clean’ when it comes to fuels and technology. This section explores relevant definitions before describing the methodology used to measure this indicator.

In light of the enormous negative impact of household air pollution exposure on health outcomes, the WHO issued its first set of normative guidelines addressing energy use in the home in 2014. The WHO “Guidelines for Indoor Air Quality: Household Fuel Combustion” (hereafter known as the “WHO Guidelines”) highlight the importance of addressing **all household energy uses** in the home. The guidelines also provide recommendations on emissions rate targets for particulate matter and carbon monoxide (CO) emissions, as well as on specific fuels and devices that are clean, safe, and pose minimal risks to health.

According to the WHO Guidelines, a heating or cooking device that burns biomass is classified as clean if it is used in a device that meets the emissions rate targets for particulate matter and carbon monoxide as outlined in the WHO Guidelines, and as confirmed in laboratory

or field tests conducted by a third party.¹ Clean fuels and technologies include:

- **For cooking:** solar, electric, liquid petroleum gas (LPG) or cooking gas, natural gas, biogas, and alcohol/ethanol.
- **For space heating:** central heating, solar air heaters, electricity, natural gas, LPG/cooking gas, biogas, and alcohol/ethanol.
- **For lighting:** electricity (including solar panels); solar-powered lantern or flashlight; rechargeable flashlight, mobile, torch, or lantern; battery powered flashlight, torch, or lantern; biogas lamp; and LPG lamp.

The use of proper ventilation (such as a chimney, hood, fan, open window, or outdoor space) while heating and cooking can help reduce exposure to pollutants. However, these considerations do not affect the classification of the fuel/technology combination as clean or polluting, as they do not alter the emissions that occur in the immediate vicinity of the device or fire. A cooking, heating, or lighting solution is only categorized as clean if the emissions will be safe for health in all conditions and locations.

Due to their associated health risks, the WHO Guidelines recommend that unprocessed coal should not be used and the use of kerosene is also discouraged. Kerosene, also known as paraffin, is a *liquid* or *nonsolid* fuel that is a major source of air pollution because it emits formaldehyde, poly-aromatic hydrocarbons, and particulate matter, including black carbon, which is a major contributor to near-term climate warming. One epidemiological study (Pokhrel *et al.* 2010) found the relative risk for tuberculosis to be nine times higher for households that use kerosene for lighting compared to those that rely on electricity. Kerosene is also the leading cause of childhood poisoning, fires, and burns in low- and middle-income countries (Lam *et al.* 2012).

¹ Using the tier guidance in ISO 19867-3 *Voluntary performance targets for cookstoves based on laboratory testing*, stoves or heaters meeting tier 4 or tier 5 for PM_{2.5} emissions are classified as **clean**. A stove or heater that achieves tier 3 for PM_{2.5} emissions is classified as **transitional**, indicating that it provides substantial reductions in health risk, but cannot be considered clean for health. Stoves and devices that achieve below the tier 3 level are considered polluting. For CO emissions, a stove or heater that achieves tier 5 is classified as **clean**; devices meeting tier 4 and 3 are classified as **transitional** and devices meeting tiers 2, 1 and 0 are classified as **polluting**. While the ISO 19867-3 guidance was developed for cookstoves, these tiers can also be used to classify space heating devices as clean, transitional, or polluting, as the PM_{2.5} and CO emission levels used to derive the tiers are based on the WHO Guidelines, which apply to household fuel combustion devices (ISO TR 19867-3:2018 available at <https://www.iso.org/standard/73935.html>). Please also see <https://www.who.int/tools/clean-household-energy-solutions-toolkit/module-7-defining-clean> for additional information

A limitation with this definition of “clean” is that it only accounts for the technical attributes of the type of fuel and does not consider the combustion performance of fuel in cooking device, except for biomass fuel with the reference to ISO 19867-3. Furthermore, the definition doesn’t encompass the user perspective and contextual nature of a household’s decision making of cooking solutions. A more comprehensive perspective to cooking access is encapsulated in the Multi-Tier Framework (see Appendix 6 for tier definitions and calculation of algorithms).

1.3 CORE QUESTIONS ON HOUSEHOLD ENERGY USE: IMPROVEMENTS OVER PREVIOUS APPROACHES

Given the complexity in defining clean fuels and technologies and the inadequate binary approach to measuring electricity access in most surveys, the WHO and World Bank led the development of the *Core Questions on Household Energy Use* in close collaboration with other agencies, including UNICEF’s Multiple Cluster Survey and USAID’s Demographic and Health Survey teams. Following stakeholder meetings, the WHO developed and extensively piloted the first set of enhanced survey questions focused on capturing household energy use for cooking, heating, and lighting. The World Bank also developed and piloted survey questions on electricity access in 16 countries, after consultations with stakeholders and survey experts. The WHO and the World Bank then collaborated to produce a single set of survey questions that capture all requisite information for both SDG 7.1 indicators; these were finalized in 2018.

The *Core Questions on Household Energy Use*, available in full in Appendix I, improve upon current survey methods for household electricity, cooking, heating, and lighting in the following ways:

Electricity

- Transcending a binary approach by measuring access to electricity in granular and comprehensive ways by including various electricity access attributes such as availability, reliability, quality, and safety.
- Capturing various sources of electricity, including national grid and off-grid options.
- Enabling data collection on options contextualized to a country’s energy patterns, particularly for off-grid sources (such as diesel generators, solar home systems, pico-hydro systems, etc.)
- Obtaining information on demand-side factors for households connected to off-grid sources to determine their level of access

Clean energy for cooking, space heating and lighting

- Aligning with WHO Guidelines on household energy options considered clean for health.
- Eliminating cleanliness classifications for cooking fuels as solid or non-solid, based on evidence that some solid fuels can be clean if used in very efficient devices, while some non-solid fuels pose significant health risks.
- Expanding the previous “fuel-only” approach to a “fuel-and-technology” approach, recognizing that emissions are produced from the interaction between a fuel and a given device.
- Capturing comprehensive energy use by moving beyond questions on primary cooking fuel to include secondary fuels and technology, recognizing that many households use more than one cooking fuel or stove, and the emissions from these additional uses must also be reported.
- Tracking multiple energy end uses, including cooking as well as space heating and lighting.
- Tracking time use, fuel collection, injuries, and health outcomes associated with household energy use.

1.4 OUTLINE OF THE CORE QUESTIONS ON HOUSEHOLD ENERGY USE

The *Core Questions on Household Energy Use* for tracking SDG Indicators 7.1.1 and 7.1.2 contain a set of modules on household energy access and use (see Appendix I for the full set of modules). These questions are identified as either *essential* for tracking progress towards SDG 7 or *highly recommended* to capture important aspects of household energy use and the resulting health impacts for informing policy.

The following modules are included:

- **Household electricity:** This module includes *essential questions* on the main source of electricity, appliances powered, hours of electricity available each day, hours of electricity available each evening, and frequency and duration of unscheduled blackouts. It also includes *recommended questions* on lightbulbs that can be powered with solar devices (if applicable), electricity provider, additional sources of electricity, damage to devices due to voltage fluctuation, and injuries.

- **Household cooking:** This module includes *essential questions* on the main cookstoves used: the brand of the main stove (for solid fuel devices to assess whether the device meets the WHO Guidelines emission rate targets), and the fuel used by the device. In addition to these essential questions, the module also includes *recommended questions* on supplemental stoves and fuels used, monthly payments for fuel, availability of fuel, time spent cooking, cooking location, ventilation, and injuries that occurred while cooking.
- **Household heating:** This module includes *essential questions* on the number of months that the main heating device was used for heating, the main fuel used for heating the home, brand of heating device (for solid fuel devices to assess whether it meets the WHO Guidelines emission rate targets), as well as the main fuel used. It also includes *recommended questions* on supplementary devices and fuels used, ventilation, and injuries that occurred from use of the heating device.
- **Household lighting:** This module includes an *essential question* on the main lighting sources, as well as a *recommended question* on supplementary lighting sources and injuries that occurred from use of the lighting sources.
- **Household energy and gender:** This module includes *recommended questions* to identify the primary collector of fuel and the primary cook, time spent collecting fuel, injuries sustained while collecting or transporting fuel, time spent preparing the stove and fuel, and time spent cooking. Including these questions informs analysis of gender dynamics for energy-related roles and responsibilities in the household.

Table : List of essential and recommended questions to track SDG 7.1.1 and 7.1.2

CATEGORY	ESSENTIAL QUESTIONS	RECOMMENDED QUESTIONS
Household electricity	<ul style="list-style-type: none"> • main source of electricity • appliances powered by main source • hours of electricity available each day from main source • hours of electricity available each evening from main source • frequency and duration of unscheduled blackouts of main source 	<ul style="list-style-type: none"> • lightbulbs that can be powered with solar devices (if applicable) • electricity provider • additional sources of electricity beyond main source • damage to devices due to voltage fluctuation • injuries from electricity use
Household cooking	<ul style="list-style-type: none"> • main and supplementary cookstoves used • the brand of the main stove (for solid fuel devices to assess whether the device meets the WHO Guidelines emission rate targets) • the fuel used by the device 	<ul style="list-style-type: none"> • supplemental stoves and fuels used • monthly payments for fuel • availability of fuel • time spent cooking • cooking location • ventilation • injuries that occurred while cooking
Household heating	<ul style="list-style-type: none"> • number of months that the main heating device was used for heating • main fuel used for heating the home • brand of heating device (for solid fuel devices to assess whether it meets the WHO Guidelines emission rate targets), as well as the main fuel used 	<ul style="list-style-type: none"> • ventilation • supplementary devices and fuels used • injuries that occurred from use of the heating device
Household lighting	<ul style="list-style-type: none"> • main lighting source 	<ul style="list-style-type: none"> • supplementary lighting sources • injuries that occurred from use of the lighting sources
Household energy and gender		<ul style="list-style-type: none"> • identify the primary collector of fuel • identify the primary cook • time spent collecting fuel • injuries sustained while collecting or transporting fuel • time spent preparing the stove and fuel • time spent cooking

2. Tracking SDG 7.1.1: Proportion of Population with Access to Electricity

The *Core Questions on Household Energy Use* allow governments to track progress toward SDG 7.1.1 on the proportion of population with access to electricity. Given that the original formulation of the indicator required only a binary measure of energy access inadequate for capturing access to electricity, there has been a shift amongst the international development community away from the binary metric towards a more multi-dimensional metric. While the indicator itself remains unchanged, the methodology behind the computation of the indicator continues to evolve. The metadata for SDG Indicator 7.1.1 now promotes measurement using the Multi-Tier Framework (MTF) for Measuring Energy Access, developed by the World Bank in partnership with UN Energy and SE4ALL Global Tracking Framework Consortium (see Box 1 for a description of the MTF). While the MTF can be used to track Indicator 7.1.1, the analysis with the full MTF questionnaire (The full MTF questionnaire can be found from energydata.info) extends beyond SDG monitoring, but help the policy makers to identify the challenges in energy access. (Please, refer to Box 1) The *Core Questions on Household Energy Use* presented in this guide include a subset of all MTF questions, which are critical for monitoring SDG 7.1.1.

2.1 MULTI-TIER FRAMEWORK FOR MEASURING ENERGY ACCESS (MTF)

The MTF approach measures energy access, provided by any technology or fuel, based on a set of attributes that affect user experience. The MTF for measuring access to electricity assigns a tier classification for each of the seven attributes independently. Tier 0 is the lowest applicable tier, representing no access, and Tier 5 is the highest clas-

sification, representing full service. Each household is then assigned an overall tier classification that corresponds to the lowest tier of all seven, which can then be averaged over the population or subpopulations of interest.

PURPOSE

Population with access to electricity (Tier 1 or above for all attributes) are defined as having access to electricity

INDICATOR

$$\text{Percentage of population with access to electricity} = \frac{\text{(Population with access to electricity from TIER 1 or above)}}{\text{(Total population)}}$$

Note: Indicator should be weighted by population weight

The attributes considered relevant for measuring access to electricity under the MTF are:

Capacity: The capacity of the electricity supply (or peak capacity) is the ability of the system to provide sufficient electricity to operate different appliances, ranging from a few watts for light-emitting diode (LED) lights and mobile phone chargers to several thousand watts for space heaters or air conditioners.

Availability: The availability or duration of supply refers to the amount of time during which electricity is available. Increased duration of supply enables improved electricity service by allowing the user to choose the time of usage.

Reliability: Unscheduled outages in the electricity supply presents a significant nuisance to consumers. The impact on the use of electricity services depends on the frequency of the power cuts and their duration.

Quality: The quality of the electricity supply is defined in terms of voltage. Most electricity applications will not function below a minimum level of supply voltage. Low voltage usually results from an overloaded electricity system. Voltage stability is also important, as fluctuations in voltage can damage equipment and cause electrical fires.

Affordability: Affordability refers to households’ ability to pay for the electricity they consume. It entails a complex interaction between (i) the quantity of electricity consumed, (ii) the price of electricity, and (iii) the ability of the consumer to pay for the electricity consumed.

Formality: Illegal connections pose a significant safety risk to the community, while also affecting the financial sustainability of the utility company (Kakkar and Mustafa 2013; Patinkin 2013; Smith 2004).

Health and Safety: Some energy sources, especially when installed poorly or acquired by illegal means, can present potential risks to user health and safety such as electrocution or fire.

Each of the individual attributes is discussed in detail in the following subsections.

Table I: Multi-Tier Framework for measuring access to electricity

ATTRIBUTES		TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
Capacity (power capacity ratings)		<3W	3W–49W	50W–199W	200W–799W	800W–1999W	≥2kW
Availability	Day	<4 hrs	Min 4 hrs		Min 8 hrs	Min 16 hrs	≥23 hrs
	Evening	<1 hr	Min 1 hr	Min 2 hrs	Min 3 hrs	Min 4 hrs	
Reliability	(Frequency of disruptions per week)	>14				4–14	≤3
	(Duration of disruptions per week)					>2 hrs (if frequency ≤3)	≤2 hrs
Quality (voltage problems affect the use of desired appliances)		Yes				No	
Affordability (cost of a standard consumption package of 365 kWh/year)		≥5% of household expenditure (income)			<5% of household expenditure (income)		
Formality (bill is paid to the utility, pre-paid card seller, or authorized representative)		No				Yes	
Health and Safety (having past accidents and perception of high risk in the future)		Yes				No	

Source: Bhatia and Angelou 2015

The questions presented in Table 2 are the questions from the Core Questions on Household Energy Use

(found in Appendix I) that are relevant for the measurement of SDG Indicator 7.1.1.

Table 2: Essential Questions and Indicators for SDG 7.1.1

	ESSENTIAL SURVEY QUESTIONS	INDICATORS
SDG 7.1.1		Percentage of population with access to electricity (Population with access to Tier 1 or above for all seven following sub-indicators).
Capacity	HE3.What source of electricity is used most of the time in this household? HE4.What appliances are powered using this household's solar device/system? HE5. How many lightbulbs can be powered using this household's solar device/system?	Capacity of electricity
Availability	HE7. In the last 7 days, how many hours of electricity were available each day on average from [NAME MAIN electricity system]? (Maximum 24 hours) HE8. In the last 7 days, how many hours of electricity were available each evening on average, from 6:00 pm to 10:00 pm from [NAME MAIN electricity system]? (Maximum 4 hours)	Availability of electricity supply
Reliability	HE9. In the last 7 days, how many times were there unscheduled outages or blackouts from [NAME MAIN electricity system]? HE10.What is the total duration of all the unscheduled outages or blackouts in the last 7 days?	Reliability of electricity supply
Quality	HE12. In the last 12 months, did any of this household's appliances get damaged because the voltage was going up and down in the [NAME MAIN electricity system from HE3]?	Voltage fluctuation of electricity supply
Affordability	This information is collected in the expenditure/consumption module	Affordability of electricity service
Formality	HE6.Who does this household currently pay for [NAME MAIN electricity system]?	Formality of electricity
Safety	HE13. In the last 12 months, did anyone using [NAME MAIN electricity system from HE3] die or have permanent limb (bodily injury) damage?	Safety of electricity

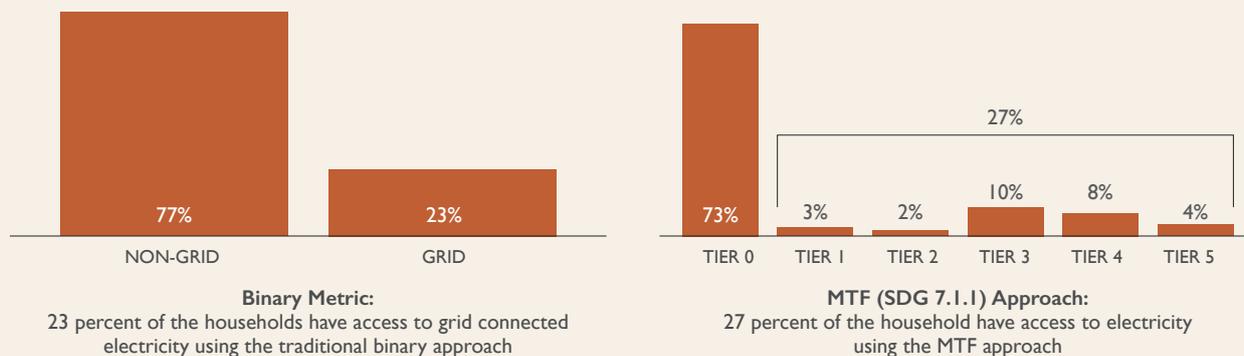
Box 1: MTF in Action – Measuring Energy Access in Rwanda

A comparison of the traditional and MTF approaches to measuring energy access highlights the value of the MTF approach. Data collected in Rwanda in 2016 using the traditional binary approach showed that less than a quarter of Rwandan households (23%) had access to grid electricity. However, the traditional binary method is defined solely by grid connection, is static, and fails to account for evolving technology solutions, despite the fact that off-grid energy solutions (mainly standalone solar devices) are used by 5 percent of Rwandan households.

The traditional binary approach also fails to take into consideration the quality, reliability, affordability, formality, safety, and availability of the electricity source. While households may have access to some sort of electricity, it is not necessarily the case that these households have access to Tier 1 electricity service, which is the cut-off used to define access to electricity for reporting under SDG indicator 7.1.1.

Approximately 2 percent of Rwandan households have access to grid or off-grid electricity sources, but do not have Tier 1 electricity service, primarily due to lack of capacity or insufficient electricity supply during the day. Thus, using the MTF approach, 27 percent of households in Rwanda were ultimately found to have access to electricity at the Tier 1 level.

The MTF approach used for measuring SDG 7.1.1 can reveal not only the percentage of the population with electricity access, but also the barriers to increased access through disaggregated analysis for each attribute and technology used. Such analysis will help to identify the key factors preventing the country from achieving higher tier levels. In Rwanda, the 2016 survey results confirmed the role of off-grid energy solutions in achieving universal access. Among the grid-connected households, the survey results revealed that reducing the interruptions of electricity and voltage fluctuation would move more Rwandan households to higher tiers.



Source: Rwanda – Beyond Connections: Energy Access Diagnostic Report based on the Multi-Tier Framework (2018)

2.2 CAPACITY OF ELECTRICITY

The capacity of the electricity supply (or peak capacity) is the ability of the system to provide a certain amount of electricity to operate different appliances, ranging from a few watts for LED lights and mobile phone chargers to several thousand watts for space heaters or air conditioners (see Figure 1).

<p>HE3. *What source of electricity is used most of the time in this household? (Please circle one)</p>	<p>No electricity in household00 ▶ NEXT MODULE <i>(Please customize options for each country)</i> National grid connection from (COMPANY).....01 ▶ HE6 Local mini grid02 ▶ HE6 Solar home system03 Solar lantern04 Electric generator05 Rechargeable battery06 Dry cell battery / torch07 ▶ HE6 Other (specify)96 ▶ HE6</p>
<p>HE4. *What appliances are powered using this household's {NAME OF MAIN electricity system from HE3} ? (Please circle all that apply.)</p>	<p>Mobile phone charger01 Radio02 Television03 Fan04 Refrigerator05 Electric iron06 Cooking device07 Other specify96</p>
<p>HE5. How many lightbulbs can be powered using this household's solar device/system?</p>	<p>Zero01 One02 Two or more03 AFTER THIS QUESTION, ▶ TO HE7</p>

* indicates essential questions for monitoring SDG 7.1.1 and 7.1.2

PURPOSE

Capacity is measured in watts for grids, mini-grids, and fossil fuel generators; and in-watt-hours for rechargeable batteries, solar lanterns, solar lighting systems (SLS), and solar home system (SHS). It may be difficult to determine the Capacity of the system by simple observation. An estimate of available Capacity may be based on the supply source and appliances used. (Bhatia and Nicolina 2015)

CALCULATION OF CAPACITY TIER

- i. National grid and mini-grid: If households use the national grid (HE3=1) or mini-grid (HE3=2), then Capacity = Tier 5.
- ii. Solar home system, electric generator, and rechargeable battery: If households use either a solar home system (HE3=3), an electric generator (HE3=5), or a rechargeable battery (HE3=6) as the main source of electricity, Capacity tier will be determined by the appliance with the highest power load level (HE4² & HE5) used with the main source of electricity.
- iii. Solar lantern: If households use a solar lantern (HE3=4) as the main source of electricity, Capacity tier will be determined between Tier 0 and Tier 1 based on the lumen-hours of lighting and phone charging.³ For more details on the methodology, please refer to the "Beyond Connections" report (Bhatia and Nicolina 2015).
- iv. Dry-cell battery: If households use a dry cell battery as the main source of electricity or do not have access to electricity (HE3=0), Capacity = Tier 0.

² Capacity tier=1 - If incandescent light, fluorescent tube, CFL bulb, LED light, light bulb-unknown type, radio (HE4=2), phone charger (HE4=1)
 Capacity tier=2 - TV-B&W, Color TV (HE4=3), Computer, Printer, Electric Fan (HE4=4)

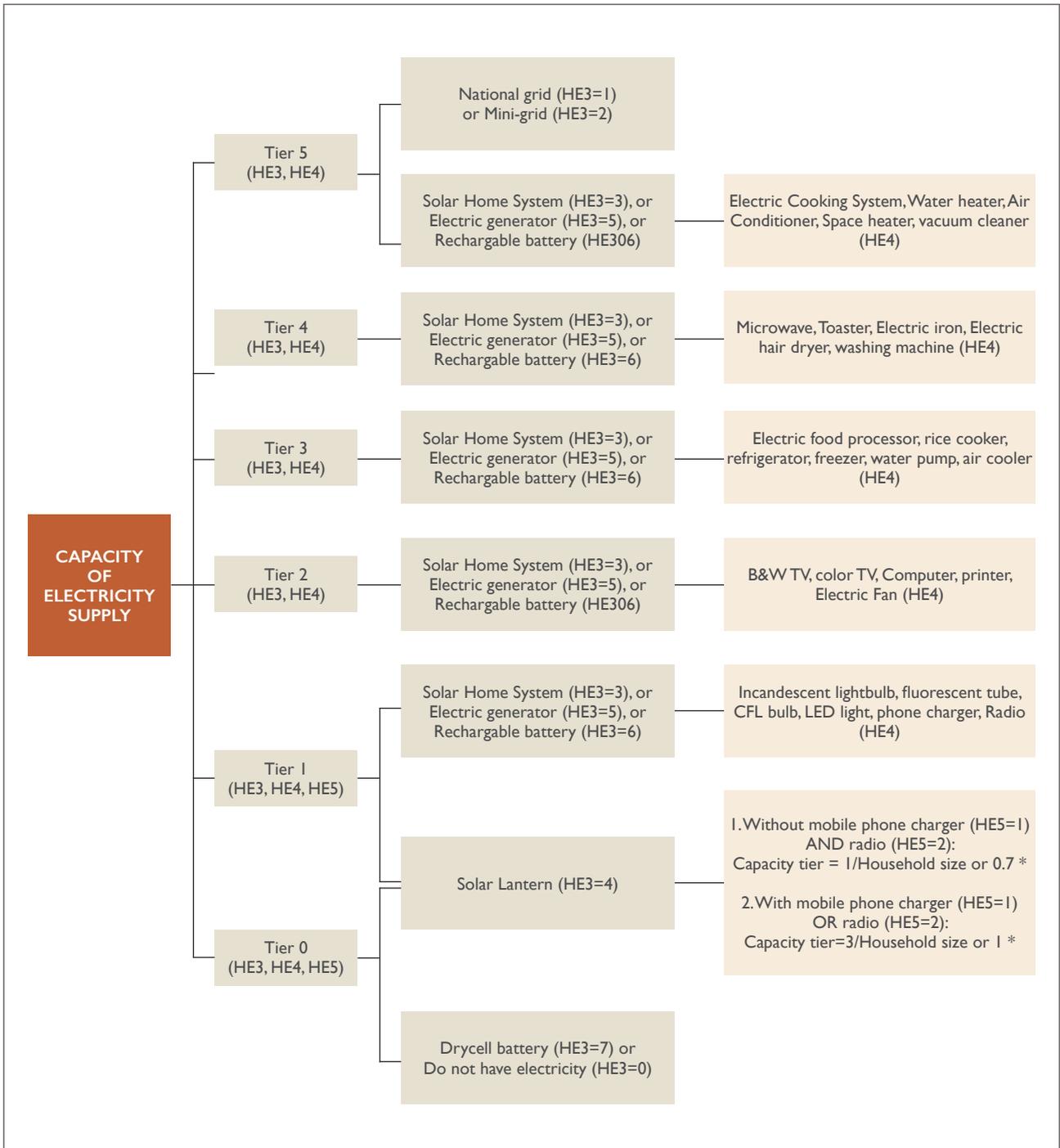
Capacity tier=3 - Electric Food processor, Rice Cooker, Refrigerator (HE4=5), Freezer, Water Pump, Air Cooler

Capacity tier=4 - Microwave, Toaster, Electric Iron (HE4=6), Electric Hair dryer, Washing Machine

Capacity tier=5 - Electric Cooking System (HE4=7), Water heater, Air Conditioner, Space heater, Vacuum Cleaner

³ If households use a solar lantern or HE5=1 (Zero) or 2 (One) without mobile phone charger and radio, Capacity tier will be calculated as 1/Household size which should be equal or less than 0.7. With the function of mobile phone charger or radio, Capacity tier will be calculated as 3/ Household size which should be equal or smaller than 1. Then, if Capacity tier for solar lantern is less than the mean value of Capacity tier among solar lantern users, then the Capacity tier will be assigned to Tier 0; otherwise, Tier 1. If households use a solar lantern or can power more than 2 lightbulbs (HE5=2) without any other appliances, Capacity tier will be 0.7. If households use multiple lightbulbs (HE5=2) with only mobile charger or radio, Capacity tier will be 1.

