Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all

Target 7.1: By 2030, ensure universal access to affordable, reliable and modern energy services

Indicator 7.1.2: Proportion of population with primary reliance on clean fuels and technology

Institutional information

Organization(s):

World Health Organization (WHO)

Concepts and definitions

Definition:

Proportion of population with primary reliance on clean fuels and technology is calculated as the number of people using clean fuels and technologies for cooking, heating and lighting divided by total population reporting that any cooking, heating or lighting, expressed as percentage. “Clean” is defined by the emission rate targets and specific fuel recommendations (i.e. against unprocessed coal and kerosene) included in the normative guidance WHO guidelines for indoor air quality: household fuel combustion.

Concepts:

Current global data collection focuses on the primary fuel used for cooking, categorized as solid or non-solid fuels, where solid fuels are considered polluting and non-modern, while non-solid fuels are considered clean. This single measure captures a good part of the lack of access to clean cooking fuels, but fails to collect data on type of device or technology is used for cooking, and also fails to capture other polluting forms of energy use in the home such as those used for lighting and heating.

New evidence-based normative guidance from the WHO (i.e. WHO Guidelines for indoor air quality guidelines: household fuel combustion), highlights the importance of addressing both fuel and the technology for adequately protecting public health. These guidelines provide technical recommendations in the form of emissions targets for as to what fuels and technology (stove, lamp, and so on) combinations in the home are clean. These guidelines also recommend against the use of unprocessed coal and discourage the use kerosene (a non-solid but highly polluting fuel) in the home. They also recommend that all major household energy end uses (e.g. cooking, space heating, lighting) use efficient fuels and technology combinations to ensure health benefits.

For this reason, the technical recommendations in the WHO guidelines, access to modern cooking solution in the home will be defined as “access to clean fuels and technologies” rather than “access to non-solid fuels.” This shift will help ensure that health and other “nexus” benefits are better counted, and thus realized.

Rationale:

Cooking, lighting and heating represent a large share of household energy use across the low- and middle-income countries. For cooking and heating, households typically rely on solid fuels (such as wood, charcoal, biomass) or kerosene paired with inefficient technologies (e.g. open fires, stoves, space heaters or lamps). It is well known that reliance on such inefficient energy for cooking, heating and lighting is associated with high levels of household (indoor) air pollution. The use of inefficient fuels for cooking alone is estimated to cause over 4 million deaths annually, mainly among women and children. This is more than TB, HIV and malaria combined. These adverse health impacts can be avoided by adopting clean fuels and technologies for all main household energy end-or in some circumstances by adopting advanced combustion cook stoves (i.e. those which achieve the emission rates targets provided by the WHO guidelines) and adopting strict protocols for their safe use. Given the importance of clean and safe household energy use as a human development issue, universal access to energy among the technical practitioner community is currently taken to mean access to both electricity and clean fuels and technologies for cooking, heating and lighting. For this reason, clean cooking forms part of the universal access objective under the UN Secretary General's Sustainable Energy for All initiative.

Comments and limitations:

The indicator uses the type of primary fuels and technologies used for cooking, heating, and lighting as a practical surrogate for estimating human exposure to household (indoor) air pollution and its related disease burden, as it is not currently possible to obtain nationally representative samples of indoor concentrations of criteria pollutants, such as fine particulate matter and carbon monoxide. However epidemiological studies provide a science-based evidence for establishing those estimates using these surrogates.

The indicator is based on the main type of fuel and technology used for cooking as cooking occupies the largest share of overall household energy needs. However, many households use more than one type of fuel and stove for cooking and, depending on climatic and geographical conditions, heating with polluting fuels can also be a contributor to household (indoor) air pollution levels. In addition, lighting with kerosene, a very polluting and hazardous fuel is also often used, and in some countries is the main fuel used for cooking.

While the existing global household survey evidence base provides a good starting point for tracking household energy access for cooking fuel, it also presents a number of limitations that will need to be addressed over time. Currently there is a limited amount of available data capturing the type of fuel and devices used in the home for heating and lighting. Accordingly WHO in cooperation with World Bank, and the Global Alliance for Clean Cook stoves, is leading a survey enhancement process with representatives from country statistical offices and national household surveying agencies (e.g. Demographic and Health Survey, Multiple Indicator Cluster Survey, Living Standards Measurement Survey) to better gather efficiently and harmoniously information on the fuels and technologies for cooking, heating and lighting. This process is currently in the piloting phase with expected rollout of the final household surveys questions (~6 questions in total) expected in the coming year. These few questions will replace and slightly expand the current set of questions commonly used on national multipurpose surveys to assess household energy.