Figure 1: Calculation of capacity tier



* If this number (whichever is smaller) is above the national mean value of solar lantern users' Capacity tier, it will be classified as Tier 1; otherwise, Tier 0.

2.3 AVAILABILITY OF ELECTRICITY

Availability of supply refers to the amount of time during which electricity is available. It is measured through two indicators: (i) the total number of hours per day (24-hour period), and (ii) the number of evening hours (the 4 hours after sunset) during which electricity is available. **Final Availability (Duration) Tier is the lowest value of Daytime Duration Tier and Evening Duration Tier.** (Bhatia and Nicolina 2015)

HE6. *In the last 7 days, how many hours and minutes of electricity were available each day on average from [NAME MAIN electricity system]? (Maximum 24 hours)	Number of hours __ __ Number of minutes __ __ Does not know / unsure 99
HE7. *In the last 7 days, how many hours and minutes of electricity were available each evening on average, from 6:00 pm to 10:00 pm from [NAME MAIN electricity system]? (Maximum 4 hours)	Number of hours __ __ Number of minutes __ __ Does not know / unsure 99

* indicates essential questions for monitoring SDG 7.1.1 and 7.1.2

PURPOSE

Availability attribute is to evaluate if households can use electricity when it is needed.

CALCULATION OF AVAILABILITY TIER

1. Daytime Duration Tier

- Tier 1 – HE6 < 4
- Tier 2 – 4 <= HE6 < 8
- Tier 3 – 8 <= HE6 < 16
- Tier 4 – 16 <= HE6 < 23
- Tier 5 – HE6 >= 23

2. Evening Duration Tier

- Tier 0 – HE7 < 1
- Tier 1 – 1 <= HE7 < 2
- Tier 2 – 2 <= HE7 < 3
- Tier 3 – 3 <= HE7 < 4
- Tier 5 – HE7 >= 4

2.4 RELIABILITY OF ELECTRICITY

Reliability attribute captures the frequency and duration of unscheduled outages, and it applies only to grid-connected households. (Bhatia and Nicolina 2015)

HE9. *In the last 7 days, how many times were there unscheduled outages or blackouts from [NAME MAIN electricity system]?	Number of outages or blackouts __ __ Don't know / unsure 99
HE10. *What is the total duration of all the unscheduled outages or blackouts in the last 7 days?	Number of hours __ __ Number of minutes __ __ Don't know / unsure 99

* indicates essential questions for monitoring SDG 7.1.1 and 7.1.2

PURPOSE

The reliability of electricity supply is a combination of two factors: (i) frequency and (ii) duration of disruption. When electricity supply goes off unexpectedly, the grid is unreliable and needs backup generators as a coping mechanism.

CALCULATION OF RELIABILITY TIER

- Tier 3 – HE9 > 14
- Tier 4 – HE9 <= 14
- Tier 5 – HE9 <= 3 & HE10 < 2 hours per week

2.5 QUALITY OF ELECTRICITY

The Quality attribute applies only to households either the national grid or mini-grid. Electric appliances generally require a certain voltage supply to operate properly.

HE12. In the last 12 months, did any of this household's appliances get damaged because the voltage was going up and down in the [NAME MAIN electricity system from HE]?	Yes 1 No 2
---	---------------------------

PURPOSE

The quality of the electricity supply is defined in terms of voltage. Most electricity applications cannot be operated properly below a minimum level of supply voltage. This attribute is only applicable to households with national grid (HE3=1) or mini-grid access (HE3=2).

CALCULATION OF QUALITY TIER

- Tier 3- HE12=1 (Yes)
- Tier 5- HE12=2 (No)

2.6 AFFORDABILITY OF ELECTRICITY

The affordability of electricity is assessed through a comparison of overall household expenditure and the standard cost of a pre-specified electricity consumption package. Total household expenditure is not included in the Core Questions on Household Energy Use. Rather, the estimate of total household expenditure is expected to come from other modules included in the multi-topic household survey instrument into which the Core Questions on Household Energy Use are integrated.

PURPOSE

Affordability is defined as spending less than 5% of household monthly expenditure (or consumption) to consume 30 kWh of electricity per month.

CALCULATION OF AFFORDABILITY TIER

Tier 2 – Total HH monthly expenditure *0.05 < Cost of standard consumption package of 30 kWh/month

Tier 5 – Total HH monthly expenditure *0.05 > Cost of standard consumption package of 30 kWh/month

2.7 FORMALITY OF ELECTRICITY

Formality of connection to the grid needs to be monitored, as informal connections post a significant safety risk and also affect the financial viability of the utility. However, monitoring informal connection is not straightforward. Particularly, households are reluctant to disclose information related to formality of the grid connection in a survey.

HE6. Who does this household currently pay for [NAME MAIN electricity system]?	<i>(Please customize options for each country)</i>
	No one00
	Energy company/National utility.....01
	Pre-paid meter card seller02
	Community/village/municipality03
	Relative04
	Neighbor05
	Landlord06
	Local store07
	Utility office08
	Bank09
Post office 10	
Other96	

PURPOSE

If households use grid electricity service without paying for it, their connection is defined as informal. This attribute is only applicable to the households with national grid access (HE3=1) or with mini-grid access (HE3=2).

CALCULATION OF FORMALITY TIER

- Tier 3 – HE6=00 (No one)
- Tier 5 – Rest will be in Tier 5 for Formality.

2.8 SAFETY OF ELECTRICITY

Using electricity can pose a substantial risk to households if the internal wiring installation isn't done according to the standards (if there is any) set by regulation. In a survey, safety will be measured through the assessment of electrocution risk by asking household's experience in past accident or perceived high risk of potential accidents in the future.

HE13. In the last 12 months, did anyone using [NAME MAIN electricity system from HE3] die or have permanent limb (bodily injury) damage?	Yes 1 No2
---	--------------------------

PURPOSE

Safety is an attribute of energy supply relating to the risk of injury from the energy supply. The spectrum of electrical injuries is broad, ranging from minor burns to severe shocks and death.

CALCULATION OF SAFETY TIER

Tier 0 – HE10=1 (Yes)

Tier 5 – HE10=2 (No)

Note: According to the MTF's Health and Safety attribute, households having past accidents and perception of high risk in the future are defined as Tier 3.

3. Tracking SDG 7.1.2: Proportion of population with primary reliance on clean fuels and technology

This section is focused on measuring access to clean energy for cooking, space heating, and lighting for the calculation of SDG Indicator 7.1.2 on the proportion of population with primary reliance on clean fuels and technologies. Traditionally, questions on the primary fuel used for cooking have been included in household surveys. However, this single metric fails to capture the main device or technology used for cooking, as well as any supplementary cooking devices and fuels. In addition, it is important to consider possible pollution generated by lighting and space heating.

There are seven essential survey questions that assess the use of clean fuels and technologies as the primary household energy sources for cooking, heating, and lighting (Table 3). It is imperative that these questions

are included to enhance reporting on SDG indicator 7.1.2. The WHO currently reports on SDG indicator 7.1.2 using Indicator 1 below, concerning “primary reliance on clean fuels and technologies for cooking”. Even though SDG 7.1.2 indicator does not specify “cooking”, the clean cooking indicator is currently used for SDG reporting because the data is widely available, while data on space heating and lighting are not commonly included in nationally representative surveys. However, as general information on fuels and technologies becomes more commonly collected, the WHO plans to report on SDG indicator 7.1.2 using the “percentage of population with primary reliance on clean fuels and technologies for cooking, space heating, and lighting” (Indicator 5 below). This Guidebook will be updated to reflect that change when it goes into effect.

Table 3: Essential Survey Questions and Indicators for SDG 7.1.2.

	ESSENTIAL SURVEY QUESTIONS	INDICATORS
Cooking	HC3. Cookstove type: 1st (MAIN) cookstove HC4. Name/Brand : 1st (MAIN) cookstove HC5. Main fuel used in 1st (MAIN) cookstove	1. Percentage of population with primary reliance on clean fuels and technologies for cooking 2. Percentage of population with primary reliance on solid fuels for cooking
Heating	HH4. Heater type: 1st (MAIN) heater HH5. Brand : 1st (MAIN) heater HH6. Main fuel used in 1st (MAIN) heater	3. Percentage of population with primary reliance on clean fuels and technologies for space heating
Lighting	HL3. Light source: 1st (MAIN) light source	4. Percentage of population with primary reliance on clean fuels and technologies for lighting
All Uses	All questions listed above	5. Percentage of population with primary reliance on clean fuels and technologies for cooking, space heating and lighting

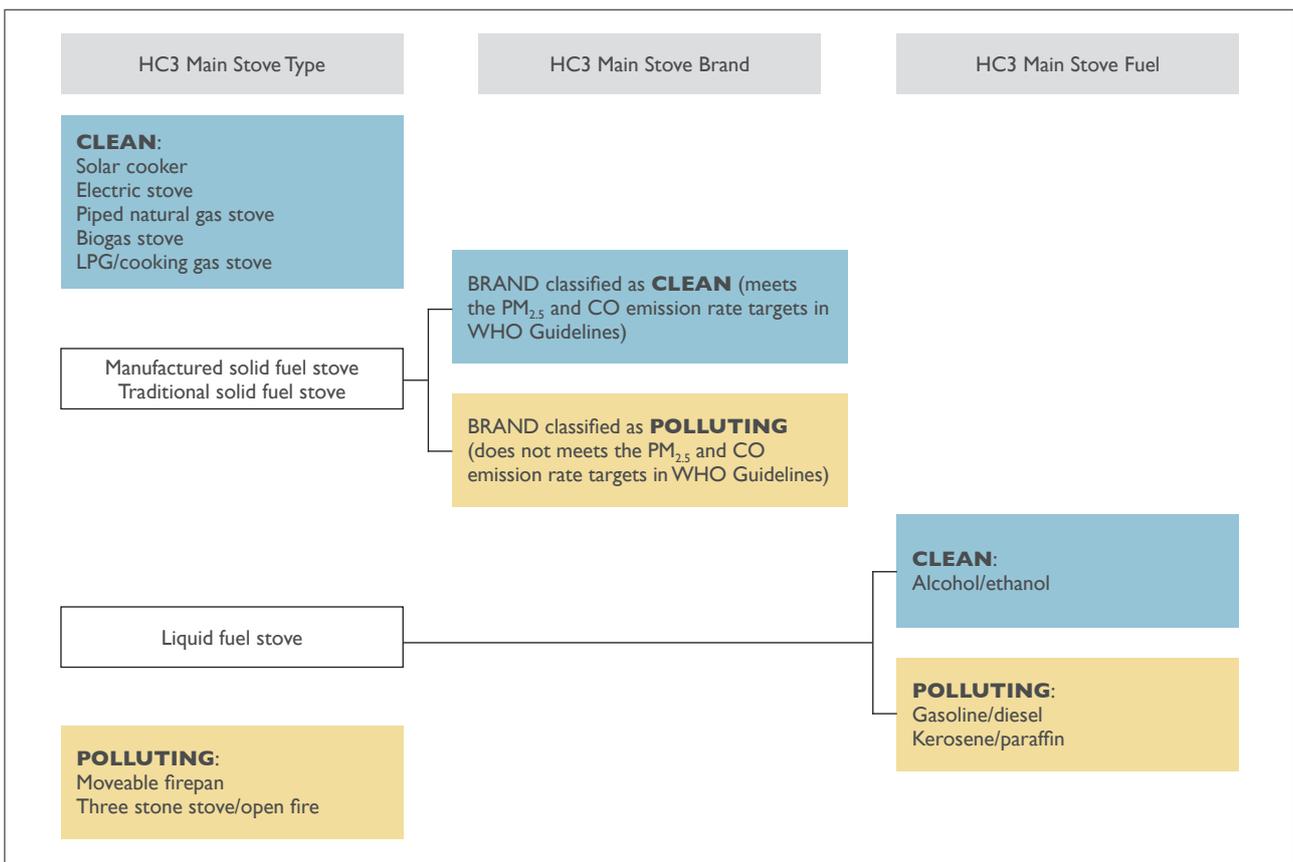
3.1 HOUSEHOLD COOKING

The highest priority indicators for cooking are constructed from the three essential questions on household cooking. The first question (HC3) captures the main cooking device, while the second and third most used cooking devices are captured in the additional columns (see Appendix I for the full survey module). The second question (HC4) collects the brand of the cookstove for all solid fuel stoves to determine whether the stove meets the WHO Guidelines to be classified as clean. Stove type alone is not sufficient in determining whether a solid fuel stove is clean or polluting because some high-performing solid fuel stoves achieve low emissions levels that are safe for health, thus making it necessary to

know the specific brand name of the device.⁴ The third question (HC5) measures the type of fuel used in the cooking device. Figure 2 shows a schematic for classifying the main cooking device as clean or polluting.

Indicator 1 below, *primary reliance on clean fuels and technologies for cooking*, is currently used for reporting on SDG indicator 7.1.2. As these **Core Questions on Household Energy Use** are adopted and data on space heating and lighting become widespread, the plan is that Indicator 5 on *primary reliance on clean fuels and technologies for cooking, heating and lighting* will be used to report on SDG indicator 7.1.2 (this Guidebook will be updated to reflect that change when it goes into effect).

Figure 2: Classification of main cooking device as clean or polluting using the Core Questions on Household Energy Use questions HC3, HC4, HC5



⁴ WHO defines a clean fuel and technology combination as clean for health at the point of use if the device achieves Tier 4 or 5 for the PM_{2.5} Voluntary Performance Target tiers and Tier 5 for the CO Voluntary Performance Target tiers (following the guidance in ISO TR 19867-3:2018, available at <https://www.iso.org/standard/73935.html>). The Clean Cooking Catalogue, maintained by the Clean Cooking Alliance, contains emissions and performance information for stoves and fuels as a result of standardized laboratory tests. Please also see <https://www.who.int/tools/clean-household-energy-solutions-toolkit/module-7-defining-clean> for additional information

A. 1st COOKSTOVE (MAIN)	
HC3.* What does this household use for cooking most of the time, including cooking food, making tea/ coffee, boiling drinking water?	Solar cooker (thermal energy, not solar panels)....01 ▶ HC7 Electric stove.....02 ▶ HC6 Piped natural gas stove03 ▶ HC6 Biogas stove.....04 ▶ HC6 Liquefied petroleum gas (LPG)/ cooking gas stove.....05 ▶ HC6 Manufactured solid fuel stove.....06 Traditional solid fuel stove (non-manufactured).....07 Liquid fuel stove08 ▶ HC5 Moveable firepan09 ▶ HC5 Three stone stove/open fire..... 10 ▶ HC5 Other, specify96
HC4.* What is the brand of the cookstove or device?	[Pre-fill with name or brand of solid fuel stoves available in country; add additional lines as needed.] NAME/BRAND 101 NAME/BRAND 2.....02 NAME/BRAND 3.....03 Other, specify96
HC5.* What type of fuel or energy source does this household use most of the time in this cookstove or device for cooking food, making tea/ coffee and boiling drinking water?	Alcohol/ethanol01 Gasoline/diesel (not in generator) ...02 Kerosene/paraffin03 Coal/lignite unprocessed04 Coal/lignite briquettes/pellets05 Charcoal unprocessed06 Charcoal briquettes/pellets.....07 Wood.....08 Agricultural or crop residue/ grass/ straw/shrubs/corn cobs.....09 Animal waste/dung..... 10 Processed biomass pellets/ briquettes 11 Woodchips..... 12 Garbage/plastic 13 Sawdust..... 14 Other96

* indicates essential questions for monitoring SDG 7.1.1 and 7.1.2

Devices classified as clean (Indicator 1) are reported for SDG indicator 7.1.2

PURPOSE

Determines whether the household cooks with a clean cooking device.

SDG INDICATOR 7.1.2 - INDICATOR 1

Definition: Percentage of population with primary reliance on clean fuels and technologies for cooking.

Numerator: Population with primary reliance on clean fuels and technologies for cooking, where this is defined as:

HC3 (a) = 01, 02, 03, 04, 05, (06 ONLY IF HC4(a) is a clean cookstove, as defined by WHO Guidelines⁴), (07 ONLY IF HC4(a) is a clean cookstove, as defined by WHO Guidelines⁴), (08 ONLY IF HC5(a) == 01).

Denominator: Total population.

$$\frac{\text{Population with primary reliance on clean fuels and technologies for cooking}}{\text{Total population}^5}$$

INDICATOR 2

Definition: Percentage of population with primary reliance on solid fuels for cooking (this is a historical indicator and proposed for historical comparison purposes only)

Numerator: Population with primary reliance on solid fuels for cooking, defined as: HC3 (a) = 06, 07, 09, or 10

Denominator: Total population.

$$\frac{\text{Population with primary reliance on solid fuels for cooking}}{\text{Total population}}$$

Note: Indicators should be weighted by population weight

3.2 HOUSEHOLD HEATING

Household air pollution is caused not only by cooking with inefficient fuels and technologies, but also from the use of polluting combinations of other major energy end uses. For example, a household may have already transitioned to a clean source of energy for cooking but may still rely on a simple open fire for space heating, negating any health benefit from the clean cooking solution. Therefore, countries need to be able to monitor all major sources of household air pollution to realize safe health and climate outcomes. The refined indicators below are aligned with the current understanding that it is the fuel and technology combination that determines adverse health impacts. Thus, the proposed survey questions capture the device used for space heating as well as the main fuel. The indicator reports on the use of clean household energy for space heating, where clean is defined by the recommendations of the WHO Guidelines.

The highest priority indicators for heating are constructed from the three essential questions below on household heating. The first question (HH4) captures the heating device used most of the time in the first column, as well as the second and third most used heating devices in additional columns (shown in the full survey module in Appendix 1). The second question (HH5) measures the brand of the device if it is a manufactured or traditional heater. It is necessary to collect brand information for these devices in order to determine whether the device meets the WHO Guidelines to be classified as clean, as some high-performing devices do achieve low emissions levels that are safe for health. However, it is insufficient to only know the type

⁵ Total population here and elsewhere refers to the sample population.

of stove to classify the device as clean; knowing the brand is just as important.⁴ The third question (HH6) measures the type of fuel used in the heating device.

A. 1st HEATER (MAIN)	
HH4. *What does this household use to heat the home when needed?	Central heating01 ▶ HH6
	Manufactured space heater.....02
	Traditional space heater03
	Manufactured cookstove04
	Traditional cookstove (non-manufactured).....05
	Moveable heating pan06 ▶ HH6
	Open fire/three-stone stove.....07 ▶ HH6
	Heat pump08 ▶ HH6
	Other, specify96
	HH5. *What is the brand of the heater, cookstove or device?
HH6. *What type of fuel or energy source does this household use most of the time for heating in this heater, cookstove or device?	Electricity (including solar panels) ...01 ▶ HH9
	Piped natural gas02 ▶ HH9
	LPG/ cooking gas.....03 ▶ HH9
	Biogas.....04 ▶ HH9
	Alcohol/ethanol05 ▶ HH8
	Gasoline/diesel (not in generator) ...06 ▶ HH8
	Kerosene/paraffin07 ▶ HH8
	Coal/lignite unprocessed08
	Coal/lignite briquettes/pellets09
	Charcoal unprocessed10
	Charcoal briquettes/pellets.....11
	Wood.....12
	Agricultural or crop residue/ grass/ straw/ shrubs/corn cobs13
	Animal waste/dung.....14
	Processed biomass pellets/ briquettes.....15
	Woodchips.....16
	Garbage/plastic17
Sawdust.....18	
Other96	

* indicates essential questions for monitoring SDG 7.1.1 and 7.1.2

PURPOSE

Determines whether the household heats the home with a clean space heating device.

INDICATOR 3

Definition: Percentage of population with primary reliance on clean fuels and technologies for space heating

$$\frac{\text{Population with primary reliance on clean fuels and technologies for space heating}}{\text{Total population}}$$

Numerator: Population in households with a primary reliance on clean fuels and technologies for space heating, defined as: HH4 (a) = 01, (02, 03, 04, 05 ONLY IF HH5 (a) is a clean heater or cookstove as defined by WHO Guidelines⁴), 08

Denominator: Total population

Note: Indicator should be weighted by population weight

3.3 HOUSEHOLD LIGHTING

The highest priority indicator for lighting is constructed from the essential question below (HL3) which captures the most used light source in the first column, as well as the second and third most used light source in additional columns (shown in full survey module in Appendix I). The indicator reports on the use of clean household energy for lighting, where clean is defined by the WHO Guidelines.⁴

A. 1st LIGHT SOURCE (MAIN)	
*What does this household use most of the time as energy for lighting, or as a light source? Please tell me the light source used for the most time each day, followed by other light sources used.	Electricity (including solar panels).....01
	Solar-powered lantern or flashlight.....02
	Rechargeable flashlight, mobile, torch or lantern.....03
	Battery powered flashlight, torch or lantern.....04
	Biogas lamp.....05
	LPG lamp.....06
	Gasoline lamp.....07
	Kerosene/ paraffin lamp.....08
	Oil lamp.....09
	Candle.....10
	Open fire.....11
Other96	

* indicates essential questions for monitoring SDG 7.1.1 and 7.1.2

PURPOSE

Determines whether the household lights the home with clean lighting.

INDICATOR 4

Percentage of population with primary reliance on clean fuels and technologies for lighting

$$\frac{\text{Population with primary reliance on clean fuels and technologies for lighting}}{\text{Total population}}$$

Numerator: Population living in households with primary reliance on clean fuels and technologies for lighting, defined as: HL3(a) = 01, 02, 03, 04, 05, 06

Denominator: Total population

Note: Indicator should be weighted by population weight

3.4 HOUSEHOLD COOKING, HEATING AND LIGHTING

As the WHO plans to transition to reporting with Indicator 5 below, the “percentage of the population with primary reliance on clean fuels and technologies for

cooking, heating and lighting”, the inclusion of questions on cooking, heating, and lighting will be necessary to calculate SDG indicator 7.1.2. This SDG indicator tracks the use of clean household energy for the three most common household energy end uses most strongly linked to adverse health impacts when polluting fuels and technologies are used.

People living in households in which food or drink are not prepared for household consumption, or in which space heating is not used, are included in the numerator. These households should not be considered as lacking access to clean cooking or clean space heating. However, people living in households which do not use lighting are considered to lack access to clean lighting and are thus removed from the numerator.

PURPOSE

Determines whether the household primarily uses clean cooking, space heating, and lighting devices.

INDICATOR 5

Definition: Percentage of population with primary reliance on clean fuels and technologies for cooking, space heating, and lighting (living in households that reported cooking and or space heating)

$$\frac{\text{Population with primary reliance on clean fuels and technologies for cooking, space heating, and lighting}}{\text{Total population}}$$

Total population

Numerator: In order to be able to calculate the indicator, population living in households that report no cooking or no space heating are included in the numerator. The numerator is calculated as the population that lives in households with primary reliance on clean fuels and technologies for cooking, space heating, and lighting, defined as:

([HC1=2] OR [HC3 (a) = 01, 02, 03, 04, 05, (06, 07 ONLY IF HC4(a) is a clean cookstove, as defined by WHO Guidelines⁴), (08 ONLY IF HC5(a) == 01])

AND

([HH1=2] OR [HH4 (a) = 01, (02, 03, 04, 05 ONLY IF HH5 (a) is a clean heater or cookstove as defined by WHO Guidelines⁴), 08])

AND

(HL3(a) = 01, 02, 03, 04, 05, 06)

Denominator: Total population.

Note: Indicator should be weighted by population weight

3.5 RECOMMENDED QUESTIONS ON HOUSEHOLD ENERGY USE AND HEALTH

To fully assess household energy use in the home and its impact on safety, time use, and expenditure, a set of recommended questions is presented in Appendix 2. These questions are not essential for tracking SDG indicator 7.1.2 on clean fuels and technologies used in the home but provide critical supplemental details for the indicator.

The recommended questions cover the following topics:

Additional fuel and technology use

These questions track the use of all fuels and technologies. It is important to understand more than just the main devices and fuels used for cooking, heating, and lighting in order to fully assess household energy use and exposure to pollution and health impacts. As most households use multiple devices (for example, a wood stove for most meals and an LPG stove for making tea), asking about only the primary device (as is done for the SDG indicator) risks omitting critical information on household exposure to household pollution. The use of a polluting device, even for a small amount of time such as 4 hours a week, can essentially override the benefits of a clean main device and fuel, leading to average indoor pollutant concentrations greater than the safe levels recommended by the WHO Guidelines (Johnson and Chiang 2015; WHO 2014). If survey implementers wish to understand whether a population is exposed to household air pollution, it is necessary to include these recommended questions.

Ventilation

The Core Questions on Household Energy Use include recommended questions on the location of each cooking device, as well as whether a chimney or hood is used with each chimney or heater.

Understanding the cooking location can provide information about the intensity of exposure to household air pollution. Cooking in a well-ventilated location, such as outdoors or on a veranda, is likely to lead to lower exposure for the primary cook, relative to cooking in an enclosed indoor space. While personal exposure can be reduced when ventilation is increased, pollution is nevertheless released to the environment when a polluting cooking system is used, which can contribute to ambient air pollution levels and exposure to harmful pollutants around the home and in the community. Factors that increase

ventilation such as opening windows and doors, cooking outside, or using a chimney, can be altered – windows can be closed, chimneys may not function efficiently, and many devices that are used in well-ventilated areas can be moved inside or to different rooms. Thus, these questions are not used for the calculation of indicators on whether cooking or heating devices are clean or polluting. Nonetheless, they provide supplemental information on factors that may decrease exposure to harmful household air pollution.

Safety and injury

Household air pollution exposure leads to many adverse health impacts, although these are rarely assessed in surveys and censuses. It is important to include questions assessing health effects related to polluting energy use for all household members in order to better understand health impacts. Burns from stoves, heaters and lamps (e.g., kerosene) are a major safety hazard in the home. Unintentional ingestion of kerosene is a common cause of child poisoning worldwide (Mills 2016), the use of poorly wired electricity systems or ungrounded electric devices can lead to shocks and injury, and carrying large loads of wood or gas canisters can lead to severe musculoskeletal injuries (Dohoo *et al.* 2013). Unfortunately, nationally representative data rarely capture these outcomes.

Although exposure to Household Air Pollution (HAP) can cause serious health problems such as cardiovascular and respiratory disease and cancer, it is impossible to attribute this to a specific stove, heater, or fuel. Thus, the Core Questions on Household Energy Use only contain questions about serious injuries directly associated with a cookstove, heater, or light source, as well as injuries that occurred while gathering fuel. Tracking injuries that occur from household energy use helps to capture the magnitude of the problem as well as to compare rates of injury between household energy uses such as cooking, heating, and lighting.

Time use

Household energy use for cooking, heating, and lighting has significant implications for health and livelihood. To measure these effects, data should be collected on time-use related to household energy, health outcomes related to household energy use, and the physical labor required to collect fuel. The recommended questions in the Core Questions for Household Energy Use cooking module assess time spent cooking by stove type, which captures data on the relative time spent using different devices as well as on the individuals who spend the most time collecting fuel and cooking. These questions are linked to identification information asked elsewhere in the survey, making it possible to analyze the sex and age of both the primary fuel collector and cook as well as to calculate the time burden of these activities.

Expenditure

There is a single recommended question to determine household expenditure on fuels or energy sources used for cooking. If another section of the survey assesses household income, expenditure, or consumption, this question (HC6) can provide important information on the affordability of cooking fuel.

Fuel availability

A question is recommended in the cooking section to assess whether the household has experienced problems with fuel availability in the past 12 months. Households may desire to use a fuel or technology but may be unable to do so due to challenges in supply. Assessing availability challenges will provide a more complete understanding of household energy use.

4. Guidance for Integrating the Core Questions on Household Energy Use into Existing Surveys

The Core Questions on Household Energy Use have been developed to be integrated into existing multi-topic household surveys, such as Living Standards Measurement Study surveys or national censuses. This section identifies key topics that survey practitioners should consider when preparing to integrate this questionnaire. For enumerator guidance on administering the questionnaire, refer to Appendix 2.

4.1 FINDING THE RIGHT PLACE FOR THE QUESTIONS TO BE INTEGRATED

While the Core Questions on Household Energy Use are presented as a series of cohesive modules (see Appendix I for the full questionnaire), this structure does not need to be maintained when it is being integrated into a longer household survey. Questions and/or modules can be separated and inserted where they fit most appropriately within the full survey instrument, provided that interview flow is maintained. **The goal is to ensure that all essential questions are asked.**

Living standards surveys often include modules related to time-use, housing characteristics, labor, expenditures, and so on. Many of the questions in the Core Questions on Household Energy Use will fit more naturally into these existing modules than they would as separate modules. For instance, if a survey already has a module on time-use, the first three questions of the cooking module could be integrated there. When breaking up modules, caution should be taken to ensure that:

- skip patterns are maintained;
- the appropriate respondent (as identified in the questionnaire module) is being interviewed; and

- the flow of the interview is optimized such that the order of questions facilitates easy recall of information by the respondent.

4.2 ADJUSTING FOR CONTEXT-SPECIFIC NEEDS

By design, the Core Questions on Household Energy Use include universally applicable response options. However, certain questions or responses will need to be customized for the survey context. While customization needs have been noted in the questionnaire itself, the primary customization areas are:

- **Identification of primary sources of electricity**
Survey practitioners will need to identify the primary electricity suppliers and the types of electricity sources commonly used. For example, if survey practitioners are certain that mini-grids are not available in the survey area, questions and response options related to mini-grids can be eliminated. Note that response options should only be removed if survey practitioners are **certain** that a given electricity source does not exist in the survey context.
- **Identification of cooking and space heating solutions in use**
The survey options must capture all types of cookstoves, space heaters, and their respective fuels used in the survey area. It is not recommended to delete any of the response options for cooking devices, space heating devices, or fuels.

- **Capture of appropriate reference photos**

Based on the information obtained on the types of cooking solutions used in the survey area, a photo aid should be developed with photos of the actual cookstoves used in the area (see Appendix 4). Providing picture references as well as information on the main features of various types of cookstoves during training will improve the enumerators' understanding of device typology, enhancing in turn the quality of data collected. Where relevant, this list should include the primary manufacturers of common cookstoves and space heaters specific to the local context.

4.3 ENSURING COMPARABILITY ACROSS SURVEY WAVES

When the Core Questions on Household Energy Use are being integrated into a panel survey or a recurring cross-sectional survey, it may be desirable to maintain comparability across survey waves. If previous waves of the survey do not include similar energy modules, then comparability will not be an issue, as the energy ques-

tions/modules will simply be an addition to the previous instrument. However, if previous waves of the survey include questions on electricity and/or household energy solutions that are inconsistent with the Core Questions on Household Energy Use, then changes will need to be made.

If the survey practitioner wishes to maintain comparability with the previous waves of the survey, but also integrate new questions from the Core Questions on Household Energy Use, then both sets of questions may be included. If questions overlap, the two versions could be split across two randomized subsets of households to allow for a comparison of the results between the two. This would help address any inconsistencies and serve as a transition or bridge between the two waves. If the survey practitioner is not concerned with comparability with previous rounds of the survey (for example, if the previously included questions were poorly designed or are not widely used), then the previous questions can simply be replaced by the Core Questions on Household Energy Use.

5. Conclusion

The main goal of this guidebook is to support the successful integration of the new energy access questions into existing household surveys. This guidebook provides the Core Questions on Household Energy Use and technical support on computation of data to track the progress toward Sustainable Development Goal 7.1, “ensure universal access to affordable, reliable, and modern energy services”.

These refined survey questions not only establish whether a household has electricity access and the main cooking fuel, but go a step further by highlighting the type of electricity access, the quality of access, impediments to access, the type of fuels and devices used for cooking, heating and lighting, and important safety and livelihood impacts of household energy use. Household surveys containing better information on household energy use will provide important insights in understanding the challenges in energy access and formulating policies to address such challenges.

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APPENDIX I.

CORE QUESTIONS ON HOUSEHOLD ENERGY USE

The survey instrument below contains a set of questions essential for monitoring SDG Indicator 7.1.2 on the primary reliance on clean fuels and technologies, as well as SDG 7.1.1 on the proportion of the population with access to electricity. These questions were developed and extensively piloted by the World Bank Group and the World Health Organization (WHO) in consultation with a diverse group of stakeholders. The essential questions for monitoring SDG 7.1.1 and SDG 7.1.2 are marked with an asterisk (*), totaling 17

questions. An interviewer manual containing guidance for implementing this questionnaire can be found in Appendix 3.

The core questions on household energy use can be downloaded in different formats including as a list, as a concise roster as shown below, or as a long roster. All formats are available from the WHO website at: <https://www.who.int/tools/core-questions-for-household-energy-use>

MODULE I. HOUSEHOLD COOKING	
Is any food or drink consumed by household members cooked or prepared at the household dwelling using a cookstove, fire or other cooking device?	Yes 1 No 2 ▶ SKIP TO HEATING MODULE
How many stoves (including open fires) are used for these activities?	Number of cookstoves... _ _ _ <i>If the respondent reports fewer than 3 cookstoves, leave extra columns (below) blank. If respondent reports use of more than 3 cookstoves, use additional sheets.</i>

	A. 1st COOKSTOVE (MAIN)	B. 2nd COOKSTOVE	C. 3rd COOKSTOVE
HC3. *What does this household use for cooking, including cooking food, making tea/coffee, and boiling drinking water? Please tell me the cookstove or device that is used for the most time, followed by the other cookstove(s) or device(s) used most often, if applicable. <i>(Phrase question based on response to HC2. Select one type for each cookstove.)</i>	Solar cooker (thermal energy, not solar panels)... 01 ▶ HC7 Electric stove..... 02 ▶ HC6 Piped natural gas stove 03 ▶ HC6 Biogas stove..... 04 ▶ HC6 Liquefied petroleum gas (LPG)/ cooking gas stove..... 05 ▶ HC6 Manufactured solid fuel stove..... 06 Traditional solid fuel stove (non-manufactured) 07 Liquid fuel stove 08 ▶ HC5 Moveable firepan 09 ▶ HC5 Three stone stove/open fire..... 10 ▶ HC5 Other (specify) 96	Solar cooker (thermal energy, not solar panels)... 01 ▶ HC7 Electric stove..... 02 ▶ HC6 Piped natural gas stove 03 ▶ HC6 Biogas stove..... 04 ▶ HC6 Liquefied petroleum gas (LPG)/ cooking gas stove..... 05 ▶ HC6 Manufactured solid fuel stove..... 06 Traditional solid fuel stove (non-manufactured) 07 Liquid fuel stove 08 ▶ HC5 Moveable firepan 09 ▶ HC5 Three stone stove/open fire..... 10 ▶ HC5 Other (specify) 96	Solar cooker (thermal energy, not solar panels)... 01 ▶ HC7 Electric stove..... 02 ▶ HC6 Piped natural gas stove 03 ▶ HC6 Biogas stove..... 04 ▶ HC6 Liquefied petroleum gas (LPG)/ cooking gas stove..... 05 ▶ HC6 Manufactured solid fuel stove..... 06 Traditional solid fuel stove (non-manufactured) 07 Liquid fuel stove 08 ▶ HC5 Moveable firepan 09 ▶ HC5 Three stone stove/open fire..... 10 ▶ HC5 Other (specify) 96
HC4. *What is the brand of the cookstove or device?	<i>(Pre-fill with name or brand of solid fuel stoves available in country- may add additional lines)</i> NAME/BRAND 101 NAME/BRAND 2.....02 NAME/BRAND 3.....03 OTHER (specify)96	<i>(Pre-fill with name or brand of solid fuel stoves available in country- may add additional lines)</i> NAME/BRAND 101 NAME/BRAND 2.....02 NAME/BRAND 3.....03 OTHER (specify)96	<i>(Pre-fill with name or brand of solid fuel stoves available in country- may add additional lines)</i> NAME/BRAND 101 NAME/BRAND 2.....02 NAME/BRAND 3.....03 OTHER (specify)96

	A. 1st COOKSTOVE (MAIN)	B. 2nd COOKSTOVE	C. 3rd COOKSTOVE
HC5. *What type of fuel or energy source does this household use in this cookstove or device for cooking food, making tea/coffee, and boiling drinking water? (Multiple choice)	Alcohol/ethanol01 Gasoline/diesel (not in generator)02 Kerosene/paraffin03 Coal/lignite unprocessed04 Coal/lignite briquettes/pellets05 Charcoal unprocessed06 Charcoal briquettes/pellets.....07 Wood.....08 Agricultural or crop residue/ grass/ straw/shrubs/corn cobs.....09 Animal waste/dung.....10 Processed biomass pellets/ briquettes11 Woodchips.....12 Garbage/plastic13 Sawdust.....14 Other96	Alcohol/ethanol01 Gasoline/diesel (not in generator)02 Kerosene/paraffin03 Coal/lignite unprocessed04 Coal/lignite briquettes/pellets05 Charcoal unprocessed06 Charcoal briquettes/pellets.....07 Wood.....08 Agricultural or crop residue/ grass/ straw/shrubs/corn cobs.....09 Animal waste/dung.....10 Processed biomass pellets/ briquettes11 Woodchips.....12 Garbage/plastic13 Sawdust.....14 Other96	Alcohol/ethanol01 Gasoline/diesel (not in generator)02 Kerosene/paraffin03 Coal/lignite unprocessed04 Coal/lignite briquettes/pellets05 Charcoal unprocessed06 Charcoal briquettes/pellets.....07 Wood.....08 Agricultural or crop residue/ grass/ straw/shrubs/corn cobs.....09 Animal waste/dung.....10 Processed biomass pellets/ briquettes11 Woodchips.....12 Garbage/plastic13 Sawdust.....14 Other96
HC6. How much did this household pay for this fuel or energy source last month for cooking (the last 30 days)? (in local currency)	_____ (local currency) Pays nothing.....00 Does not know.....99	_____ (local currency) Pays nothing.....00 Does not know.....99	_____ (local currency) Pays nothing.....00 Does not know.....99
HC7. In the past 12 months, how often was this fuel or energy source unavailable in the quantity you desired?	Often (more than once a month)...01 Sometimes (4-12 times a year)02 Rarely (less than 4 times a year)...03 Never (always available).....04 Does not know / unsure99	Often (more than once a month)...01 Sometimes (4-12 times a year)02 Rarely (less than 4 times a year)...03 Never (always available).....04 Does not know / unsure99	Often (more than once a month)...01 Sometimes (4-12 times a year)02 Rarely (less than 4 times a year)...03 Never (always available).....04 Does not know / unsure99
HC8. *What other fuels and energy sources does this household use in this cookstove or device for cooking food, making tea/coffee, and boiling drinking water? (Circle all that respondent mentions)	No others00 Alcohol/ethanol01 Gasoline/diesel (not in generator) ...02 Kerosene/paraffin03 Coal/lignite unprocessed04 Coal/lignite briquettes/pellets05 Charcoal unprocessed06 Charcoal briquettes/pellets.....07 Wood.....08 Agricultural or crop residue/ grass/ straw/shrubs/corn cobs.....09 Animal waste/dung.....10 Processed biomass pellets/briquettes11 Woodchips.....12 Garbage/plastic13 Sawdust.....14 Other96	No others00 Alcohol/ethanol01 Gasoline/diesel (not in generator) ...02 Kerosene/paraffin03 Coal/lignite unprocessed04 Coal/lignite briquettes/pellets05 Charcoal unprocessed06 Charcoal briquettes/pellets.....07 Wood.....08 Agricultural or crop residue/ grass/ straw/shrubs/corn cobs.....09 Animal waste/dung.....10 Processed biomass pellets/briquettes11 Woodchips.....12 Garbage/plastic13 Sawdust.....14 Other96	No others00 Alcohol/ethanol01 Gasoline/diesel (not in generator) ...02 Kerosene/paraffin03 Coal/lignite unprocessed04 Coal/lignite briquettes/pellets05 Charcoal unprocessed06 Charcoal briquettes/pellets.....07 Wood.....08 Agricultural or crop residue/ grass/ straw/shrubs/corn cobs.....09 Animal waste/dung.....10 Processed biomass pellets/briquettes11 Woodchips.....12 Garbage/plastic13 Sawdust.....14 Other96
HC9. Yesterday, how much time was this cookstove used for cooking food, making tea/coffee, and boiling drinking water?	Number of hours __ __ Number of minutes __ __ Does not know / unsure99	Number of hours __ __ Number of minutes __ __ Does not know / unsure99	Number of hours __ __ Number of minutes __ __ Does not know / unsure99
HC10. How often did you use the cookstove or cooking device over the last week (last 7 days) for these activities?	Several times each day01 About once per day.....02 A few times this week.....03 About once this week.....04 Does not know.....99	Several times each day01 About once per day.....02 A few times this week.....03 About once this week.....04 Does not know.....99	Several times each day01 About once per day.....02 A few times this week.....03 About once this week.....04 Does not know.....99

	A. 1st COOKSTOVE (MAIN)	B. 2nd COOKSTOVE	C. 3rd COOKSTOVE
HC11. Is the cooking usually done in the house, in a separate building, or outdoors? <i>(If in main house, probe to determine if cooking is done in a separate room. If outdoors, probe to determine if cooking is done on veranda, covered porch, or open air.)</i>	In main house: no separate room 01 In main house: separate room 02 Outside of main house: in a separate room..... 03 Outside of main house in open air..... 04 ▶ HC13 On veranda or covered porch..... 05 ▶ HC13 Other 96	In main house: no separate room 01 In main house: separate room 02 Outside of main house: in a separate room..... 03 Outside of main house in open air..... 04 ▶ HC13 On veranda or covered porch..... 05 ▶ HC13 Other 96	In main house: no separate room 01 In main house: separate room 02 Outside of main house: in a separate room..... 03 Outside of main house in open air..... 04 ▶ HC13 On veranda or covered porch..... 05 ▶ HC13 Other 96
HC12. Does the cookstove have a chimney or hood?	Yes 01 No 02 Don't know..... 99	Yes 01 No 02 Don't know..... 99	Yes 01 No 02 Don't know..... 99
HC13. In the past 12 months, did any harm or injury happen from using this cookstove, device or fuel? <i>(Circle all that respondent mentions.)</i>	None 01 Person burned 02 Fire in house 03 Poisoning 04 Death 05 Other 96	None 01 Person burned 02 Fire in house 03 Poisoning 04 Death 05 Other 96	None 01 Person burned 02 Fire in house 03 Poisoning 04 Death 05 Other 96

MODULE 2. TIME USE MODULE

HG1. Enumerator/CAPi check: Is the cookstove used most of the time (HC3) electric, solar, or piped natural gas?	Yes 01 ▶ HG7 No 02
HG2. In the past month (the last 30 days), who usually goes to collect the main fuel for the cookstove your household uses most of the time? <i>Record the name of the person who spends the most time collecting the main fuel for the cookstove indicated in HG1 and copy the line number of this person from the LIST OF HOUSEHOLD MEMBERS Module. If multiple people spend the same amount of time collecting fuel, add additional names and line numbers.</i>	MEMBERS DO NOT COLLECT 00 ▶ HG7 Name _____ Line Number __ __ <i>(if multiple collect for the same AMOUNT OF time)</i> SECOND PERSON Name _____ SECOND PERSON Line Number __ __
HG3. On a single trip, how long does it take for this person to go to collect the fuel, get the fuel, and come back?	Number of hours __ __ Number of minutes __ __ Does not know/unsure 99
HG4. In the past month (the last 30 days), how many times has this person collected this fuel for household cooking?	Number of times in past month __ __ Does not know/unsure..... 99
HG5. In the past 12 months, did this person experience an injury while collecting or transporting fuel? <i>(Prompt. Circle all.)</i>	No injury 00 Back pain 01 Back, neck or shoulder injury 02 Cuts or scrapes 03 Snake or animal bite 04 Other 05 Does not know/unsure 99
HG6. Yesterday, how much time in total was spent preparing the [COOKSTOVE] and fuel for cooking, including setting up the fuel and lighting/turning on the cookstove but not including gathering fuel or cooking time? <i>(Time spent by anyone, not just person in HG2.)</i>	Number of hours __ __ Number of minutes __ __ Does not know/unsure 99
HG7. In the past month, who in the household does most of the cooking, including cooking food, making tea/coffee and boiling drinking water? <i>Record the name of the person and copy the line number of this person from the List of Household Members Module.</i>	MAIN COOK IS NOT HOUSEHOLD MEMBER 00 Name _____ Line Number __ __
HG8. Yesterday, how much time did this person spent cooking, including cooking food, tea/coffee, and boiling drinking water for household consumption?	Number of hours __ __ Number of minutes __ __ Does not know/unsure 99

MODULE 3. HOUSEHOLD HEATING	
<p>HH1. Does this household use any heating device or fire to keep the dwelling/living quarters warm at any time during the year?</p>	Yes 1 No 2 ▶ SKIPTO LIGHTING MODULE
<p>HH2. In the last 12 months, during how many months did you use a heating device or fire to keep the dwelling/living quarters warm?</p>	Number of months... _ _
<p>HH3. How many space heaters or heating devices (including cookstoves and open fires) are used in or around the dwelling to produce heat at any time during the year?</p>	Number of heaters... _ _ <i>If the respondent reports using fewer than 3 heaters to produce heat in the household, leave extra columns blank. If respondent reports using more than 3 heaters, use additional sheets.</i>

	A. 1st HEATER (MAIN)	B. 2nd HEATER	C. 3rd HEATER
<p>HH4. *What does this household use to heat the home when needed? For example, do you use a space heater(s), or use your cookstove in the winter for warmth? Please tell me the heaters, cookstoves, or heat systems used. [followed by the other heater(s), cookstove(s) or device(s) used most often, if applicable]</p> <p><i>(Phrase question based on response to HH3, and select one type for each heater.)</i></p>	Central heating 01 ▶ HH6 Manufactured space heater 02 Traditional space heater ... 03 Manufactured cookstove .. 04 Traditional cookstove (non-manufactured) 05 Moveable heating pan 06 ▶ HH6 Open fire/Three-stone stove..... 07 ▶ HH6 Heat pump..... 08 ▶ HH6 Other (specify) 96	Central heating 01 ▶ HH6 Manufactured space heater..... 02 Traditional space heater ... 03 Manufactured cookstove .. 04 Traditional cookstove (non-manufactured) 05 Moveable heating pan 06 ▶ HH6 Open fire/Three-stone stove..... 07 ▶ HH6 Heat pump..... 08 ▶ HH6 Other (specify) 96	Central heating 01 ▶ HH6 Manufactured space heater..... 02 Traditional space heater ... 03 Manufactured cookstove .. 04 Traditional cookstove (non-manufactured) 05 Moveable heating pan 06 ▶ HH6 Open fire/Three-stone stove..... 07 ▶ HH6 Heat pump..... 08 ▶ HH6 Other (specify) 96
<p>HH5. *What is the brand of the heater, cookstove or device?</p>	<p><i>(Pre-fill with name or brand of devices available in country- may add additional lines)</i></p> NAME/BRAND 1 01 NAME/BRAND 2 02 NAME/BRAND 3 03 OTHER (specify) 96	<p><i>(Pre-fill with name or brand of devices available in country- may add additional lines)</i></p> NAME/BRAND 1 01 NAME/BRAND 2 02 NAME/BRAND 3 03 OTHER (specify) 96	<p><i>(Pre-fill with name or brand of devices available in country- may add additional lines)</i></p> NAME/BRAND 1 01 NAME/BRAND 2 02 NAME/BRAND 3 03 OTHER (specify) 96
<p>HH6. *What type of fuel or energy source does this household use most of the time for heating in this heater, cookstove or device?</p>	Electricity (including solar panels) 01 ▶ HH9 Piped natural gas 02 ▶ HH9 LPG/ cooking gas..... 03 ▶ HH9 Biogas..... 04 ▶ HH9 Alcohol/ethanol 05 ▶ HH8 Gasoline/diesel (not in generator) 06 ▶ HH8 Kerosene/paraffin 07 ▶ HH8 Coal/lignite unprocessed.... 08 Coal/lignite briquettes/pellets..... 09 Charcoal unprocessed 10 Charcoal briquettes/pellets..... 11 Wood..... 12 Agricultural or crop residue/grass/ straw/ shrubs/corn cobs..... 13 Animal waste/dung..... 14 Processed biomass pellets/briquettes..... 15 Woodchips..... 16 Garbage/plastic 17 Sawdust..... 18 Other 96	Electricity (including solar panels) 01 ▶ HH9 Piped natural gas 02 ▶ HH9 LPG/ cooking gas..... 03 ▶ HH9 Biogas..... 04 ▶ HH9 Alcohol/ethanol 05 ▶ HH8 Gasoline/diesel (not in generator) 06 ▶ HH8 Kerosene/paraffin 07 ▶ HH8 Coal/lignite unprocessed.... 08 Coal/lignite briquettes/pellets..... 09 Charcoal unprocessed 10 Charcoal briquettes/pellets..... 11 Wood..... 12 Agricultural or crop residue/grass/ straw/ shrubs/corn cobs..... 13 Animal waste/dung..... 14 Processed biomass pellets/briquettes..... 15 Woodchips..... 16 Garbage/plastic 17 Sawdust..... 18 Other 96	Electricity (including solar panels) 01 ▶ HH9 Piped natural gas 02 ▶ HH9 LPG/ cooking gas..... 03 ▶ HH9 Biogas..... 04 ▶ HH9 Alcohol/ethanol 05 ▶ HH8 Gasoline/diesel (not in generator) 06 ▶ HH8 Kerosene/paraffin 07 ▶ HH8 Coal/lignite unprocessed.... 08 Coal/lignite briquettes/pellets..... 09 Charcoal unprocessed 10 Charcoal briquettes/pellets..... 11 Wood..... 12 Agricultural or crop residue/grass/ straw/ shrubs/corn cobs..... 13 Animal waste/dung..... 14 Processed biomass pellets/briquettes..... 15 Woodchips..... 16 Garbage/plastic 17 Sawdust..... 18 Other 96

	A. 1st HEATER (MAIN)	B. 2nd HEATER	C. 3rd HEATER
HH7. Does it have a chimney or hood?	Yes01 No02 Does not know.....99	Yes01 No02 Does not know.....99	Yes01 No02 Does not know.....99
HH8. Which other fuels or energy sources are used for heating in this space heater, cookstove, device or fuel? <i>(Circle all that respondent mentions.)</i>	No others00 Electricity (including solar panels)...01 Piped natural gas02 LPG/ cooking gas.....03 Biogas.....04 Alcohol/ethanol05 Gasoline/diesel (not in generator)...06 Kerosene/paraffin07 Coal/lignite unprocessed08 Coal/lignite briquettes/pellets09 Charcoal unprocessed10 Charcoal briquettes/pellets.....11 Wood.....12 Agricultural or crop residue/ grass/ straw/shrubs/corn cobs.....13 Animal waste/dung.....14 Processed biomass pellets/briquettes.....15 Woodchips.....16 Garbage/plastic17 Sawdust.....18 Other96	No others00 Electricity (including solar panels)...01 Piped natural gas02 LPG/ cooking gas.....03 Biogas.....04 Alcohol/ethanol05 Gasoline/diesel (not in generator)...06 Kerosene/paraffin07 Coal/lignite unprocessed08 Coal/lignite briquettes/pellets09 Charcoal unprocessed10 Charcoal briquettes/pellets.....11 Wood.....12 Agricultural or crop residue/ grass/ straw/shrubs/corn cobs.....13 Animal waste/dung.....14 Processed biomass pellets/briquettes.....15 Woodchips.....16 Garbage/plastic17 Sawdust.....18 Other96	No others00 Electricity (including solar panels)...01 Piped natural gas02 LPG/ cooking gas.....03 Biogas.....04 Alcohol/ethanol05 Gasoline/diesel (not in generator)...06 Kerosene/paraffin07 Coal/lignite unprocessed08 Coal/lignite briquettes/pellets09 Charcoal unprocessed10 Charcoal briquettes/pellets.....11 Wood.....12 Agricultural or crop residue/ grass/ straw/shrubs/corn cobs.....13 Animal waste/dung.....14 Processed biomass pellets/briquettes.....15 Woodchips.....16 Garbage/plastic17 Sawdust.....18 Other96
HH9. In the past 12 months, did any harm or injury happen from using this space heater, cookstove, or device? <i>(Circle all that respondent mentions.)</i>	None01 Person burned02 Fire in house03 Poisoning.....04 Death05 Other96	None01 Person burned02 Fire in house03 Poisoning.....04 Death05 Other96	None01 Person burned02 Fire in house03 Poisoning.....04 Death05 Other96

MODULE 4. HOUSEHOLD LIGHTING	
HL1. Does this household use anything for lighting?	Yes1 No2 ▶ SKIP TO ELECTRICITY MODULE
HL2. How many different energy sources for lighting are used in the dwelling/living quarters? <i>(If the respondent reports using fewer than 3 energy sources for lighting in the household, leave extra columns in the following table blank. If respondent reports using more than 3 energy sources for light, use additional sheets.)</i>	Number of sources of light... _ _

	A. 1st LIGHT SOURCE (MAIN)	B. 2nd LIGHT SOURCE	C. 3rd LIGHT SOURCE
HL3. *What does this household use as energy for lighting, or as a light source? Please tell me the light source used for the most time each day, followed by other light sources used. <i>(Select one type for each light source.)</i>	Electricity (including solar panels)01 Solar-powered lantern or flashlight.....02 Rechargeable flashlight, mobile, torch or lantern.....03 Battery powered flashlight, torch or lantern.....04 Biogas lamp.....05 LPG lamp.....06 Gasoline lamp.....07 Kerosene/paraffin lamp08 Oil lamp.....09 Candle.....10 Open fire.....11 Other96	Electricity (including solar panels)01 Solar-powered lantern or flashlight.....02 Rechargeable flashlight, mobile, torch or lantern.....03 Battery powered flashlight, torch or lantern.....04 Biogas lamp.....05 LPG lamp.....06 Gasoline lamp.....07 Kerosene/paraffin lamp08 Oil lamp.....09 Candle.....10 Open fire.....11 Other96	Electricity (including solar panels)01 Solar-powered lantern or flashlight.....02 Rechargeable flashlight, mobile, torch or lantern.....03 Battery powered flashlight, torch or lantern.....04 Biogas lamp.....05 LPG lamp.....06 Gasoline lamp.....07 Kerosene/paraffin lamp08 Oil lamp.....09 Candle.....10 Open fire.....11 Other96

	A. 1st LIGHT SOURCE (MAIN)	B. 2nd LIGHT SOURCE	C. 3rd LIGHT SOURCE
HL4. In the past 12 months, did any harm or injury happen from using this lighting source? (Circle all that respondent mentions.)	None01 Person burned02 Fire in house03 Poisoning04 Death05 Other96	None01 Person burned02 Fire in house03 Poisoning04 Death05 Other96	None01 Person burned02 Fire in house03 Poisoning04 Death05 Other96

MODULE 5. HOUSEHOLD ELECTRICITY	
HE1. Do you have electricity in your household?	Yes 01 No 02 ▶ SKIP TO NEXT MODULE
HE2. What source of electricity is used in this household? (Please circle all that apply)	(Please customize options for each country) National grid connection from (COMPANY)01 Local mini grid02 Solar home system03 Solar lantern04 Electric generator05 Rechargeable battery06 Dry cell battery / torch07 Other (specify)96
HE3. *What source of electricity is used most of the time in this household? (Please circle one)	(Please customize options for each country) National grid connection from (COMPANY)01 ▶ HE6 Local mini grid02 ▶ HE6 Solar home system03 Solar lantern04 Electric generator05 Rechargeable battery06 Dry cell battery / torch07 ▶ SKIP TO NEXT MODULE Other (specify)96 ▶
HE4. *What appliances are powered using this household's {Electricity source from HE3}? (Please circle all that apply)	Mobile phone charger01 Radio02 Television03 Fan04 Refrigerator05 Electric iron06 Cooking device07 Other (specify)96
HE5. How many lightbulbs can be powered using this household's {electricity source from HE3}?	Zero01 One02 Two or more03 AFTER THIS QUESTION, SKIP TO HE7
HE6. *Who does this household currently pay for [NAME MAIN electricity system]?	(Please customize options for each country) No one00 Energy company/National utility01 Pre-paid meter card seller02 Community/village/municipality03 Relative04 Neighbor05 Landlord06 Local store07 Utility office08 Bank09 Post office10 Other96
HE7. *In the last 7 days, how many hours of electricity were available each day on average from [NAME MAIN electricity system]? (Maximum 24 hours)	Number of hours __ __ Number of minutes __ __ Does not know/unsure99

MODULE 5. HOUSEHOLD ELECTRICITY	
HE8. *In the last 7 days, how many hours of electricity were available each evening on average, from 6:00 pm to 10:00 pm from [NAME MAIN electricity system]? (Maximum 4 hours)	Number of hours __ __ Number of minutes __ __ Does not know/unsure 99
HE9. *In the last 7 days, how many times were there unscheduled outages or blackouts from [NAME MAIN electricity system]?	Number of outages or blackouts __ __ Does not know/unsure 99
HE10. *What is the total duration of all the unscheduled outages or blackouts in the last 7 days?	Does not know/unsure 99
HE11. Enumerator/CAPI check: Is the household's main source of electricity a National Grid or Local Mini Grid? If HE3 is 1 or 2, mark "Yes"	Yes 1 No 2 ▶ SKIPTO NEXT MODULE
HE12. *In the last 12 months, did any of this household's appliances get damaged because the voltage was going up and down in the [NAME MAIN electricity system from HE3]?	Yes 1 No 2
HE13. *In the last 12 months, did anyone using [NAME MAIN electricity system from HE3] die or have permanent limb (bodily injury) damage?	Yes 1 No 2

APPENDIX 2.

ADDITIONAL RECOMMENDED INDICATORS FOR HOUSEHOLD ENERGY USE

I.1 ADDITIONAL FUEL AND TECHNOLOGY USE

Table 4. Recommended Questions on Use of Additional Fuels and Technologies

	RECOMMENDED SURVEY QUESTIONS	INDICATORS
Cooking	HC3. Cookstove type: 2 nd and 3 rd cookstove or device HC4. Name/Brand: 2 nd and 3 rd cookstove or device HC5. Main fuel used in 2 nd and 3 rd cookstove or device HC8. Other fuels and energy sources used in 1 st , 2 nd and 3 rd cookstoves	Percentage of household members with reliance on clean fuels and technologies for cooking for all cookstoves
Heating	HH4. Heater type: 2 nd and 3 rd heater HH5. Name/Brand: 2 nd and 3 rd heater HH6. Main fuel used in 2 nd and 3 rd heater HH8. Other fuels and energy sources used in 1 st , 2 nd and 3 rd heater	Percentage of household members with reliance on clean fuels and technologies for space heating for all space heating devices
Lighting	HL3. Light source: 2 nd and 3 rd light source	Percentage of household members with reliance on clean fuels and technologies for lighting for all lighting devices
All uses		Percentage of household members with exclusive reliance on clean fuels and technologies for cooking, space heating and lighting in all cooking, heating and lighting devices

PURPOSE

Including questions about additional fuels and technologies used beyond the primary stove, heater, and light source is needed to fully understand the exposure to household air pollution.

Note: Indicator should be weighted by population weight

INDICATOR 6

EXCLUSIVE RELIANCE ON CLEAN FUELS AND TECHNOLOGIES FOR COOKING

Definition: Percentage of household members with exclusive reliance on clean fuels and technologies for cooking for all cookstoves

$$\frac{\text{Population with exclusive reliance on clean fuels and technologies for all cookstoves}}{\text{Total population}}$$

Numerator: Population with exclusive reliance on clean fuels and technologies for all cookstoves for cooking, where this is defined as:

For all cooking devices reported in HC2: [HC3(a) = 01, 02, 03, 04, 05, (06 ONLY IF HC4(a) is a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(a) is a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(a) == 01)]

AND

[HC3 (b) = 01, 02, 03, 04, 05, (06 ONLY IF HC4(b) is a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(b) is a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(b) == 01)]

AND

[HC3 (c) = 01, 02, 03, 04, 05, (06 ONLY IF HC4(c) is a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(c) is a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(c) == 01)]

Denominator:Total population

INDICATOR 7

EXCLUSIVE RELIANCE ON CLEAN FUELS AND TECHNOLOGIES FOR SPACE HEATING

Definition: Percentage of household members with reliance on clean fuels and technologies for space heating for all space heating devices

$$\frac{\text{Population with exclusive reliance on clean fuels and technologies for all space heating devices}}{\text{Total population}}$$

Numerator: Population with exclusive reliance on clean fuels and technologies for all devices used for space heating, where this is defined as:

For all heating devices reported in HH3: [HH4 (a) = 01, (02, 03, 04, 05 ONLY IF HH5 (a) is a clean heater or cookstove, as defined by WHO Guidelines⁶), 08]

AND

[HH4 (b) = 01, (02, 03, 04, 05 ONLY IF HH5 (a) is a clean heater or cookstove, as defined by WHO Guidelines⁶), 08]

AND

[HH4 (c) = 01, (02, 03, 04, 05 ONLY IF HH5 (a) is a clean heater or cookstove, as defined by WHO Guidelines⁶), 08]

Denominator: Total population

INDICATOR 8

EXCLUSIVE RELIANCE ON CLEAN FUELS AND TECHNOLOGIES FOR LIGHTING

Definition: Percentage of household members with reliance on clean fuels and technologies for lighting for all lighting devices

$$\frac{\text{Population with exclusive reliance on clean fuels and technologies for all lighting devices}}{\text{Total population}}$$

Numerator: Population with exclusive reliance on clean fuels and technologies for all lighting devices, where this is defined as:

For all lighting devices reported in HL2 that are defined as a clean lighting device by WHO Guidelines⁶: [HL3a) = 01, 02, 03, 04, 05, 06] AND

[HL3(b) = 01, 02, 03, 04, 05, 06] AND

[HL3(c) = 01, 02, 03, 04, 05, 06]

Denominator:Total population

⁶ WHO defines a clean fuel and technology combination as clean for health at the point of use if the device achieves Tier 4 or 5 for the PM_{2.5} Voluntary Performance Target tiers and Tier 5 for the CO Voluntary Performance Target tiers (following the guidance in ISO TR 19867-3:2018, available at <https://www.iso.org/standard/73935.html>). The Clean Cooking Catalogue, maintained by the Clean Cooking Alliance, contains emissions and performance information for stoves and fuels as a result of standardized laboratory tests. Please also see <https://www.who.int/tools/clean-household-energy-solutions-toolkit/module-7-defining-clean> for additional information

INDICATOR 9**EXCLUSIVE RELIANCE ON CLEAN FUELS AND TECHNOLOGIES FOR COOKING, SPACE HEATING AND LIGHTING**

Definition: Percentage of household members with reliance on clean fuels and technologies for cooking, space heating and lighting in all cooking, heating and lighting devices

$$\frac{\text{Population with exclusive reliance on clean fuels and technologies for all cooking, space heating and lighting devices}}{\text{Total population}}$$

Numerator: In order to be able to calculate the indicator, the population living in households that report no cooking or no space heating are included in the numerator.

Numerator is calculated as the population that lives in households with exclusive reliance on clean fuels and technologies for cooking, space heating, and lighting in all devices, defined as:

Calculated for all cooking devices reported in HC2:

[HC1==2 OR [[HC3 (a) = 01, 02, 03, 04, 05, (06 ONLY IF HC4(a) is a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(a) is a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(a) == 01)]]

AND

[HC3 (b) = 01, 02, 03, 04, 05, (06 ONLY IF HC4(b) is a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(b) is a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(b) == 01)]

AND

[HC3 (c) = 01, 02, 03, 04, 05, (06 ONLY IF HC4(c) is a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(c) is a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(c) == 01)]]]

AND

Calculated for all space heating devices reported in HH3:

[HH1==2 OR [HH4 (a) = 01, (02, 03, 04, 05 ONLY IF HH5 (a) is a clean heater or cookstove, as defined by WHO Guidelines⁶), 08]

AND

[HH4 (b) = 01, (02, 03, 04, 05 ONLY IF HH5 (a) is a clean heater or cookstove, as defined by WHO Guidelines⁶), 08]

AND

[HH4 (c) = 01, (02, 03, 04, 05 ONLY IF HH5 (a) is a clean heater or cookstove, as defined by WHO Guidelines⁶), 08]]]

AND

Calculated for all lighting devices reported in HL2:

[[HL3(a) = 01, 02, 03, 04, 05, 06] AND

[HL3(b) = 01, 02, 03, 04, 05, 06] AND

[HL3(c) = 01, 02, 03, 04, 05, 06]]]

Denominator: Total population

1.2 VENTILATION

Table 5. Recommended Questions on Ventilation

	RECOMMENDED SURVEY QUESTIONS	INDICATORS
Cooking	HC11. Cooking location of 1 st (MAIN) cookstove HC12. Chimney or hood used with 1 st (MAIN) cookstove	Percentage of household members with primary reliance on a ventilated cookstove used in an enclosed location
Heating	HH7. Chimney or hood used with 1 st (MAIN) heater	Percentage of household members with primary reliance on a ventilated space heater

<p>HC11. Is the cooking usually done in the house, in a separate building, or outdoors?</p> <p><i>(If in main house, probe to determine if cooking is done in a separate room. If outdoors, probe to determine if cooking is done on veranda, covered porch, or open air.)</i></p>	<p>In main house: no separate room.....01</p> <p>In main house: separate room.....02</p> <p>Outside of main house: in a separate room.....03</p> <p>Outside of main house in open air04 ▶ HC13</p> <p>On veranda or covered porch.....05 ▶ HC13</p> <p>Other96</p>
<p>HC12. Does the cookstove have a chimney or hood?</p>	<p>Yes01</p> <p>No02</p> <p>Don't know.....99</p>
<p>HH7. Does it have a chimney or hood?</p>	<p>Yes01</p> <p>No02</p> <p>Don't know.....99</p>

PURPOSE

Assess use of ventilation for cooking and heating, thus providing additional information about factors affecting exposure to household air pollution.

Note: Indicators should be weighted by population weight

INDICATOR 12

MAIN COOKSTOVE USED WITH VENTILATION IN AN ENCLOSED LOCATION

Definition: Percentage of population with primary reliance on a ventilated cookstove (living in households that cook in an enclosed location)

$$\frac{\text{Population with primary reliance on a cookstove used in an enclosed location with a chimney or hood}}{\text{Total population cooking in an enclosed location}}$$

Numerator: Numerator is calculated as the population with primary reliance on a cookstove used with a chimney or hood as ventilation, defined as:

$$(HC1 == 1) \text{ AND } (HC12(a) = 01)$$

Denominator: Total population in households cooking in an enclosed location, defined as:

$$(HC11(a) = 1, 2, 3)$$

INDICATOR 14

MAIN SPACE HEATER USED WITH VENTILATION

Definition: Percentage of household members with primary reliance on a ventilated space heater

$$\frac{\text{Population with primary reliance on a space heater used with ventilation}}{\text{Total population using a space heater}}$$

Numerator: Numerator is calculated as the population with primary reliance on a space heater used with a chimney or hood as ventilation, defined as:

$$HH7(a) = 01$$

Denominator: Total population using a space heater, defined as:

$$HH1(a) = 1$$

I.3 SAFETY AND INJURY

Table 6. Health Effects by Subgroup

	RECOMMENDED SURVEY QUESTIONS	INDICATOR/ANALYSIS
Cooking	HC13. Harm or injury from cookstove	Percentage of households reporting harm or injury from use of any cooking device
Heating	HH9. Harm or injury from space heater	Percentage of households reporting harm or injury from use of any heating device
Lighting	HL4. Harm or injury from light source	Percentage of households reporting harm or injury from use of any lighting device
Household Energy (all uses)		Percentage of households reporting poisoning from use of any liquid fuel cooking, heating, or lighting device
Gender	HG5. Injury while collecting or transporting fuel	Percentage of households in which main cooking fuel collector reports injury while collecting or transporting fuel

<p>HC13. In the past 12 months, did any harm or injury happen from using this cookstove, device or fuel? (Circle all that respondent mentions.)</p>	None.....01 Person burned02 Fire in house.....03 Poisoning.....04 Death05 Other96
<p>HG5. In the past 12 months, did this person experience an injury while collecting or transporting fuel? (Prompt. Circle all.)</p>	No injury.....00 Back pain01 Back, neck or shoulder injury.....02 Cuts or scrapes03 Snake or animal bite04 Other05 Does not know / unsure99
<p>HH9. In the past 12 months, did any harm or injury happen from using this space heater, cookstove or device? (Circle all that respondent mentions.)</p>	None.....01 Person burned02 Fire in house.....03 Poisoning.....04 Death05 Other96
<p>HL4. In the past 12 months, did any harm or injury happen from using this lighting source? (Circle all that respondent mentions.)</p>	None.....01 Person burned02 Fire in house.....03 Poisoning.....04 Death05 Other96

PURPOSE

Assess rates of injury arising during cooking, heating and lighting to better understand safety risks from household energy use.

Note: Indicators should be weighted by household weight

INDICATOR 17

HARM OR INJURY FROM USE OF FUELS AND TECHNOLOGIES FOR COOKING

Definition: Percentage of households reporting harm or injury from use of any cooking device (living in households that reported cooking)

$$\frac{\text{Households reporting harm or injury from any cooking device}}{\text{All households that cook}}$$

Note: indicator should be calculated for the number of cookstoves indicated in HC2.

Numerator:The number of households reporting an incident of harm or injury from using the cookstove, device or fuel in the past 12 months, defined as:

[HC13(a)= 02, 03, 04, 05, 96] OR [HC13(b)= 02, 03, 04, 05, 96] OR [HC13(c)= 02, 03, 04, 05, 96]

Denominator:The number of households cooking in the home, defined as:

HCI=01

INDICATOR 20

HARM OR INJURY FROM USE OF FUELS AND TECHNOLOGIES FOR SPACE HEATING

Definition: Percentage of households reporting harm or injury from use of any space heating device (living in households that reported use of space heating)

$$\frac{\text{Households reporting harm or injury from any space heating device}}{\text{All households that use space heating}}$$

Note: indicator should be calculated for the number of space heating devices indicated in HH3.

Numerator:The number of households reporting an incident of harm or injury from using the space heating device in the past 12 months, defined as:

HH9(a)=02,03,04,05, 96 OR HH9(b)=02,03,04,05,96 OR HH9(c)=02,03,04,05,96

Denominator:The number of households that report use of space heating, defined as: HHI=1

INDICATOR 23

HARM OR INJURY FROM USE OF FUELS AND TECHNOLOGIES FOR LIGHTING

Definition: Percentage of households reporting harm or injury from use of any lighting device (living in households that report the use of lighting device(s))

$$\frac{\text{Households reporting harm or injury from any lighting device}}{\text{All households that use lighting}}$$

Note: indicator should be calculated for the number of lighting devices indicated in HL2.

Numerator:The number of households reporting an incident of harm or injury from using the lighting device in the past 12 months, defined as:

HL4(a)=02,03,04,05,96 OR HL4(b)=02,03,04,05,96 OR HL4(c)=02,03,04,05,96

Denominator:The number of households that report use of a lighting device(s), defined as: HLI=1

INDICATOR 24

BURN INJURY TO HOUSEHOLD MEMBER(S) FROM COOKING, SPACE HEATING, OR LIGHTING FUEL/DEVICE

Definition: Percentage of households reporting burn injury from the use of any cooking, heating or lighting device (living in households that use cooking, heating and/or lighting devices)

$$\frac{\text{Households reporting harm or injury from any cooking, space heating or lighting device}}{\text{All households that use cooking, space heating or lighting devices}}$$

Note: indicator should be calculated for the number of cooking devices indicated in HC2, heating devices indicated in HH3, and lighting devices indicated in HL2.

Numerator:The number of households reporting an incident of harm or injury from using a cooking, space heating or lighting device in the past 12 months, defined as:

HC13(a)= 02, 03, 04, 05,96 OR HC13(b)= 02, 03, 04, 05,96 OR HC13(c)= 02, 03, 04, 05,96

OR

HH9(a)=02,03,04,05,96 OR HH9(b)=02,03,04,05,96 OR HH9(c)=02,03,04,05,96

OR

HL4(a)=02,03,04,05,96 OR HL4(b)=02,03,04,05,96 OR HL4(c)=02,03,04,05,96

Denominator: Number of households that report use of a cooking, space heating, or lighting device(s):

HCI=1 OR HHI=1 OR HLI=1

INDICATOR 25**POISONINGS FROM LIQUID FUEL COOKSTOVES, HEATERS, OR LAMPS IN THE YEAR BEFORE THE SURVEY**

Definition: Percentage of households reporting poisoning from use of any liquid fuel cooking, heating, or lighting device

$$\frac{\text{Households reporting poisoning from liquid fuels used in any cooking, space heating or lighting device}}{\text{All households that use liquid fuels in cooking, space heating or lighting devices}}$$

Note: indicator should be calculated for the number of cooking devices indicated in HC2, heating devices indicated in HH3, and lighting devices indicated in HL2.

Numerator: The number of households that report poisoning from liquid fuels used in a cooking, space heating or lighting device in the past 12 months, defined as:

[HC13(a)= 04 OR HC13(b)= 04 OR HC13(c)= 04]

OR

[HH9(a)=04 OR HH9(b)=04 OR HH9(c)=04]

OR

[HL4(a)=04 OR HL4(b)=04 OR HL4(c)=04]

Denominator: Number of households that report use of a liquid fuel in a cooking, space heating, or lighting device(s):

[HC3(a)=08 OR HC3(b)=08 OR HC3(c)=08]

OR

[HH6(a)= 05,06,07 OR HH6(b)= 05,06,07 OR HH6(c)= 05,06,07]

OR

[HL3(a) =07,08,09 OR HL3(b) = 07,08,09 OR HL3(c) = 07,08,09]

INDICATOR 26**PHYSICAL INJURY FROM CARRYING FUEL FOR COOKING**

Definition: Percentage of households in which main cooking fuel collector reports injury while collecting or transporting fuel

$$\frac{\text{Households in which main fuel collector reports injury while collecting or transporting fuel}}{\text{All households that collect fuel}}$$

Numerator: Households in which main person who goes to collect primary cookstove fuel experiences an injury while collecting or transporting fuel, defined as:

HG5=01,02,03,04,05

Denominator: Total number of households that collect fuel, defined as:

HG1=2 AND HG2 ≠ 00

I.4 TIME USE

Household energy use for cooking, heating and lighting has significant effects on health and livelihood. To measure these effects, data should be collected on time use related to household energy, health outcomes related to household energy use, and the physical labor required to collect fuel. Table 7 presents a set of recommended questions in the cooking module which assess time spent cooking by stove type, capturing data on the relative time spent using different devices.

In addition, Table 7 includes a set of recommended questions focused on the individuals who spend the most time collecting fuel and cooking. These questions are linked to identification information asked elsewhere in the survey, making it possible to analyze the sex and gender of the primary fuel collector and cook, and to calculate the time burdens of these activities. This also facilitates analysis of potential child labor.

Table 7. Time Use by Subgroup

	TOPIC	INDICATOR/ANALYSIS
Cooking	HC9. Time spent cooking (by cooking device) HC10. Frequency of cookstove use	<ul style="list-style-type: none"> • Average number of hours in a day that households spent cooking with all clean fuels and technologies • Average number of hours in a day that households spent cooking with all polluting fuels and technologies
Energy and Gender	HG2. Identity of main cooking fuel collector HG3. Time spent collecting fuel HG4. Monthly trips to collect fuel HG6. Time preparing cookstove and fuel HG7. Identity of primary cook HG8. Time spent cooking (by primary cook)	<ul style="list-style-type: none"> • Time spent collecting main cooking fuel in past month, for households mainly using clean fuel and technology to cook • Time spent collecting main cooking fuel in past month, for households mainly using polluting fuel and technology to cook • Time spent preparing the main cookstove in past day, for households mainly using clean fuels and technologies to cook • Time spent preparing the main cookstove in past day, for households mainly using polluting fuels and technologies to cook • Time spent cooking by the primary cook

PURPOSE

Determines the amount of time spent cooking with clean versus polluting devices (thus obtaining more information about the relative exposure to each) as well as time spent on activities related to cooking

Note: Indicators should be weighted by household weight.

INDICATOR 28

TIME SPENT COOKING ON ALL COOKSTOVES WITH CLEAN FUELS AND TECHNOLOGIES

Definition: Average number of hours in a day that households spent cooking with all clean fuels and technologies

$$\frac{\text{Hours per day households spent cooking with clean fuels and technologies}}{\text{All households that cook}}$$

Note: Indicator is calculated for all household and all cooking devices reported in HC2.

Numerator: Hours spent in a day cooking with all clean fuels and technologies, calculated as:

[(HC9(a)hours+ HC9(a)minutes/60) if (HC3 (a) = 01, 02, 03, 04, 05, (06 ONLY IF HC4(a) is a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(a) is a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(a) == 01).)]

PLUS

[(HC9(b)hours+ HC9(b)minutes/60) if (HC3 (b) = 01, 02, 03, 04, 05, (06 ONLY IF HC4(b) is a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(b) is a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(b) == 01).)]

PLUS

[(HC9(c)hours+ HC9(c)minutes/60) if (HC3 (c) = 01, 02, 03, 04, 05, (06 ONLY IF HC4(c) is a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(c) is a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(c) == 01).)]

Denominator: The number of households using any cooking device:

HCI=I

INDICATOR 30**TIME SPENT COOKING ON ALL COOKSTOVES WITH POLLUTING FUELS AND TECHNOLOGIES**

Definition: Average number of hours in a day that households spent cooking with all polluting fuels and technologies

$$\frac{\text{Hours per day households spent cooking with polluting fuels and technologies}}{\text{All households that cook}}$$

Note: Indicator is calculated for all households, and for all cooking devices reported in HC2.

Numerator: Hours spent in a day cooking with all polluting fuels and technologies, calculated as:

[(HC9(a)hours+ HC9(a)minutes/60) if (HC3(a) = (06 ONLY IF HC4(a) is NOT a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(a) is NOT a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(a) =02,03,04,05, 06,07,08,09,10,11,12,13,14) ,09,10)]

PLUS

[(HC9(b)hours+ HC9(b)minutes/60) if (HC3(b) = (06 ONLY IF HC4(b) is NOT a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(b) is NOT a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(b) =02,03,04,05, 06,07,08,09,10,11,12,13,14) ,09,10)]

PLUS

[(HC9(c)hours+ HC9(c)minutes/60) if (HC3(c) = (06 ONLY IF HC4(c) is NOT a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(c) is NOT a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(c) =02,03,04,05, 06,07,08,09,10,11,12,13,14) ,09,10)]

Denominator: The number of households using any cooking device, calculated as:

HCI=I

INDICATOR 34**TIME SPENT COLLECTING MAIN COOKING FUEL IN PAST MONTH, FOR HOUSEHOLDS MAINLY USING CLEAN FUEL AND TECHNOLOGY TO COOK**

Definition: Total time spent over the last thirty days by the main fuel collector in the household to collect the main cooking fuel, including time spent to go collect the fuel, get the fuel, and come back in households that primarily cook with clean fuels and technologies

$$\frac{\text{Hours over the last 30 days households spent collecting the main cooking fuel}}{\text{All households that cook}}$$

Numerator: Total time spent over the last thirty days by the main fuel collector in the household to collect the main cooking fuel, defined as

0 if HG1 = 01 OR (HG1=02 AND HG2=00)

ELSE

(HG3_hours + HG3_minutes/60) * HG4]

Denominator: Number of households that report cooking and primarily cook with clean fuels and technologies, defined as:

HCI == I

AND

HC3 (a) = 01, 02, 03, 04, 05, (06 ONLY IF HC4(a) is a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(a) is a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(a)=01)

INDICATOR 35**TIME SPENT COLLECTING MAIN COOKING FUEL IN PAST MONTH, FOR HOUSEHOLDS MAINLY USING POLLUTING FUEL AND TECHNOLOGY TO COOK**

*Definition:*Total time spent over the last thirty days by the main fuel collector in the household to collect the main cooking fuel, including time spent to go collect the fuel, get the fuel, and come back in households that primarily cook with polluting fuels and technologies

$$\frac{\text{Hours over the last thirty days households spent collecting the main cooking fuel}}{\text{All households that mainly cook with polluting fuels and devices}}$$

Numerator: Hours over the last thirty days by the main fuel collector in the household to collect the main cooking fuel, defined as

0 if HG1 = 01 OR (HG1=02 AND HG2=00)

ELSE

(HG3_hours + HG3_minutes/60) * HG4]

Denominator:

Number of households that report cooking and primarily cook with polluting fuels and technologies, defined as:
 HC1 == 1 AND

HC3(a) = (06 ONLY IF HC4(a) is NOT a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(a) is NOT a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(a) =02,03,04,05,06,07,08,09,10,11,12,13,14), 09, 10.

INDICATOR 36**TIME SPENT PREPARING THE MAIN COOKSTOVE IN PAST DAY, FOR HOUSEHOLDS MAINLY USING CLEAN FUELS AND TECHNOLOGIES TO COOK**

*Definition:*Average time spent in the last twenty-four hours to prepare the main cookstove and fuel for cooking, including setting up the fuel and lighting/turning on the cookstove (but not including gathering fuel or cooking time) in households that primarily cook with clean fuels and technologies

$$\frac{\text{Hours per day households spent preparing the main cooking stove and fuel}}{\text{All households that mainly cook with clean fuels and devices}}$$

Numerator:Time in hours spent per day to prepare the main cookstove and fuel for cooking, including setting up the fuel and lighting/turning on the cookstove but not gathering fuel or cooking time, defined as

(HG6_hours + HG6_minutes/60)

Denominator: Number of households that report cooking and primarily cook with clean fuels and technologies, defined as:

HC1==1 AND

HC3 (a) = 01, 02, 03, 04, 05, (06 ONLY IF HC4(a) is a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(a) is a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(a)=01)

INDICATOR 37**TIME SPENT PREPARING THE MAIN COOKSTOVE IN PAST DAY, FOR HOUSEHOLDS MAINLY USING POLLUTING FUELS AND TECHNOLOGIES TO COOK**

Definition: Time spent in the last twenty-four hours to prepare the main cookstove and fuel for cooking, including setting up the fuel and lighting/turning on the cookstove (but not including gathering fuel or cooking time) in households that primarily cook with polluting fuels and technologies

$$\frac{\text{Hours per day households spent preparing the main cooking stove and fuel}}{\text{All households that mainly cook with polluting fuels and devices}}$$

Numerator: Time in hours spent per day to prepare the main cookstove and fuel for cooking, including setting up the fuel and lighting/turning on the cookstove but not gathering fuel or cooking time, defined as

(HG6_hours + HG6_minutes/60) IF

HC(a) = 06 (ONLY IF HC4(a) is NOT a clean cookstove, as defined by WHO Guidelines⁶), 07 (ONLY IF HC4(a) is NOT a clean cookstove, as defined by WHO Guidelines⁶), 08 (ONLY IF HC5(a) = 02,03,04,05,06,07,08,09,10,11,12,13,14), 09, 10.

Denominator: Number of households that report cooking and primarily cook with polluting fuels and technologies, defined as: HCI == 1 AND

HC(a) = (06 ONLY IF HC4(a) is NOT a clean cookstove, as defined by WHO Guidelines⁶), (07 ONLY IF HC4(a) is NOT a clean cookstove, as defined by WHO Guidelines⁶), (08 ONLY IF HC5(a) = 02,03,04,05,06,07,08,09,10,11,12,13,14), 09, 10.

INDICATOR 38**TIME SPENT COOKING BY THE PRIMARY COOK**

Definition: Average hours the primary cook spent cooking yesterday, including cooking food, tea/coffee, and boiling drinking water for household consumption

Note: it is possible to disaggregate this indicator by sex by linking HG7 to the household roster in the survey.

$$\frac{\text{Hours per day primary cook spends cooking}}{\text{All households that cook}}$$

Numerator: Time spent during the day before the survey by main cook on cooking tasks, including cooking food, making tea/coffee, and boiling drinking water for household consumption, defined as:

(HG8_hours + HG8_minutes/60)

Denominator: All households that report cooking

HCI == 1

I.5 EXPENDITURE

There is a single question in the cooking section that is recommended to determine the household expenditure on fuels or energy sources used for cooking. If another

section of the survey assesses household income, expenditure, or consumption, this question (HC6) can provide important information on the affordability of cooking fuel.

Table 8. Recommended Questions on Expenditure on Cooking Fuel or Energy Source

	RECOMMENDED SURVEY QUESTIONS	INDICATORS
Cooking	HC6. Expenditure on cookstove fuel or energy source	Average amount household spent on the fuel or energy source needed for all cookstoves in the last thirty days
	HC6. How much did this household pay for this fuel or energy source last month for cooking (the last 30 days)? (in local currency)	_____ (local currency) Pays nothing.....00 Does not know.....99

PURPOSE

Examine household expenditure on cooking fuels or energy sources.

Note: Indicator should be weighted by household weight

INDICATOR 40

EXPENDITURE ON FUELS AND ENERGY SOURCES FOR COOKING WITH ALL COOKSTOVES IN THE PAST MONTH

Definition: Average amount household spent on the fuel or energy source needed for all cookstoves in the last thirty days (in all households reporting cooking) (in local currency)

Note: indicator is calculated for all cooking devices indicated in HC2.

$$\frac{\text{Amount households spent on all cooking fuel or energy for all cookstoves in last 30 days}}{\text{All households that report cooking}}$$

Numerator: 0 if (HC6(a)==0 AND HC6(b) ==0 AND HC6(c)==0), else HC6(a)+HC6(b)+HC6(c)

Denominator: HC1==1

I.6 FUEL AVAILABILITY

The next question in the cooking section is *recommended* to assess whether the household has experienced problems with fuel availability in the past year. Households may desire to use a fuel or technology but are unable to

do so due to challenges in supply – thus, it is important to assess availability challenges when examining household energy use.

Table 9. Recommended Questions on Fuel Availability

	RECOMMENDED SURVEY QUESTIONS	INDICATORS
Cooking	HC7. Availability of fuel or energy source	Population in households reporting problems with availability of the fuel or energy source for main cookstove occurring at least four times in the past 12 months
	HC7. In the past 12 months, how often was this fuel or energy source unavailable in the quantity you desired?	Often (more than once a month)01 Sometimes (4-12 times a year)02 Rarely (less than 4 times a year).....03 Never (always available).....04 Does not know / unsure99

PURPOSE

Assess availability of cooking fuels or energy sources

Note: Indicator should be weighted by population weight

INDICATOR 41

PROBLEMS WITH AVAILABILITY (4 times or more per year) OF MAIN COOKING FUEL OR ENERGY SOURCE

Definition: Percentage of the population in households reporting problems with availability of the fuel or energy source for main cookstove occurring at least four times in the past 12 months (in households reporting cooking)

$$\frac{\text{Population in households with fuel availability problems at least 4 times in past month}}{\text{Total population that reports cooking}}$$

Numerator: Population in households reporting that fuel or energy source were unavailable in the desired quantity 4 or more times in the past 12 months, defined as: HC7(a)=01,02

Denominator: Population in households that report cooking, defined as:
(HC1==1)

APPENDIX 3.

MANUAL FOR ENUMERATORS AND FIELD SUPERVISORS

This appendix includes guidance for the implementation of the module in practice. Together with the glossary and the photo aids found in Appendix 4, this appendix can be used as a manual for interviewers, providing key guidance for successful interviewing. It includes the following sections:

1. Fundamentals of Interviewer Training

- 1.1 Training of Interviewers
- 1.2 Supervision of Interviewers
- 1.3 Survey Regulations
- 1.4 Conducting Interviews
- 1.5 Question Types
- 1.6 When Problems Arise...

2. Question-by-Question Guidance

- 2.1 Household Cooking
- 2.2 Household Energy & Gender
- 2.3 Household Heating
- 2.4 Household Lighting
- 2.5 Household Electricity

I. FUNDAMENTALS OF INTERVIEWER TRAINING

Interviewers occupy the central position in the survey, as they collect the information from respondents that forms the basis of data analysis. Thus, the success of the survey depends on the quality of the interviewer's work. This section provides basic guidelines for the interviewers, and subsequent sections cover question-by-question instructions from the household cooking, energy, heating, and electricity survey questionnaires.

I.1 Training of Interviewers

Study this manual carefully along with the questionnaire, write down any questions you may have, and ask your supervisors and co-interviewers the questions in order to avoid mistakes during actual interviews. Interviewers can learn a lot from each other by asking questions and talking about situations that may be encountered in actual interview situations.

During training, questions and instructions are discussed in detail. Practice reading the questionnaire aloud to another person so that you may become comfortable with reading the questions aloud. This is very important in preparing yourself for the interviews. Another means of training is *role playing*, in which you practice by interviewing another interviewer – one of you will be the interviewer and the other will be the respondent.

Your training does not end when the formal training is completed, as it consists of a combination of classroom training and practical experience. Each time a supervisor discusses something with you in the field, your training continues. You may also run into situations that were not covered in training, and it is recommended that you discuss them with your team so that others can benefit from your experiences.

I.2 Supervision of Interviewers

Supervision throughout the fieldwork facilitates the training and data collection process. Your supervisor will play a very important role in continuing your training by doing the following:

- Observing some of your interviews to ensure that you are conducting yourself well, asking the questions in the right manner, and interpreting the answers correctly
- Reviewing the completed questionnaire to ensure that it is filled out properly and consistently

- Meeting with the team members individually and as a group (as needed) to discuss performance

I.3 Survey Regulations

During the survey period, your presence, interest, participation, and cooperation are vital. The following survey regulations have been established and will be strictly enforced:

- All information collected should be handled with strict confidentiality
- Your conduct must be professional, and your behavior must be congenial when dealing with the public. You must be aware that the success of your work depends on the goodwill and cooperation of the people you interview. Therefore, any team member who is aggressive, abrupt, or disrespectful to the respondent may be dismissed from the survey team
- For the survey to succeed, each of you must work closely together, sharing the difficulties you face and cooperating with and supporting each other.

I.4 Conducting Interviews

Interviewing should not be treated as a mechanical process. Each interview is a new source of information, and it helps when it is interesting and pleasant. While the art of interviewing develops with practice, there are certain basic principles that should be followed to become successful as an interviewer. This section offers a few general guidelines on how to build rapport with a respondent and conduct a successful interview.

a. Building rapport with the respondent:

At the beginning of an interview, you and the respondent are strangers to each other. The respondent's first impression of you will influence his or her willingness to cooperate with the survey. Be sure that your manner is friendly when you introduce yourself. Here are few examples:

- Make a good first impression:** When you initially approach the respondent, do your best to make him or her feel at ease. With a few well-chosen words, you can put the respondent in the right frame of mind for the interview. Open the interview with a smile and friendly greeting such as "Good morning" and then proceed with your introduction. The best way of introducing yourself is as follows:

“Hello, my name is _____.

I would like to ask you a few questions aimed at measuring access to cooking, heating, lighting and electricity. All the answers that you provide will be kept private – only members of the survey team will have access to this information. You can ask me to clarify any question or ask me to repeat something you don’t understand. Your cooperation is greatly appreciated.”

Then ask if the respondent has any questions for you.

NOW THE INTERVIEW CAN START.

ii. Emphasize confidentiality of responses when necessary: If the respondent is hesitant about responding to the interview or asks what the data will be used for, explain that the information you collect will remain confidential, that no individual names will be used for any purpose, and that all information will be grouped together to write a report. Also, you should never mention other interviews or show completed questionnaires to other interviewers or supervisors in the presence of a respondent or any other person.

iii. Answer any questions from the respondent frankly: Before agreeing to be interviewed, the respondent may ask you some questions about the survey or how he or she was selected to be interviewed. Be direct and pleasant when you answer. Indicate your willingness to return later if it is more convenient for the respondent to answer questions at another time.

b. Tips for conducting the interview:

i. Be neutral throughout the interview: Most people are polite and will tend to give answers that they think you want to hear. It is therefore very important that you remain completely neutral as you ask the questions. Never allow the respondent to think that they have given the “right” or “wrong” answer to the question, either by the expression on your face or by the tone of your voice. Never appear to approve or disapprove of any of the respondent’s replies. A respondent may ask for your opinions about the question he or she has been asked. Tell him or her that you are interested in his or her opinions and that you cannot answer his or her questions because that would slow down the pace of the work. The questions are all carefully worded to be neutral. They do not suggest that one answer is more likely or preferable to another answer. If you fail to read the complete

question, you may destroy that neutrality. That is why it is important to read the whole question as it is written. If the respondent gives an ambiguous answer, try to probe in a neutral way by asking questions such as:

“Can you explain a little more?” or

“I did not quite understand, could you please tell me again?” or

“There is no hurry. Take a moment to think about it.”

ii. Do not change the wording or sequence of questions: The wording of the questions and their sequence in the questionnaire must be maintained. If the respondent has not understood the question, you should repeat the question slowly and clearly. If the respondent still does not understand, you may reword the question, being careful not to alter the meaning of the original question. In some cases, you may have to ask additional questions to obtain a complete answer from a respondent; this is called probing. If you do this, you must ensure that your probes are “neutral” and that they do not suggest an answer to the respondent.

iii. Handle hesitant respondents tactfully: There will be situations where the respondent simply says, “I don’t know,” gives an irrelevant answer, acts very bored or detached, or contradicts something he/she has already said. In those cases, try to interest the respondent in the conversation. For example, if you sense that the respondent feels shy or afraid, try to put them at ease before proceeding. Spend a few moments on small talk (for example, about the village, a special event, the weather, daily activities, etc.). If the respondent gives irrelevant answers, do not stop them abruptly; listen to what they have to say, then try to steer them gently back to the original question. A good atmosphere must be maintained throughout the interview. The best atmosphere for an interview is one in which the respondent sees the interviewer as a friendly, sympathetic, and responsive person who is not intimidating. As indicated earlier, privacy is a major factor when it comes to being in control of an interview and this could be helped by securing a private area prior to conducting the interview.

If the respondent is reluctant or unwilling to answer a question, try to overcome their reluctance by assuring them once again that the same question is being asked all over the country and that the answers will all be merged while maintaining their anonymity. If they still refuse, simply write REFUSED next to the question and proceed as if nothing had happened. If you can success-

fully complete the interview, you may try to return to the unanswered questions at the end, but do not push too hard for an answer. Remember, the respondent cannot be forced to give an answer.

iv. Do not rush the interview: Ask the questions slowly to ensure the respondent understands what they are being asked. After you have asked a question, pause and give them time to think. If the respondent feels hurried or is not allowed to formulate an opinion, they may respond with “I don’t know” or give an inaccurate answer. If you feel the respondent is answering without thinking just to speed up the interview, say to the respondent, “There is no hurry. Your opinion is very important, so please consider your answers carefully.”

c. Tips for handling different types of questions:

Each individual question in the questionnaire will be discussed in Section 2. This section is an overview of how different types of questions should be handled.

- **Instruction for enumerator:** these are printed in CAPITAL letters to distinguish them from regular questions. Questions that are in all CAPITAL letters should not be read to the respondent; they are for the enumerator only.

<p>HC8.</p> <p>ENUMERATOR: In the past month, who in the household does most of the cooking, including cooking food, making tea/coffee and boiling drinking water?</p> <p>MAIN COOK IS NOT HOUSEHOLD MEMBER.....00</p> <p>Name _____</p> <p>Line Number ____</p> <p>INSTRUCTIONS: the enumerator won't read aloud the options to the respondent and will report the code of the answer in the box</p>
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- **Brackets and capital letters:** These mean that the interviewer must replace the word in the brackets with another word, when he/she asks the question. In certain sections of the questionnaire, the word “name” is often written in brackets, such as “[COOKSTOVE]” or “[NAME MAIN electricity system]”. In these cases, replace the word in brackets with the name of the main device indicated by the person being interviewed at that moment.

I.5 Question Types

All of the questions are written exactly as they are to be read to the respondents unless indicated in the instructions on the questionnaire (IN CAPITAL LETTERS). Enumerators should not ask the questions according to their own criteria, except in situations where the respondent does not understand the question. In such situations, you must explain the content without changing the meaning of the question. This is important to ensure that all respondents are answering the same questions.

There are different question formats:

- **Closed or pre-coded questions:** for this type of question, all possible responses are coded. Only the code (number) for the respondent’s answer will be entered. The enumerator must read the question exactly as it appears in the questionnaire.
- **The enumerator should read the options for the answer ONLY when the options are reported in lower case letters.** To record a respondent’s answer, you report the number (code) that corresponds to the reply in the designated space. The responses to these questions are listed in the questionnaire. See the two examples below for questions with coded responses (categorical variable).

<p>HC8.</p> <p>How often was this fuel or energy source unavailable in the quantity you desired?</p> <p>Often (more than once a month)....01</p> <p>Sometimes (4-12 times a year).....02</p> <p>Rarely (less than 4 times a year).....03</p> <p>Never (always available).....04</p> <p>Does not know / unsure99</p>	<p>HG2.</p> <p>In the past month (the last 30 days), who usually goes to collect the main fuel for the cookstove your household uses most of the time?</p> <p>MEMBERS DO NOT COLLECT00HG7</p> <p>Name _____</p> <p>Line Number ____</p> <p><i>(if multiple collect for the same AMOUNT OF time)</i></p> <p>SECOND PERSON Name _____</p> <p>SECOND PERSON Line Number ____</p>
<p>INSTRUCTIONS: the enumerator will read aloud the options to the respondent and will report the code of the answer in the box</p>	<p>INSTRUCTIONS: the enumerator will not read aloud the options to the respondent and will report the code of the answer in the box</p>

In some cases, pre-coded responses will include an “OTHER” category. The “OTHER” code should be reported when the respondent’s answer is different from any of the pre-coded responses listed for the question. Before using the “OTHER” code, you should make sure

that the answer does not fit in any of the other categories. When you use “OTHER” for a particular question, you must always write the respondent’s answer separately in the space provided. If you need more room, use the margin or make notes to share with your supervisor when you return your questionnaire forms.

- **Open questions:** for this type of question, the interviewer reads only the question text and then enters the answer *exactly* as given by the respondent. For such questions there are no coded answers, and the interviewer enters either words or numbers depending on the question and answer. “Respondent’s name” is an example of open question where the interviewer enters words. In entering the response for these questions, you must write the respondent’s answer in the space provided. Usually, you will record a number or date in the boxes provided.

HH2. In the last 12 months, during how many months did you use a heating device or fire to keep the dwelling/living quarters warm?
Number of months... _ _ _

If the number is too large for the space provided, write it in the margin or somewhere else on the same page with an accompanying note. There are other cases, however, where you must write down the response in the respondent’s own words. Try to record those answers exactly as they are given. If you need to shorten a lengthy description, be careful to keep the meaning accurate, and if necessary, write a note at the bottom or side of the page to explain.

- **Skip patterns:** *The questionnaires are to be filled in order, question by question. Everybody is to be asked question 1, then question 2, 3, etc., except for cases with special instructions.* However, in some cases, the given answer determines which question to ask next, or which question to skip. Paper questionnaires use certain marks that show which question is to be skipped. An example of a skip is shown below. In this question, if the response is “04” or “05”, the enumerator skips to question HC13. If the response is other than “04” or “05”, the enumerator continues with the next question because the skip is only for response “04” or “05”.

HC11. Is the cooking usually done in the house, in a separate building, or outdoors?	
In main house: no separate room.....	01
In main house: separate room.....	02
Outside of main house: in a separate room.....	03
Outside of main house in open air	04 ▶ HC13
On a veranda or covered porch.....	05 ▶ HC13
Other	96

- **Zero response:** Responses that require a time figure must be filled with ‘0’ if there was no amount used for the particular question. In the following example, if the respondent says that he did not spend time preparing the cookstove and fuel for cooking, the correct method of recording is to put “0” in the number of hours and minutes blank space.

HG0037.	
Yesterday, how much time total was spent preparing the [COOKSTOVE] and fuel for cooking, including setting up the fuel and lighting/turning on the cookstove but not including gathering fuel or cooking time?	
Number of hours	__ __
Number of minutes	__ __
Does not know / unsure	99

It is never permissible to leave a question blank that was not originally intended to be blank from the skip patterns. If the respondent does not know, probe to get the necessary information. If after probing the respondent still does not know, indicate ‘99’ on the questionnaire instead of leaving it blank. Note, ‘99’ answers cannot be used in the analysis, so every effort should be made to minimize the incidence of these responses.

d. Correcting mistakes:

It is very important that you record all answers neatly and correctly. If you make a mistake in entering an answer and need to change the response, *cross out the incorrect response and enter the right answer.* Do not try to erase an answer or write on top of the wrongly entered figure. Just put two lines through the incorrect response.

e. Checking completed questionnaires:

After you have completed an interview, review the questionnaire by carefully checking the answer to each question. It is important to check that you have followed all the appropriate skip patterns and that you have not omitted any sections. If necessary, you may correct your handwriting or clarify answers. You should review the

questionnaire before you leave the premises, in case you need to ask the respondent further questions. Write any comments about the interview that you feel would clarify the answers you recorded or would be of interest to your supervisor. If you have any doubts about how to record an answer, feel free to write a note on the questionnaire and check with your supervisor. The supervisor is there to help you.

1.6 When problems arise...

Communicate with your supervisor or head office. Unforeseen issues will always arise during fieldwork. If interviewers have any questions, concerns, or problems during training or fieldwork, they should contact their supervisor immediately. Early communication ensures that problems are dealt with in a timely manner.

2. CUSTOMIZING SURVEY RESPONSE OPTIONS

There are a few questions that require customization in each country before conducting training on the survey or launching the survey in households. Detailed information for how the answer options should be selected and developed follows.

HC4. *What is the brand of the cookstove or device?

(Pre-fill with name or brand of manufactured or traditional solid fuel stoves available in country- may add additional lines.)

NAME/BRAND 101
 NAME/BRAND 2.....02
 NAME/BRAND 3.....03
 Other, specify96

HC4: Before conducting the survey, the survey implementation team should populate the response options with a list of the main manufactured solid fuel stoves used by households in the country. Only manufactured solid fuel stoves should be added, such as stoves that burn wood, pellets, or charcoal. Other stove types, such as liquid fuel stoves or traditional solid fuel stoves, should not be included in this list because of the skip pattern (other stove types will be captured by the preceding question). In order to determine appropriate response options for this question, it is suggested to consult with national ministries that may have distributed manufactured solid fuel stoves, international experts (e.g. the WHO and World Bank Group), and academics who have conducted research on household pollution. These individuals may be able to suggest the most commonly used types of manufactured solid fuel stoves in the country that

should be included as response options. A comprehensive list of manufactured cookstoves is also available in the Clean Cooking Catalogue managed by the Clean Cooking Alliance (available here: <http://catalog.cleancookstoves.org/>), and it is possible to filter by stoves available in different geographic areas. The final response list should be finalized after piloting the survey in a small number of households to confirm that the list is comprehensive and valid. As an example, the list could read:

Mimimoto stove01
 Philips stove with fan.....02
 ACE stove.....03
 Other, specify96

HH5. *What is the brand of the heater, cookstove or device?

NAME/BRAND 101
 NAME/BRAND 2.....02
 NAME/BRAND 3.....03
 Other, specify96

HH5. Before conducting the survey, the survey implementation team should populate the response options with a list of the main manufactured solid fuel devices used by households in the country for heating. Only manufactured solid fuel devices should be added, such as heaters that burn wood, pellets, or charcoal. Other heating devices, such as traditional heat stoves and heaters that use liquid fuels, should not be listed here because of the skip pattern (other stove types will be captured by the preceding question). To determine appropriate response options for this question, it is suggested to consult with national ministries that may have distributed solid fuel devices for heating (if applicable), international experts (e.g., the WHO and the World Bank Group), and academics who have conducted research on household pollution. These individuals may be able to suggest the most common types of manufactured solid fuel devices used in the country that should be included as response options. A comprehensive list of manufactured stoves is also available in the Clean Cooking Catalog managed by the Clean Cooking Alliance (available here: <http://catalog.cleancookstoves.org/>), and it is possible to filter by stoves available in different geographic areas. The final response list should be finalized after piloting the survey in a small number of households to ensure that the list is comprehensive and valid in the local context.

3. QUESTION-BY-QUESTION GUIDANCE

Instructions for Interviewer: Please inform the respondent that you will now ask questions about cooking, fuel collection, heating, lighting, and electricity use. The respondent should be the most knowledgeable household member for each module. Respondents may differ across modules.

3.1 Household cooking

For manufactured and traditional solid fuel cookstove definitions as well as for photos of various cooking solutions, refer to Appendix 3.

<p>HC1</p>	<p><i>Is any food or drink consumed by household members cooked or prepared at the household dwelling using a cookstove, fire, or other cooking device?</i></p> <p>Select YES if the food or drink consumed by the household members is prepared at the household dwelling using a cookstove, fire, or other cooking device.</p> <p>If the food or drink consumed by the household members is NOT prepared at the household dwelling using a cookstove, fire, or other cooking device, select NO and skip to HEATING MODULE.</p>
<p>HC2</p>	<p><i>How many stoves (including open fires) are used for these activities?</i></p> <p>Record the TOTAL number of stoves or cooking devices (including open fires) that the household members use to prepare the food or drink. If the respondent reports fewer than 3 cookstoves, in the NEXT QUESTION leave the extra columns blank. <u>If the respondent reports the use of more than 3 cookstoves, use additional sheets to record all the cookstoves.</u></p>
<p>HC3</p>	<p><i>What does this household use for cooking most of the time, including cooking food, making tea/coffee, and boiling drinking water?</i></p> <p>First, identify the cookstove or cooking device that is used most frequently by asking the respondent. Record the code related to the cookstove or device indicated as the principal in the first column. In the second column, record the code related to the second cookstove used most often, and so on.</p> <p>For this question, select only ONE type for each cookstove.</p> <p>If the selected answer is <i>Solar cooker (thermal energy, not solar panels)</i> skip to question HC7.</p> <p>If the selected answer is <i>Electric stove, Piped natural gas stove, Biogas stove or Liquefied petroleum gas (LPG) cooking gas stove</i> skip to question HC6.</p> <p>If the selected answer is <i>Liquid fuel stove, Moveable firepan or Three stone stove/open fire</i> skip to question HC5.</p>

<p>HC4</p>	<p><i>What is the brand of the cookstove or device?</i></p> <p>For this question, record the answers for EACH cookstove or device indicated by the respondent in question HC2, starting with the MOST USED cookstove and ending with the least used.</p> <p>Select one of the names/brands of manufactured or traditional solid fuel stoves available in country or write 96 and specify the name of the brand (if it is not on the list). Record the brand for each cookstove.</p> <p>Note that you should only be answering this question if the answer for HC3 is a manufactured solid fuel cookstove (code 6), a traditional solid fuel cookstove (code 7), or other (96).</p>
<p>HC5</p>	<p><i>What type of fuel or energy source does this household use in this cookstove or device for cooking food, making tea/coffee and boiling drinking water? (Multiple choice)</i></p> <p>For this question, record the answers for EACH cookstove or device indicated by the respondent in question HC2, starting with the MOST USED cookstove.</p> <p>Select ALL the fuels and energy sources that the household uses for each stove to make food or drink and/or to start the fire. If there are no other fuels, select 01.</p>
<p>HC6</p>	<p><i>How much did this household pay for this fuel or energy source last month for cooking (the last 30 days)?</i></p> <p>For this question, record the answers for EACH cookstove or device indicated by the respondent in question HC3, starting with the MOST USED cookstove and ending with the least used.</p> <p>Record IN LOCAL CURRENCY the TOTAL amount the household paid for the fuel or energy source in the LAST 30 DAYS. If the household paid nothing, record '00', and if the respondent does not know, record '99'. Record the total amount for each cookstove or device.</p>
<p>HC7</p>	<p><i>In the past 12 months, how often was this fuel or energy source unavailable in the quantity you desired?</i></p> <p>For this question, record the answers for EACH cookstove or device indicated by the respondent in question HC3, starting with the MOST USED cookstove.</p> <p>Record the frequency with which the fuel or energy source was unavailable in the quantity desired in the last 12 months for each cookstove or device:</p> <p>Record 01 if it was unavailable more than once in a month (often).</p> <p>Record 02 if it was unavailable 4 to 12 times in a year (sometimes).</p> <p>Record 03 if it was unavailable less than 4 times in a year (rarely).</p> <p>Record 04 if it was always available (never).</p> <p>If respondent does not know or is unsure, record 99.</p>
<p>HC8</p>	<p><i>What other fuels and energy sources does this household use most of the time in this cookstove or device for cooking food, making tea/coffee, and boiling drinking water?</i></p> <p>For this question, record the answers for EACH cookstove or device indicated by the respondent in question HC3, starting with the MOST USED cookstove.</p> <p>Select the energy source the household uses MOST OF THE TIME in each of the cookstoves or devices for making food and drinks.</p>

HC9	<p><i>Yesterday, how much time was this cookstove used for cooking food, making tea/coffee, and boiling drinking water?</i></p> <p>For this question, record the answers for EACH cookstove or device indicated by the respondent in question HC3, starting with the MOST USED cookstove. Record the TOTAL numbers of hours and/or minutes the household member spends to go to collect the fuel, get the fuel, and return.</p> <p>If the household member is not sure, record '99'.</p>
HC10	<p><i>How often did you use the cookstove or cooking device over the last week (last 7 days) for these activities?</i></p> <p>For this question, record the answers for EACH cookstove or device indicated by the respondent in question HC3, starting with the MOST USED cookstove. Select from the list of options the FREQUENCY with which the cookstove or device was used for making food or drinks.</p> <p>If the household member is not sure, record 99.</p>
HC11	<p><i>Is the cooking usually done in the house, in a separate building, or outdoors?</i></p> <p>For this question, record the answers for EACH cookstove or device indicated by the respondent in question HC3, starting with the MOST USED cookstove. Record WHERE the cooking is usually done using the cookstove. If it is done in the main house, determine if it is done in a separate room. If it is done outside the main house, determine if the cooking is done in a separate room, on a veranda, on a covered porch, or in open air.</p> <p>If cooking is done in open air, on a veranda, or on a covered porch, skip to question HC13.</p>
HC12	<p><i>Does the cookstove have a chimney or hood?</i></p> <p>For this question, record the answers for EACH cookstove or device indicated by the respondent in question HC3, starting with the MOST USED cookstove. Select YES if the cookstove has a chimney or hood, select NO if it does not. If the household member is not sure, select 99.</p>
HC13	<p><i>In the past 12 months, did any harm or injury happen from using this cookstove, device, or fuel?</i></p> <p>For this question, record the answers for EACH cookstove or device indicated by the respondent in question HC3, starting with the MOST USED cookstove. Select ALL the injuries, if any, that happened while using the cookstove, device, or fuel. If there were no injuries, select 01.</p>

2.2 Household energy & gender

HG1	<p>ENUMERATOR/CAPI CHECK: Is the cookstove used most of the time (HC3) electric, solar, or piped natural gas?</p> <p>Select YES if the main cookstove is electric, solar or piped natural gas and skip to question HG7.</p> <p>Select NO if the main cookstove is not electric, solar, or piped natural gas and proceed to question HG2.</p>
HG2	<p><i>In the past month (the last 30 days) who usually goes to collect the main fuel for the cookstove your household uses most of the time?</i></p> <p>Record the NAME of the person who spends the most time collecting the main fuel for the main cookstove (question HG1) and copy the LINE NUMBER of this person from the list of Household Members Module. If multiple people spend the same amount of time collecting fuel, add additional names and line numbers.</p> <p>If no members of the household collect fuel, skip to question HG7.</p>
HG3	<p><i>On a single trip, how long does it take for this person to go to collect the fuel, get the fuel, and come back?</i></p> <p>Record the TOTAL numbers of hours and/or minutes the household member spends in transit.</p> <p>If the household member is not sure, select 99.</p>
HG4	<p><i>In the past month (the last 30 days), how many times has this person collected this fuel for household cooking?</i></p> <p>Record the TOTAL number of times the household member collected this fuel in the PAST 30 DAYS. If the household member is not sure, write 99.</p>
HG5	<p><i>In the past 12 months, did this person experience an injury while collecting or transporting fuel?</i></p> <p>Circle ALL the injuries, if any, that the household member experienced while collecting or transporting fuel for the household. If the household member is not sure, record 99.</p>
HG6	<p><i>Yesterday, how much time total was spent preparing the [COOKSTOVE] and fuel for cooking, including setting up the fuel and lighting/turning on the cookstove but not including gathering fuel or cooking time?</i></p> <p>Record the TOTAL number of hours and/or minutes it took YESTERDAY to prepare the main cookstove (recorded in question HG2) and fuel for cooking. Include the time for lighting/turning on the cookstove, do not include the time spent gathering fuel or the cooking time. Record the time spent by anyone in the household, not necessarily the person (or people) in question HG2.</p>
HG7	<p><i>In the past month (the last 30 days), who in the household does most of the cooking, including cooking food, making tea/coffee and boiling drinking water?</i></p> <p>Record the NAME of the household member who does most of the cooking (including making food, making tea/coffee, and boiling drinking water) and copy the LINE NUMBER of this person from the List of Household Members Module.</p> <p>If the person who does most of the cooking is not a household member, write 00.</p>

HG8	<p><i>Yesterday, how much time did this person spend cooking, including cooking food, tea/coffee, and boiling drinking water for household consumption?</i></p> <p>Record the TOTAL number of hours and/or minutes it took YESTERDAY for the household member recorded in question HG7 to cook (including making food, making tea/coffee, and boiling drinking water).</p> <p>If the household member is not sure, write 99.</p>
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2.3 Household heating

HH1	<p><i>Does this household use any heating device or fire to keep the dwelling/living quarters warm at any time during the year?</i></p> <p>Select YES if household uses any heating device or fire to keep the dwelling/living quarters warm at any time during the year.</p> <p>Select NO and skip to LIGHTING MODULE if household never uses any heating device or fire to keep the dwelling/living quarters warm.</p>
HH2	<p><i>In the last 12 months, during how many months did you use a heating device or fire to keep the dwelling/living quarters warm?</i></p> <p>Record the TOTAL number of months the household used a heating device or fire to keep the dwelling/living quarters warm.</p>
HH3	<p><i>How many space heaters or heating devices (including cookstoves and open fires) are used in or around the dwelling to produce heat at any time during the year?</i></p> <p>Record the TOTAL number of space heaters or heating devices (including cookstoves and open fires) used in or around the dwelling to produce heat at any time during the year.</p> <p>If the respondent reports using fewer than 3 heaters to produce heat in the household, leave the extra columns blank in the next question. If the respondent reports using more than 3 heaters, use additional sheets.</p>
HH4	<p><i>What does this household use to heat the home when needed? For example, do you use a space heater(s) or your cookstove in the winter for warmth? Please tell me the heaters, cookstoves, or heat systems used.</i></p> <p>First, ask the respondent to identify the heater, cookstove, or heating system that is most often used. Record the answers related to the heater, cookstove, or heating system indicated as the principal in the first column. In the second column, record the answers related to the second cookstove used most often, and so on.</p> <p>For this question, SELECT ONE TYPE for each heater.</p> <p>If the selected answer is <i>central heating, moveable heating pan, open fire/three-stone stove or heat pump</i>, skip to question HH6.</p>
HH5	<p><i>What is the brand of the heater, cookstove or device?</i></p> <p>For this question, record the answers for EACH heater or device indicated by the respondent in question HH3, starting with the MOST USED cookstove and ending with the least used.</p> <p>For each cookstove, record the code for one of the brands of manufactured solid fuel stoves available in country or write 96 and specify the name of the brand (if it is not on the list).</p> <p>Note that this question should NOT be answered if the answer for HH4 is <i>central heating (01), moveable heating pan (06), open fire/three-stone stove (07) or heat pump (08)</i>.</p>

HH6	<p><i>What type of fuel or energy source does this household use most of the time for heating in this heater, cookstove or device?</i></p> <p>For this question, record the answers for EACH heater or device indicated by the respondent in question HH3, starting with the MOST USED cookstove and ending with the least used.</p> <p>Select the energy source the household uses MOST OF THE TIME in each of the cookstoves or devices for making food/drinks.</p> <p>If selected answer is <i>electricity (including solar panels), piped natural gas, LPG/ cooking gas or biogas</i>, skip to question HH9. Any devices that plug into a wall and are powered by electricity are classified as Electricity in HH6, even if the device uses heat transfer oil, kerosene, or other fuels but the fuels are fully contained in a radiator powered by electricity and the device emits no emissions.</p> <p>If selected answer is <i>alcohol/ethanol, gasoline/diesel (not in generator) or kerosene/paraffin</i>, skip to question HH8.</p>
HH7	<p><i>Does it have a chimney or hood?</i></p> <p>For this question, record the answers for EACH heater or device indicated by the respondent in question HH4, starting with the MOST USED cookstove.</p> <p>Select YES if the heater, cookstove or heating system has a chimney or hood, select NO if it does not. If the household member is not sure, select 99.</p>
HH8	<p><i>Which other fuels or energy sources are used for heating in this space heater, cookstove, device or fuel?</i></p> <p>For this question, record the answers for EACH heater or device indicated by the respondent in question HH4, starting with the MOST USED cookstove.</p> <p>Record ALL the other fuels and energy sources that the household uses for each heater, cookstove or heating system. If there are no other fuels, select 00.</p>
HH9	<p><i>In the past 12 months, did any harm or injury happen from using this space heater, cookstove, or device?</i></p> <p>For this question, record the answers for EACH heater or device indicated by the respondent in question HH4, starting with the MOST USED cookstove.</p> <p>Record ALL the injuries, if any, that happened using the heater, cookstove, or heating system. If there were no injuries, select 01.</p>

2.4 Household lighting

HL1	<p><i>Does this household use anything for lighting?</i></p> <p>Select YES if household uses any sources for lighting. Select NO and skip to ELECTRICITY MODULE if the household does not use any sources for lighting.</p>
HL2	<p><i>How many different energy sources for lighting are used in the dwelling/living quarters?</i></p> <p>Record the TOTAL number of sources of light used in the dwelling/living quarters.</p> <p>If the respondent reports using fewer than 3 sources of light in the household, leave the extra columns blank in the next question. If respondent reports using more than 3 heaters, use additional sheets to record all the lighting sources.</p>

HL3	<p><i>What does this household use most of the time as energy for lighting, or as a light source? Please tell me the light source used for the most time each day, followed by other light sources used.</i></p> <p>First, identify the source of light that is mostly used by asking the respondent. Record the answers related to the source of light indicated as the principal in the first column. In the second column, record the answers related to the second source of light used most often, and so on.</p> <p>For this question SELECT ONE TYPE for each lighting source.</p>
HL4	<p><i>In the past 12 months, did any harm or injury occur from using this lighting source?</i></p> <p>For this question, record the answers for EACH source of light indicated by the respondent in question HL2, starting with the MOST USED cookstove.</p> <p>Record ALL the injuries, if any, that happened using the lighting source. If there were no injuries, record 01.</p>

2.5 Household electricity

HE1	<p><i>Do you have electricity in your household?</i></p> <p>Record YES (01) if the household has electricity. If there is no electricity in the household, record NO (02) and skip to NEXT MODULE.</p>
HE2	<p><i>What source of electricity is used in this household?</i></p> <p>Record ALL the sources of electricity used in the household.</p>
HE3	<p><i>What source of electricity is used most of the time in this household?</i></p> <p>Record the MAIN source of electricity used in the household.</p> <p>If selected answer is <i>national grid connection from (COMPANY), local mini grid, dry cell battery/torch, or other (specify)</i>, skip to question HE6. If selected answer is solar home system, solar lantern, electric generator, or rechargeable battery, proceed to question HE4.</p>
HE4	<p><i>What appliances are powered using this household's solar device/system?</i></p> <p>Record ALL the appliances that are powered by the solar device/system in the household.</p>
HE5	<p><i>How many lightbulbs can be powered using {Source of electricity in HE3}?</i></p> <p>Record 01 if no lightbulbs can be powered using the household's solar device/system. Record 02 if ONE lightbulb can be powered using the household's solar device/system. Record 03 if MORE THAN ONE lightbulb can be powered using the household's solar device/system.</p>
HE6	<p><i>Who does this household currently pay for [NAME MAIN electricity system]?</i></p> <p>Record the code for the institution/person whom the household currently pays for the main electricity system. If the household pays no one, record '00'.</p>

HE7	<p>In the last 7 days, how many hours of electricity were available each day on average from [NAME MAIN electricity system]?</p> <p>Record the AVERAGE numbers of hours and/or minutes the electricity was available EACH DAY in the last 7 days (maximum 24 hours).</p> <p>If the household member is not sure, record '99'.</p>
HE8	<p>In the last 7 days, how many hours of electricity were available each evening on average, from 6:00 pm to 10:00 pm from [NAME MAIN electricity system]?</p> <p>Record the AVERAGE numbers of hours (maximum 4) and/or minutes the electricity was available EACH EVENING in the last 7 days.</p> <p>If the household member is not sure, record '99'.</p>
HE9	<p><i>In the last 7 days, how many times were there unscheduled outages or blackouts from [NAME MAIN electricity system]?</i></p> <p>Record the TOTAL number of unscheduled outages or blackouts in the last 7 days for the main electricity system.</p> <p>If the household member is not sure, select '99'.</p>
HE10	<p><i>What is the total duration of all the unscheduled outages or blackouts in the last 7 days?</i></p> <p>Record the TOTAL duration (in hours and/or minutes) of ALL the unscheduled outages or blackouts in the LAST 7 DAYS.</p>
HE11	<p>ENUMERATOR/CAPI CHECK: Is the household's main source of electricity a National Grid or Local Mini Grid? If HE3 is 1 or 2, mark "Yes"</p> <p>Record '1' for YES if the household's main source of electricity is a National Grid or Local Mini Grid. Otherwise, record '2' for NO and skip to the NEXT MODULE.</p>
HE12	<p><i>In the last 12 months, did any of this household's appliances get damaged because the voltage was going up and down in the [NAME MAIN electricity system from HE3]?</i></p> <p>Record '1' for YES if any of the household's appliances got damaged because of voltage irregularities in the main electricity system from question HE1. Otherwise, record '2' for NO.</p>
HE13	<p><i>In the last 12 months, did anyone using [NAME MAIN electricity system from HE3] die or have permanent limb (bodily injury) damage?</i></p> <p>Record '1' for YES if any of anyone using the main electricity system died or suffered permanent damage to a limb (bodily injury). Otherwise, record '2' for NO.</p>

APPENDIX 4.

PHOTO GUIDE OF COOKING, HEATING AND LIGHTING FUELS AND TECHNOLOGIES TO ACCOMPANY THE CORE QUESTIONS ON HOUSEHOLD ENERGY USE

PURPOSE OF THIS CATALOG

This photo guide is intended to assist agencies and researchers implementing the Core Questions on Household Energy Use, particularly as a tool for interviewer training. All individuals involved in implementing surveys related to household energy use must have a thorough and common understanding of the different types of fuels and technologies available in each context. Furthermore, to ensure that the data collected is relevant for analysis, the fuels and technologies found in households must be categorized in a consistent manner across all interviews.

To facilitate this understanding, in each locality where survey questions are being implemented, trainers and interviewers must compile a thorough list of the fuels and technologies used in that locality, and must discuss the appropriate categories for each of these devices. The examples and images presented here are merely illustrative. They are intended to help clarify the category definitions, and are not an exhaustive list of all devices, brands, and/or models available on the market or used by households in all localities. Therefore, this should be reviewed and adapted for the country context of interest.

During the development of this catalog, the Global Alliance for Clean Cookstoves' Clean Cooking Catalog and the GIZ/HERA Cooking Energy Compendium were referenced as resources. These can serve as other useful sources of information regarding fuels and technologies used at the household level. The categories in this catalog are meant to be mutually exclusive and collectively exhaustive, so that any cooking, heating, or lighting technology and/or fuel found in a household will fit into one—and only one—category.

Within the cooking and heating sections, technologies and fuels are categorized separately. In the lighting section, light sources are categorized as combinations of technology and fuel. The cooking section also contains a sub-section on cooking location which defines areas in which households cook based on factors related to proximity to the main living area and ventilation. Kitchen location can affect the exposure of individuals to household air pollution.

COOKING

A. COOKING TECHNOLOGIES

1. Solar Cooker (thermal energy)

Other terms

Parabolic cooker, box cooker, panel cooker

Category description

Solar cookers directly capture the sun's thermal rays, convert them to heat, and in some models, retain that heat for cooking. Solar cookers come in many shapes, including parabolic cookers, box cookers, and panel cookers. This category does not include solar panels that generate electricity for cooking, as all stoves using electricity are classified as electric stoves.

Possible types of fuel

Solar energy

Parabolic solar cooker



© Anastasiia/AdobeStock

2. Electric Stove

Other terms

Induction stove, coil stove

Category description

Electric stoves convert electrical energy into heat for cooking. Electricity is a form of energy that is carried through wires. The electricity to power these stoves can be generated outside of the home and distributed to the home through a grid or micro-grid. It can also be generated at the home by, for example, a fixed or portable generator or a solar home system.

Possible types of fuel

Electricity from any source (e.g., solar, coal, etc.)

Electric coil stove



© Jessica Lewis/WHO

3. Piped natural gas stove

Category description

Piped natural gas stoves exclusively burn natural gas, a fossil fuel that consists primarily of methane. The natural gas is piped from a centralized distributor or public utility into the home (they do not use a gas canister like LPG stoves).

Possible types of fuel

Natural gas, piped LPG

Piped natural gas stove



© The Joy of Film/Unsplash

4. Biogas stove

Category description

Biogas stoves burn biogas produced in local anaerobic digesters. A single digester can serve one or multiple households. The digester converts organic waste and dung into combustible methane gas called biogas, which is piped from the digester to the cookstove. Biogas stoves contain a valve to premix the biogas with the right amount of oxygen and a burner to combust the mixture. Stoves and ovens for biogas application are similar to those of conventional appliances running on commercial gas fuels. Most of these conventional appliances can be adapted for use with biogas by special measures (particularly the modification of the burners) to ensure proper combustion and efficient use of energy.

Possible types of fuel

Biogas from biomass (animal manure, human waste, food residue, and crop residue)

Stove for biogas application



© Heather Adair-Rohani/WHO

5. Liquid petroleum gas (LPG)/cooking gas stove

Other terms

Propane, butane, cooking gas

Category description

Liquid petroleum gas (LPG) stoves exclusively burn LPG, which is a gaseous fuel obtained during petroleum refining and consists mainly of butane or propane. LPG is gaseous at normal ambient temperatures and pressures but becomes liquid when compressed. For distribution to the end user, LPG is bottled in individual gas cylinders of various sizes (between 3 kg and 50 kg or larger). Empty containers usually need to be returned to a bottling station to be refilled. The LPG stove has multiple parts, including the stove burner(s), hose, and regulator (in addition to the cylinder). NOTE: This category only includes stoves using LPG cylinders. If the LPG is piped into the household from a central distributor, it falls into the piped natural gas stove category.

Possible types of fuel

Liquid petroleum gas, cooking gas, propane, butane

LPG stoves



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6. Manufactured solid fuel stove

Other terms

A wide variety of names are used to describe this type of stove, including: Ceramic jiko, Mini Moto, ACEI, Shengzhou Charcoal Stove, Top-lit updraft gasifier

Category description

The category for manufactured cookstoves includes any cookstove that is produced and sold or distributed to the end user (including “traditional” cookstoves that are manufactured). For some manufactured cookstoves, specialized technicians come to the household to install/build the cookstove. Manufactured cookstoves are often constructed from prefabricated materials or materials usually not readily available in the immediate community. Manufactured cookstoves are often designed with improvements or advanced design features such as an improved and enclosed combustion chamber, high-quality materials, and/or high-quality production processes – unlike traditional solid fuel cookstoves.

Possible types of fuel

Coal/lignite unprocessed, coal/lignite briquettes/pellets, charcoal unprocessed, charcoal briquettes/pellets, wood, agricultural or crop residue, grass, straw, shrubs, animal dung or waste, processed biomass pellets or briquettes, woodchips, garbage/plastic, sawdust

Manufactured solid fuel stoves



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 © Improved cookstoves/ World Bank Photo Collection (CC by NC-ND 2.0)
 © 004/ raccoflickr (CC by NC 2.0)
 © Zorlah Miller/ Dollar Street (CC by 4.0) 2015
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7. Traditional solid fuel stove

Other terms

Chulha (India)

Category description

Traditional cookstoves are usually constructed at the home. Traditional cookstoves are made with local materials, such as mud, ceramics or clay. These cookstoves do not generally contain advanced design features but may include limited improvements over a three-stone cookstove or open fire (e.g., a pot rest, simple enclosed combustion spaces).

Possible types of fuel

Coal/lignite unprocessed, coal/lignite briquettes/pellets, charcoal unprocessed, charcoal briquettes/pellets, wood, agricultural or crop residue, grass, straw, shrubs, animal dung or waste, processed biomass pellets or briquettes, woodchips, garbage/plastic, sawdust

Traditional cookstove



© Jonathan Mingle
 © Johan Eriksson/ Dollar Street (CC by 4.0) 2015
 © Ajay Pillarisetti/Emory University
 © Zorlah Miller/ Dollar Street (CC by 4.0) 2015

8. Liquid fuel stove

Other terms

Kerosene wick stove, gravity stove

Category description

Liquid fuel stoves can be pressurized or unpressurized. Pressurized liquid fuel stoves can be used with pre-pressurized fuels or can be equipped with self-pressurizing technology, like a hand pump. One type of unpressurized stove uses wicks to draw fuel from the tank or reservoir. Other unpressurized liquid fuel stoves use gravity or capillary action, i.e. moving liquid through small passages to deliver fuel directly to the flame.

Possible types of fuel

Alcohol, ethanol, methanol, gasoline/diesel/petrol, kerosene/paraffin, biofuel, plant oils

Ethanol stove



© Megan Benka-Coker, Wubshet Tadele, Alex Milano, Desalegn Getaneh, and Harry Stokes
© Jessica Lewis/WHO

Kerosene stove



Pressurized kerosene stove



© Tissina Bamako Mali/ elFrank70 (CC BY-NC-ND 2.0)
© Victrixia Montes/ Dollar Street (CC by 4.0) 2015

9. Moveable firepan

Other terms

Brazier, sagarh (India)

Category description

A moveable firepan is contained and moveable fire that can be transported from one place to another, such as in a metal tray or metal box. The moveable firepan may have rocks or stones set on top which are used to hold a pot; this device is differentiated from a three stone fire because it can be moved to a different room or outside the home. An example includes a brazier, an ancient technology often used to move hot coals or burning charcoal for ceremonial purposes, cooking, and heating.

Possible types of fuel

Coal/lignite unprocessed, coal/lignite briquettes/pellets, charcoal unprocessed, charcoal briquettes/pellets, wood, agricultural or crop residue, grass, straw, shrubs, animal dung or waste, processed biomass pellets or briquettes, woodchips, garbage/plastic, sawdust

Firepan or Sagarh



© Alan Labisch/Unsplash



© Jessica Lewis/WHO

10. Three-stone stove/open fire

Other terms

Tripod

Category description

Three-stone cooking fires use stones or rocks to support the pot. Sometimes, a circle of stones is placed besides the fire itself, to keep the fire from spreading into the environment, and to keep wind away from the fire. An open fire is not contained in an oven or stove. It is exposed to the air on at least three sides.

Possible types of fuel

Coal/lignite unprocessed, coal/lignite briquettes/pellets, charcoal unprocessed, charcoal briquettes/pellets, wood, agricultural or crop residue, grass, straw, shrubs, animal dung or waste, processed biomass pellets or briquettes, woodchips, garbage/plastic, sawdust

Three-stone stove



© Zoriah Miller/Dollar Street

Open fire



© Golam Op/ Unsplash

B. VENTILATION

Chimney or hood

Other terms

Flue, vent

Category description

Chimneys are structural additions that ventilate gas and smoke from the cookstove outside the home or cooking area. Chimneys can be made from clay pipes, sheet metal, cast iron, masonry, concrete pipes, bamboo, and many other materials. For the purposes of the categories presented in this catalog, chimneys include all ventilation systems that carry pollutants or combustion by-products outside of the home.

Cookstove with chimney



© Nigel Bruce/University of Liverpool

Installation of chimney to vent smoke outside



© Jonathan Mingle

C. COOKING FUELS

1. Alcohol/ethanol

Category description

Alcohol as a cooking fuel is produced by fermentation of sugars from various crops, such as maize, sorghum, wheat, cassava and sugarcane. Types used for cooking include ethanol, butanol, methanol, and isopropanol. Most alcohol used for cooking comes in liquid form. Some cooking ethanol comes in gel form, which has been thickened and contains coloring and flavoring agents for safety reasons.

Ethanol gel



© Project Gaia

2. Gasoline/diesel

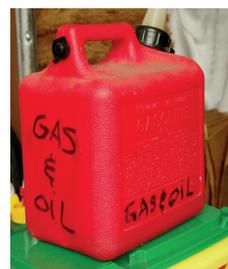
Other terms

Petrol

Category description

Gasoline is a transparent, petroleum-derived liquid used mainly as fuel for internal combustion engines. Gasoline primarily consists of organic compounds and often contains additives. Some gasoline contains varied amounts of ethanol as an alternative fuel for economic or environmental reasons. This category is for gasoline/diesel used in a cookstove or cooking device, and not in an electricity generator.

Gasoline



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3. Kerosene/paraffin

Category description

Kerosene is a product of crude oil distillation, and mainly consists of a mixture of hydrocarbons. It has a high energy density. Kerosene is a colorless liquid, although it can yellow over time. In some areas, colored dye is added to the fuel for safety or pricing reasons. Kerosene can easily be transported in bulk and does not need to be transported in special containers.



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4. Coal/lignite unprocessed

Coal is a black, solid, carbon-rich material found underground. It is not to be confused with charcoal. Coal is a mineral, whereas charcoal is a form of burnt wood. The major classes of coal are lignite (brown coal), bituminous (black coal), and anthracite. Coal is used in different forms for household cooking, heating and lighting. This category is for unprocessed, raw coal.



© Nick Nice/Unsplash

5. Coal/lignite briquettes/pellets

Category description

Coal is a black, solid, carbon-rich material found underground. It is not to be confused with charcoal. Coal is a mineral, whereas charcoal is a form of burnt wood. Coal is used in different forms for household cooking, heating and lighting. This category of processed coal is for coal that has been transformed from its raw form into pellets, briquettes, or another processed form. Some examples are bee-nest coal briquettes (also called “bee-hive”), coal pellets, and coal cakes.

Bee nest coal briquette



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6. Charcoal unprocessed

Category description

Charcoal is charred wood, which has lost all moisture and its most volatile contents in the production process. Charcoal is usually produced by slowly heating wood in the absence of oxygen. This category is for charcoal that has not been further processed into briquettes or pellets.

Charcoal in cookstove



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7. Charcoal briquettes/pellets

Category description

Charcoal is charred wood, which has lost all moisture and its most volatile contents in the production process. Charcoal is usually produced by slowly heating wood in the absence of oxygen. This category is for charcoal that has been processed into briquettes or pellets.



© Vladsinger (CC by SA)

8. Wood

Category description

Firewood is unprocessed wood that is burned for fuel. Firewood may be dried and/or chopped into smaller logs, pieces, or sticks in preparation for use, but otherwise the fuel is unprocessed. Wood is collected either directly from trees and large bushes or from sections that have died or fallen to the ground.

Logs of firewood



© Jessica Lewis/WHO

Firewood collection



© Jessica Lewis/WHO

9. Agricultural or crop residue/grass/straw/shrubs/corn cobs

Category description

Crop residues are any non-timber (or non-wood), solid biomass, or plant-generated material that is used as fuel. Fuels in this category are unprocessed. They can be grown specifically for fuel or can be by-products of other productive (often agricultural) activities. Common types of crop residues are straw, stem, stalks, leaves, husk, shell, peel, lint, stones, pulp, stubble, etc., which come from cereals, cotton, groundnut, jute, legumes, coffee, cacao, olive, tea, fruits, and palm oil.

Corn cobs



© Crina Parasca/Unsplash

Rice straw



© Lucas Gallone/Unsplash

10. Animal waste/dung

Category description

Dung is the undigested waste excreted by animals, especially cattle, goats, sheep, yaks, elephants, llamas, etc. Fresh dung needs to be dried before it can be used as a fuel. It can be left in its natural shape or formed into round dung balls, flat dung cakes, or molded around a stick. In some regions dung is mixed with other kinds of fuel, such as coal dust or agricultural residues, in order to enhance combustion performance (to increase the energy-density).

Dung



© Satdeep gill (CC by SA 3.0)

11. Processed biomass pellets/briquettes

Other terms

Biomass briquette

Category description

Processed biomass is timber or non-timber biomass that has been densified or compacted. This fuel can take the form of wood pellets, briquettes, and other forms. Biomass materials that can be used are wood, crop residue, pine needles, scrap paper, etc.

Pellets



© Tom Bruton/Wikimedia Commons

Biomass sawdust briquette



© Adien Gunarta/Wikimedia Commons

12. Woodchips

Category description

Woodchips are timber or non-timber biomass that has been broken into small chips, but has not been processed further.

Woodchips



© William Warby/Wikimedia Commons

13. Garbage/plastic

Category description

Garbage is non-biomass waste material, such as plastic or other synthetic materials.

Garbage



© Vivianne Lema/Unsplash

14. Sawdust

Category description

Sawdust or wood dust is a by-product of cutting, grinding, drilling, sanding, or otherwise pulverizing wood or any other material with a saw or other tool. It is composed of fine particles of wood. Sawdust is different from processed biomass in that it is not compressed or densified.

Sawdust



© Noslenlou/Wikimedia Commons

D. COOKING LOCATIONS

This section provides a series of graphical examples for common kitchen layouts and the location where cooking occurs. This section can be used to train enumerators on how to identify cooking locations.

Key to icons:

indicates the location of the stove or cooking area 

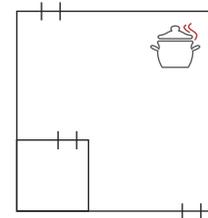
indicates a door or doorway for access 

indicates a covered porch or veranda 

1. In main house: no separate room

Category description

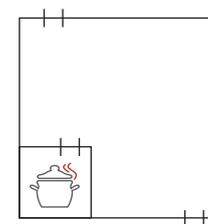
The kitchen is considered to be in the same room as the main living area if the cooking area is open to the main living area on one or more sides. Low walls and temporary dividers such as plastic, folding curtains or fabric curtains are not considered dividers between the cooking area and the main living area.



2. In main house: separate room

Category description

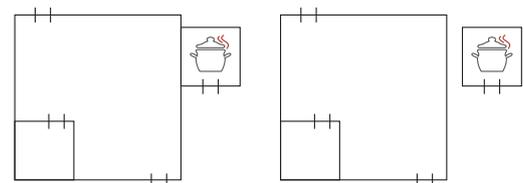
A separate room is a room that is separated from the rest of the house with a permanent wall that extends all the way or almost all of the way to the ceiling or roof. Separate rooms are accessible from the main living area through a door or doorway. If the room is only accessible from the main living area through an opening like a window, it is considered a separate room as opposed to a separate building. Temporary dividers such as plastic, folding curtains or fabric curtains do not count as walls.



3. Outside of main house: in a separate room

Category description

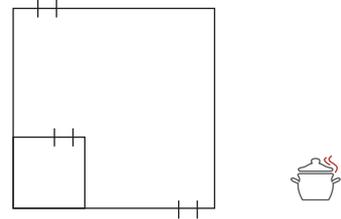
A separate room outside of the main house is a room or building that is not connected in any way to the main house. To reach it, a person must walk outside, even if under a covered walkway, to go between the separate building/room and the main house. This separate building/room may share a wall with the main living space but is completely separated from the main living space by a solid, permanent wall.



4. Outside of main house in open air

Category description

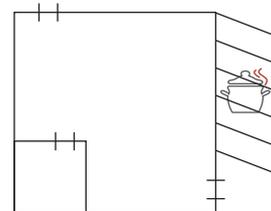
Outdoors or open air refers to an area not connected to the house and protected by permanent walls on two or fewer sides. Open air kitchens can have a roof to protect against rain.



5. On veranda/covered porch

Category description

A veranda is a covered porch, open to the outside, which abuts the house or dwelling on at least one side. An inner courtyard constitutes a veranda if it is partially covered; if completely open, it is considered outside.



HEATING

A. HEATING TECHNOLOGIES

I. Central heating

Other terms
Furnace, boiler

Category description
Central heating systems produce heat in a central location and distribute it via ducts or pipes to multiple, interconnected spaces. Heat can be distributed through warmed air, steam, or liquids. Many central heaters are part of a larger heating, ventilation, and air conditioning (HVAC) system in the home.

Possible fuel types
Electricity from any source (e.g., solar, coal, etc.), solar, natural gas, wood pellets, heating oil, coal

Central heating system wood as fuel



© Dawn Janacek / Dollar Street (CC by 4.0) 2018

Central heating system (HVAC)



© Tommy Halvarsson/Wikimedia Commons

In-room, permanent central heat



© Graes Magazin/ Unsplash

Thermostat for controlling central distribution radiator heating temperature



© Luc Forsyth / Dollar Street (CC by 4.0) 2015

In-room, central heat distribution vent



© Zorah Miller / Dollar Street (CC by 4.0) 2015

2. Manufactured space heater

Category description
Space heaters are devices for heating an enclosed space. They can be permanent (fixed) or portable. They work either through convection – circulation of air throughout a room – or radiant heating – emitting infrared radiation to directly heat objects or people.

Manufactured heaters are produced in a centralized location and sold or distributed to the end user or household as a finished product. It is possible that, especially in the case of large space heaters, specialized technicians come to the household to install the heater. Manufactured stoves are constructed from prefabricated materials or materials not easily available in the immediate community.

Halogen heater



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© Access crawl (CC Attribution-Share Alike 4.0)
© Fain12 (CC by 3.0)

Wood heater with chimney



Oil-filled radiant portable heater that uses electricity



Possible fuel types

Electricity from any source (e.g., solar, coal, etc.), piped natural gas, LPG, biogas, ethanol/alcohol, gasoline/diesel, kerosene/paraffin, coal/lignite unprocessed, coal/lignite briquettes/pellets, charcoal unprocessed, charcoal briquettes/pellets, wood, agricultural or crop residue, grass, straw, shrubs, animal dung or waste, processed biomass pellets or briquettes, woodchips, garbage/plastic, sawdust.

Kerosene heater

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Kerosene space heater requiring electricity

© Douglas P. Perkins (CC Attribution 3.0)

3. Traditional space heater**Other terms**

Kang heater (China), sagarh (India), bukhari (Pakistan/India)

Category description

Space heaters are devices for heating an enclosed space. They can be permanent (fixed) or portable. They work either through convection—circulation of air throughout a room—or radiant heating—emitting infrared radiation to directly heat objects or people. Traditional heaters are produced locally. They are made in the household by household members or by a local artisan. It is possible that traditional heaters are made by an artisan outside of the household, but that artisan must work and source materials locally. Traditional heaters are made with local materials such as ceramics, clay, bricks or scrap metal, that are either collected by household members themselves or procured from easily available and accessible sources in the community.

Possible fuel types

Coal/lignite unprocessed, coal/lignite briquettes/pellets, charcoal unprocessed, charcoal briquettes/pellets, wood, agricultural or crop residue, grass, straw, shrubs, animal dung or waste, processed biomass pellets or briquettes, woodchips, garbage/plastic, sawdust

Traditional heater Romania

© Roland Zsigmond/Dollar Street (CC by 4.0) 2015

Traditional heater Turkey

© Agata Skowronek/Dollar Street (CC by 4.0) 2014

Wood heater

© Boryana Katsarova/Dollar Street (CC by 4.0) 2015

4 and 5. Manufactured and traditional cookstoves

For category descriptions and images, see above in the Cooking Technologies section of this guide.

6. Moveable heating pan

For category description and images, see above in the Cooking Technologies section of this guide.

7. Open fire/three stone stove

For category descriptions and images, see above in the Cooking Technologies section of this guide.

8. Heat pump

Category description

Heat pumps are devices that use a refrigerant and heat-exchange coils to extract heat from the ambient environment and transfer it indoors for space heating. Heat pumps consist of an outdoor compressor/condenser unit and an indoor air-handling unit, both typically powered by electricity. Operating much like an air conditioning unit in reverse, they can be air-sourced or ground-sourced. Air-source heat pumps move heat from outdoors to indoors by harnessing the latent heat released when a refrigerant undergoes a phase change from gas to liquid (condensing). Ground-source or geothermal heat pumps draw heat from the ground, or underground water. Both can achieve high levels of energy efficiency, compared to electric resistance heating. Heat pumps can also be used to provide cooling during warm weather.

Heat pumps are often connected to a network of ducts or pipes to distribute hot air or water throughout the house, but they can also be wall-mounted to heat a single room or area. Mini-split heat pumps are ductless, smaller units designed to heat a single room or living space. A new category of air-sourced heat pumps known as absorption heat pumps are fired by gas.

Possible fuel types

Electricity from any source (e.g., solar, wind, coal, etc.), gas

Air-source heat pump



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B. HEATING FUELS

For category descriptions and images of heating fuels, see the Cooking Technologies and Cooking Fuels sections of this guide.

LIGHTING

LIGHTING SOURCES

1. Electricity

Category description

Electricity is a form of energy that is carried through wires. Electricity can be generated outside of the home and distributed to the home through a grid or micro-grid. It can also be generated at the home by, for example, a fixed or portable generator or a solar home system.

The types of light bulbs used with electricity include incandescent bulbs, halogen incandescent bulbs, fluorescent bulbs, and light-emitting diodes (LEDs).

Incandescent lightbulbs and electrical cord



LED bulbs



Fluorescent tube lamp



© Josh Calabrese/Unsplash
© Zátanyi Sándor/ (if.) Fizped (CC by 3.0)
© Chetvorno/CC0

2. Solar-powered lantern or flashlight

Other terms

Pico PV, Solar Pico System (SPS)

Category description

A solar lantern uses photovoltaic (PV) cells and rechargeable batteries to provide power for a single light. Solar lanterns differ from solar home systems in that they are portable, and only produce enough power for the lantern and, in some cases, phone charging. The power ratings of these systems are typically below 10 watt-peak and most have a voltage of 12 volts or lower.

Solar power flashlight/torch



© Sujatha (CC by SA 3.0)
© CLI (CC by SA 4.0)

3. Rechargeable flashlight, mobile, torch or lantern

Category description

A flashlight, or torch, is a handheld, portable electronic device. The light source is usually a small incandescent light bulb or light-emitting diode (LED).

Flashlights in this category can be recharged either by a hand-crank or other external power source such as electricity. They may use batteries for power, but these are only rechargeable and not disposable.

This category does not include lanterns that are recharged using solar power, which would fall into the solar lantern (if portable) or electricity category.

Rechargeable crank flashlight



© Robert J. Fluegel/U.S. Navy



© Darekm135 (CC by SA 3.0)

4. Battery-powered flashlight, torch or lantern

Category description

A flashlight is a handheld, portable electronic device. The light source is usually a small incandescent light bulb or light-emitting diode (LED).

Flashlights in this category are powered by one or more disposable batteries.

Battery-powered flashlight/torch



© Rfc1394 at English Wikipedia

5. Biogas lamp

Category description

A biogas lamp is an appliance that uses biogas, or the gas produced from an anaerobic digester, to produce light. The digester converts organic waste and dung into combustible methane (the primary constituent of biogas), which is piped from the digester to the lamp.

Most biogas lamps require a mantle, or cloth-like material containing mineral elements, to produce light via incandescence.

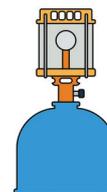


© SuSanA Secretariat

6. LPG lamp

Category description

An LPG lamp is an appliance that uses liquified petroleum gas (LPG) or cooking gas to produce light. The fuel is supplied from a pressurized canister attached to the lamp.



© Konovalov Pavel/AdobeStock

7. Gasoline lamp

Other terms

Diesel lamp

Category description

A gasoline lamp is an appliance that uses gasoline to produce light. Gasoline is a transparent, petroleum-derived liquid used mainly as fuel for internal combustion engines. It is primarily made up of organic compounds and often contains additives. Some gasoline contains varied amounts of ethanol as an alternative fuel for economic or environmental reasons.

Most gas lamps require that the gasoline is in a pressurized container and need a mantle, or cloth-like material containing mineral elements, to produce light via incandescence.



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8. Kerosene/paraffin lamp

Other terms

Hurricane lamp

Category description

A kerosene lamp is an appliance that uses kerosene to produce light. Many use a wick to draw the fuel from the reservoir to the flame.

Kerosene is a product of crude oil, and mainly consists of a mixture of hydrocarbons. It has a high energy density. Kerosene is a colorless liquid, though it can yellow over time. In some areas, colored dye is added to the fuel for safety or pricing reasons. Kerosene can easily be transported in bulk and does not need to be transported in special containers.

Kerosene lamp with wick, made from a tin can



© Steve Terrill/ AFP/Getty Images

Kerosene lamp with wick (hurricane lamp)



© Jordan Davis/Unsplash
© Amber Wolfe/Unsplash
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9. Oil lamp

Category description

An oil lamp is an appliance that uses lamp oil to produce light. Many use a wick to draw the fuel from the reservoir to the flame.

Lamp oil is a liquid fuel that burns with less odor than kerosene. Lamp oil can be purchased in a variety of scents for aesthetic or ceremonial purposes. Oil lamps are usually not pressurized.

Traditional oil lamp



© Charu Chaturvedi/Unsplash

10. Candle

Category description

A candle is made up of an ignitable wick embedded in wax or another flammable solid substance, such as tallow, that provides light.



© Christian Wiedl/ Unsplash

11. Open fire/three stone stove

For category description and images, see the Cooking Technologies section above in this guide.

APPENDIX 5.

THE CURRENT LANDSCAPE IN MEASURING HOUSEHOLD ENERGY ACCESS

This section provides a comprehensive review of the electricity and cooking solutions content in household surveys, as well as an understanding of the data currently available in 32 low-income countries and 47 lower-middle-income countries. Of the 78 surveys included in the review, 73 (93.6%) include at least one question related to electricity and/or cooking solutions.

SURVEY QUESTIONS ON ELECTRIFICATION

The 9 most common questions found in the reviewed studies for electricity are listed in Table A1 below. While the geographical coverage of surveys inquiring about electricity access is high, the breadth of the questions asked is less satisfactory. The binary approach is used by many surveys, with 64.1% posing a yes or no question regarding the existence of household electricity. Meanwhile, less than 4% of surveys ask why some households are not connected to a grid, which is a critical question for informing policy.

Table A1. Most common questions about electricity access in questionnaires reviewed (78 countries)

QUESTION	%
Does your household have electricity?	62.8%
What is the main source of energy used for lighting the dwelling?	35.9%
How much did you last pay for electricity?	14.1%
On average, how much does the household spend on electricity each month?	10.3%
How much did this household spend in the last month for each type of fuel used?	7.7%
What is the source of your electricity supply?	6.4%
Is the household connected to the national grid or to a local mini grid?	5.1%
Do you have a generator you use in this house?	5.1%
What is the main reason for your household not to have access to electricity?	3.9%

Source: Authors' compilation from reviewed surveys.

SURVEY QUESTIONS ON CLEAN COOKING

When it comes to access to clean cooking (Table A2), 86.1% of the reviewed country surveys report at least one question about the type of fuel used for cooking. Other parameters were captured in a variety of question types, with 50.6% of surveys asking about cooking location. However, only 25.3% of the studies asked explicitly about the monthly expenditures on cooking fuel. Notably, very few surveys asked about the type of cookstove used (focusing instead on the type of fuel), and none included the use of other fuels and technologies for cooking. Very few surveys included a question about whether cookstoves were also used for heating.

Table A2. Most common questions about cooking solutions in questionnaires reviewed (78 countries)

QUESTION	%
What type of fuel does your household mainly use for cooking?	86.1%
Is the cooking usually done in the house, in a separate building, or outdoors?	50.6%
Do you have a separate room which is used as a kitchen?	48.1%
How much do you normally spend on the fuel you use for cooking in a month?	25.3%
How much do you spend on the fuel for this stove in the last month/in the last week?	15.2%
Does the fire/stove have a chimney or a hood?	12.7%
In this household, is food cooked on an open fire, an open stove or a closed stove?	11.4%
Does your household currently own an electric or gas stove, wood stove, cooker oven?	11.4%
Do you also sleep in the room where you cook?	3.8%
What other source of heating does your household mainly use?	3.8%

Source: Authors' compilation from reviewed surveys.

While categorizing the electricity related questions, we found that about 40.0% of the surveys included a question about the sources of electricity such as a national grid, local mini grid, solar, generator, etc. Most surveys (64.1%) included a question to determine if the household has access to electricity. Unfortunately, although service availability (questions such as: *During the past*

month, how many days was electricity unavailable?) is crucial for the households, only 10% of the surveys reviewed included a question on this. In addition, while 26% of the surveys included at least one question on the cost that the household must pay for electricity, just 3% of the surveys included questions about the time it takes for households to get the grid connection.

APPENDIX 6.

MTF ANALYSIS FOR ACCESS TO MODERN ENERGY COOKING SERVICES USING THE CORE QUESTIONS ON HOUSEHOLD ENERGY USE

Data collected through the Core Questions on Household Energy Use can help policy makers track SDG Indicators 7.1.1 and 7.1.2. Beyond indicator computation, however, the granular data collected through the module can help policymakers better understand and address specific barriers to achieving universal access to electricity as well as clean fuels and technology.

CONCEPT OF MULTI-TIER TRACKING FRAMEWORK (MTF) FOR ENERGY ACCESS

In collaboration with various stakeholders, the World Bank's Energy Sector Management Assistance Program

(ESMAP), developed the Multi-Tier Framework (MTF) for analyzing household access to electricity and clean cooking solutions in a multi-dimensional fashion, including the ability to monitor incremental, attribute-specific progress. This Guidebook previously describes how to use the MTF methodology to assess access to electricity. Using the MTF to assess current levels of energy access can help identify the aspects that must be improved to reach higher tiers of access to modern energy cooking solutions. The MTF provides a comprehensive tool for capturing information on access to energy for cooking, encompassing user behavior, cooking conditions, and the use of multiple cooking solutions, as well as aspects of convenience and safety.

Box 1: Multi-Tier Framework for Measuring MTF Tier Energy Access

The MTF defines access to modern energy cooking services by six technical and contextual attributes that consider users' cooking experience, environment, and the market and energy ecosystems in which they live: (i) exposure, (ii) efficiency, (iii) convenience, (iv) safety, (v) affordability, and (vi) fuel availability. To measure progress, each attribute has six tiers, ranging from 0 to 5, as shown in Table 1. Tier 0 is the lowest applicable tier, representing no access, and Tier 5 is the highest classification, representing full service. Each household is then assigned an aggregate tier classification that **corresponds to the lowest tier of all six**, which can then be averaged over the population or subpopulations of interest.

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).

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. Household contexts with a status of MTF Tier 2 or Tier 3 are considered in Transition.

MTF ATTRIBUTES

The attributes considered in measuring access to MECS under the MTF are:

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

The MTF also includes a framework for computing and monitoring access to modern energy cooking services. This analytical framework can be used with the Core Questions on Household Energy Use in Appendix 1.

Table 1. The Multi-Tier Framework for Measuring Access to Modern Energy Cooking Solutions

Attribute	Measurement Indicators	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Exposure	ISO's voluntary performance targets on emissions-default ventilation						
	PM _{2.5} (mg/MJd) CO (g/MJd)	>1030 >18.3	≤1030 ≤18.3	≤481 ≤11.5	≤218 ≤7.2	≤62 ≤4.4	≤5 ≤3.0
	High ventilation						
Exposure	PM _{2.5} (mg/MJd) CO (g/MJd)	>1489 >26.9	≤1489 ≤26.9	≤733 ≤16.0	≤321 ≤10.3	≤92 ≤6.2	≤7 ≤4.4
	Low ventilation						
Exposure	PM _{2.5} (mg/MJd) CO (g/MJd)	>550 >9.9	≤550 ≤9.9	≤252 ≤5.5	≤115 ≤3.7	≤32 ≤2.2	≤2 ≤1.4
	Efficiency	Stove efficiency, using ISO's voluntary performance targets (%)	<10	≥10	≥20	≥30	≥40
Convenience	Fuel acquisition and preparation time (hours/week)	≥7		<7	<3	<1.5	<0.5
	Stove preparation time (minutes/meal)	≥10			<10	<5	<2
Safety	Severity of accidents caused by the stove over the past year	Serious			Minor	None	
Affordability	Fuel cost as a share of household expenditure (%)	≥10			<10	<5	
Availability	Ready availability of primary fuel when needed (% of the year)	≤80			>80	>90	100

Source: ESMAP 2020

CALCULATION OF MTF TIERS FOR MODERN ENERGY COOKING SERVICES

Exposure:

The Exposure attribute can be calculated based on emission testing information available in the country. The ISO/TR 19867-3 Voluntary Performance Targets for cookstoves based on laboratory testing (2018) provides the tiers and thresholds for stove and fuel emissions for PM_{2.5} and CO. If laboratory and/or field-testing data is available in the country, then questions from the Core Questions on Household Energy Use HC3 (a, b, c), HC4 (a, b, c) and HC5 (a, b, c) can be used to determine the Cooking Exposure tier.⁷

A. 1st COOKSTOVE (MAIN)	
<p>HC3. *What does this household use for cooking most of the time, including cooking food, making tea/coffee, and boiling drinking water? Please tell me the cookstove or device that is used for the most time, <i>followed by the other cookstove(s) or device(s) used most often, if applicable.</i> <i>(Phrase question based on response to HC2. Select one type for each cookstove.)</i></p>	<p>Solar cooker (thermal energy, not solar panels).....01 ▶ HC7 Electric stove.....02 ▶ HC6 Piped natural gas stove03 ▶ HC6 Biogas stove.....04 ▶ HC6 Liquefied petroleum gas (LPG)/ cooking gas stove05 ▶ HC6 Manufactured solid fuel stove.....06 Traditional solid fuel stove (non-manufactured)07 Liquid fuel stove08 ▶ HC5 Moveable firepan.....09 ▶ HC5 Three stone stove/open fire.....10 ▶ HC5 Other (specify).....96</p>
<p>HC4. *What is the brand of the cookstove or device?</p>	<p><i>(Pre-fill with name or brand of manufactured or traditional solid fuel stoves available in country- may add additional lines.)</i> NAME/BRAND 101 NAME/BRAND 2.....02 NAME/BRAND 3.....03 Other, specify96</p>
<p>HC5. *What type of fuel or energy source does this household use most of the time in this cookstove or device for cooking food, making tea/coffee, and boiling drinking water?</p>	<p>Alcohol/ethanol01 Gasoline/diesel (not in generator)...02 Kerosene/paraffin03 Coal/lignite unprocessed04 Coal/lignite briquettes/pellets05 Charcoal unprocessed06 Charcoal briquettes/pellets.....07 Wood.....08 Agricultural or crop residue/ grass/ straw/shrubs/corn cobs.....09 Animal waste/dung.....10 Processed biomass pellets/ briquettes11 Woodchips.....12 Garbage/plastic13 Sawdust.....14 Other96</p>

⁷ ESMAP and the Clean Cooking Alliance both keep a repository of stove and fuel typology as well as testing information that can be used as a reference in contexts with limited information.

A. 1st COOKSTOVE (MAIN)	
<p>HC9: Yesterday, how much time was this cookstove used for cooking food, making tea/coffee, and boiling drinking water?</p>	<p>Number of hours __ __ Number of minutes __ __ Does not know / unsure 99</p>
<p>HC11: Is the cooking usually done in the house, in a separate building, or outdoors? <i>(If in main house, probe to determine if cooking is done in a separate room.</i> <i>If outdoors, probe to determine if cooking is done on veranda, covered porch, or open air.)</i></p>	<p>In main house: no separate room 01 In main house: separate room 02 Outside of main house: in a separate room..... 03 Outside of main house in open air..... 04 ▶ HC13 On veranda or covered porch..... 05 ▶ HC13 Other 96</p>
<p>HC12: Does the cookstove have a chimney or hood?</p>	<p>Yes 01 No 02 Don't know..... 99</p>

The 'Exposure' attribute can also be constructed as a composite measurement using a proxy approach of the emissions from the cooking activity, i.e. the combination of the stove type and fuel, mitigated by the ventilation in the cooking area and the contact time of the primary cook (the time spent cooking). If a household uses multiple stoves, the cooking exposure attribute is measured as a weighted average of the time each stove is used.

CALCULATION ALGORITHM

Stove emission attribute: Based on the information from HC3, HC4, and HC5, stove emission level should be determined.

1. Stove emission tier is 0 if households use traditional solid fuel stove (HC3=7) as their primary stove.
2. Stove emission tier is 5 if households use solar cooker (HC3=1), electric stove (HC3=2), piped natural gas stove (HC3=3), biogas stove (HC3=4), or LPG cooking gas stove (HC3=5) as their primary cookstove.
3. Stove emission tier will be between Tier 1-4 as determined by questions HC4 and HC5. More information on actual PM_{2.5} and CO emission levels is required.⁸

Ventilation structure relies on questions HC11 and HC12.

⁸ If possible, the emission factor for the stove/fuel will be estimated using existing lab testing results. However, if such data is unavailable, MTF Exposure tier will be determined through qualitative and consultative discussion with experts on the cooking solution. (ESMAP 2020)

Efficiency:

Efficiency is the combination of combustion and heat-transfer efficiency of the cooking technology. The ISO/TR 19867-3 Voluntary Performance Targets for cookstoves based on laboratory testing (2018) provide the tiers and thresholds for efficiency. If laboratory and/or field-testing data is available in the country, then questions HC3 (a, b, c), HC4 (a, b, c) and HC5 (a, b, c) can be used to determine the Efficiency tier.⁹

A. 1st COOKSTOVE (MAIN)	
<p>HC3. *What does this household use for cooking most of the time, including cooking food, making tea/coffee, and boiling drinking water?</p> <p>Please tell me the cookstove or device that is used for the most time, followed by the other cookstove(s) or device(s) used most often, if applicable.</p> <p><i>(Phrase question based on response to HC2. Select one type for each cookstove.)</i></p>	<p>Solar cooker (thermal energy, not solar panels)..... 01 ▶ HC7</p> <p>Electric stove..... 02 ▶ HC6</p> <p>Piped natural gas stove 03 ▶ HC6</p> <p>Biogas stove..... 04 ▶ HC6</p> <p>Liquefied petroleum gas (LPG)/ cooking gas stove 05 ▶ HC6</p> <p>Manufactured solid fuel stove 06</p> <p>Traditional solid fuel stove (non-manufactured) 07</p> <p>Liquid fuel stove 08 ▶ HC5</p> <p>Moveable firepan 09 ▶ HC5</p> <p>Three stone stove/open fire..... 10 ▶ HC5</p> <p>Other (specify)..... 96</p>
<p>HC4. *What is the brand of the cookstove or device?</p>	<p><i>(Pre-fill with name or brand of manufactured or traditional solid fuel stoves available in country- may add additional lines.)</i></p> <p>NAME/BRAND 1 01</p> <p>NAME/BRAND 2 02</p> <p>NAME/BRAND 3 03</p> <p>Other, specify 96</p>
<p>HC5. *What type of fuel or energy source does this household use most of the time in this cookstove or device for cooking food, making tea/coffee, and boiling drinking water?</p>	<p>Alcohol/ethanol 01</p> <p>Gasoline/diesel (not in generator)... 02</p> <p>Kerosene/paraffin 03</p> <p>Coal/lignite unprocessed 04</p> <p>Coal/lignite briquettes/pellets 05</p> <p>Charcoal unprocessed 06</p> <p>Charcoal briquettes/pellets..... 07</p> <p>Wood..... 08</p> <p>Agricultural or crop residue/ grass/ straw/shrubs/corn cobs..... 09</p> <p>Animal waste/dung..... 10</p> <p>Processed biomass pellets/ briquettes 11</p> <p>Woodchips..... 12</p> <p>Garbage/plastic 13</p> <p>Sawdust..... 14</p> <p>Other 96</p>

Convenience:

Convenience is measured by the amount of time a household spends collecting or purchasing fuel as well as preparing the fuel and their stove for cooking. Questions HG3, HG4 and HG6 can be used to determine the Convenience tier.

<p>HG3: On a single trip, how long does it take for this person to go to collect the fuel, get the fuel, and come back?</p>	<p>Number of hours ___</p> <p>Number of minutes ___</p> <p>Does not know / unsure99</p>
<p>HG4: In the past month (the last 30 days), how many times has this person collected this fuel for household cooking?</p>	<p>Number of times in past month ___</p> <p>Does not know / unsure99</p>
<p>HG6: Yesterday, how much time in total was spent preparing the [COOKSTOVE] and fuel for cooking, including setting up the fuel and lighting/turning on the cookstove but not including gathering fuel or cooking time? <i>(Time spent by anyone, not use person in HG2.)</i></p>	<p>Number of hours ___</p> <p>Number of minutes ___</p> <p>Does not know / unsure99</p>

CALCULATION ALGORITHM

Calculate average hours per week for cooking fuel acquisition and average minutes per meal for stove and fuel preparation. Average hours per week for cooking fuel acquisition (HR_fuel) is calculated using HG3 and HG4. For HG4, convert times per month into times per week: $X/30 * 30 / X / 7$

Formula will be as follows: $HR_fuel = HG3 * (HG4) / 7$

- i. Tier 1 – $HR_fuel \geq 7$ hrs per week & $HG6 \geq 10$ minutes per meal
- ii. Tier 2 – $3 \leq HR_fuel < 7$ hrs/week & $HG6 \geq 10$ minutes per meal
- iii. Tier 3 – $1.5 \leq HR_fuel < 3$ hrs/week & $5 \leq HG6 < 10$ mins/meal
- iv. Tier 4 – $0.5 \leq HR_fuel < 1.5$ hrs/week & $2 \leq HG6 < 5$ mins/meal
- v. Tier 5 – $HR_fuel < 0.5$ hrs/week & $HG6 < 2$ mins/meal

⁹ ESMAP and the Clean Cooking Alliance both keep a repository of stove and fuel typology as well as testing information that can be used as a reference in contexts with limited information.

Safety:

Safety of the primary stove is based on serious injuries resulting from the stove over the last 12 months. Questions HC13(a) OR HC13 (b) OR HC13 (c) can be used to determine the Safety tier.

HC13: In the past 12 months, did any harm or injury happen from using this cookstove, device or fuel? (Circle all that respondent mentions.)	None.....01
	Person burned.....02
	Fire in house.....03
	Poisoning.....04
	Death.....05
	Other.....96

CALCULATION ALGORITHM

- i. Tier 0 – HC13= “Death” (HC13=05)
- ii. Tier 2 – HC13= “Poisoning” (HC13=04), “Fire in house” (HC13=03), “Person burned” (HC13=02)
- iii. Tier 3 – HC13= “Other” (HC13=96) (If other specifies very minor problems)
- iv. Tier 5 – HC13= “None” (HC13=01)

Affordability:

Affordability is measured using the levelized cost of the fuel. A cooking solution is considered affordable if a household spends less than 5% of the household expenditure on their cooking fuel in a month. Question HC6 (a, b, or c) can be used to determine the Affordability tier.

HC6: How much did this household pay for this fuel or energy source last month for cooking (the last 30 days)? (in local currency)	_____ (local currency)
	Pays nothing..... 00
	Does not know..... -99

CALCULATION ALGORITHM

- i. Tier 2 – HC6/ Household’s monthly total expenditure ≥ 0.10
- ii. Tier 3 – HC6/Household’s monthly total expenditure $0.10 > \geq 0.05$
- iii. Tier 5 – HC6/Household’s monthly total expenditure < 0.05

Availability:

Availability measures the availability of the primary fuel over the last 12 months. Question HC7 (a, b, c) can be used to determine the Availability tier.

HC7: In the past 12 months, how often was this fuel or energy source unavailable in the quantity you desired?	Often (more than once a month) .. 01
	Sometimes (4-12 times a year) 02
	Rarely (less than 4 times a year)..... 03
	Never (always available)..... 04
	Does not know / unsure 99

CALCULATION ALGORITHM

- i. Tier 2 – HC7= Often (HC7=01)
- ii. Tier 3 – HC7 = Sometimes (HC2=02)
- iii. Tier 4 – HC7= Rarely (HC7=03)
- iv. Tier 5 – HC7= Never (HC7=04)

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