Substantial progress has already been made toward developing and piloting a new methodology known as the Multi-Tier Framework for Measuring Energy Access (World Bank) which is able to capture the affordability and reliability of energy access explicitly referenced in the language of SDG7 and harnesses the normative guidance in the WHO guidelines to benchmark tiers of energy access. The methodology for the Multi-Tier Framework for Measuring Energy Access has already been published based on a broad consultative exercise and represents a consensus view across numerous international agencies working in the field. A first Global Energy Access Survey using this methodology has already been launched and is underway expecting to yield results by early 2017.

Methodology

Computation method:

The indicator is modelled with household survey data compiled by WHO. The information on cooking fuel use and cooking practices comes from about 300 nationally representative survey and censuses. Survey sources include Demographic and Health Surveys (DHS) and Living Standards Measurement Surveys (LSMS), Multi-Indicator Cluster Surveys (MICS), the World Health Survey (WHS), and other nationally developed and implemented surveys.

Estimates of primary cooking energy for the total, urban and rural population for a given country and year are obtained together using a single multivariate hierarchical model. Using household survey data as inputs, the model jointly estimates primary reliance on 6 specific fuel types: 1. unprocessed biomass (e.g. wood), 2. charcoal, 3. coal, 4. kerosene, 5. gaseous fuels (e.g. LPG), and 6. electricity; and a final category including other clean fuels (e.g. alcohol). Estimates of the proportion of the population with primary reliance on clean fuels and technology (SDG indicator 7.1.2) are then derived by aggregating the estimates for primary reliance on clean fuel types from the model. Details on the model are published in Stoner et al. (2019).

Only survey data providing individual fuel breakdowns and with less than 15% of the population reporting “missing” and “no cooking” and “other fuels” were included in the analysis.

Countries with no household fuel data but classified as high-income according to the World Bank country classification (37 countries) were assumed to have fully transitioned to clean household energy and therefore are reported as >95% access to clean technologies.

No estimates were reported for low- and middle-income countries without data (Bulgaria, Cuba, Lebanon, Libya). Modelled specific fuel estimates were derived for 135 low- and middle-income countries and estimates of overall clean fuel use were reported for 190 countries.

Treatment of missing values:

- ***At country level:***

No reporting for low- and middle-income countries with no data.

High income countries with no data are assumed to have transitioned to clean fuels and technologies, and are therefore reported as >95% of their population using clean fuels and technologies.

- ***At regional and global levels:***

Low- and middle-income countries with no data were excluded from regional and global aggregations.

High income countries with no data are assumed to have transitioned to clean fuels and technologies, and are therefore assumed to have 100% of their population using clean fuels and technologies for the purpose of calculating regional and global aggregations.

Regional aggregates:

Regional and global estimates are population-weighted; i.e. the country estimates (e.g. 56%) is multiplied by its population, this figure is summed (by region or for all countries) and divided by the sum of the population of the countries included.

Sources of discrepancies:

There may be discrepancies between internationally reported and nationally reported figures. The reasons are the following:

- Modelled estimates versus survey data point.
- Use of different definitions of polluting (or previously solid) fuels (wood only or wood and any other biomass, e.g. dung residues; kerosene included or not as polluting fuels).
- Use of different total population estimate
- Estimates are expressed as percentage of population using polluting (or solid) fuels (as per SDG indicator) as compared to percentage of household using polluting (or solid) fuels (as assessed by surveys such as DHS or MICS).
- In the estimates presented here, values above 95% polluting fuel use are reported as “>95”, and values below 5% as “<5.”

Changes in modelling methodology:

Prior to 2018, estimates of the proportion of the population primarily relying on solid fuels were obtained from a multilevel model with region and nonparametric functions of time as the only covariates (Bonjour et al. 2013). For tracking SDG7 in 2018 and 2019 this model was used to estimate polluting and clean fuel use, though this time it was implemented in the Bayesian framework for increased robustness and more reliable quantification of uncertainty. For 2020, the model has been expanded to allow estimates for individual fuels, and extra flexibility has been added to the functions of time to better capture nonlinear trends in some countries (Stoner et al. 2019). These refinements have been introduced alongside an ever-expanding collection of data, which underwent a major quality-control effort. Due to the increased data availability, borrowing of information across regions is no longer essential, hence time is now the only covariate.

On both occasions where the model changed, the WHO conducted a thorough sensitivity analysis, including full country-by-country comparisons of estimates between the existing model and the candidate model. In most cases, estimates of the proportion using clean fuels exhibited little change, see annex below. Where larger discrepancies were identified, they were carefully investigated to determine the likely cause. Many of these were in fact the result of the new model better capturing nonlinear trends.

Data sources

Primary household fuels and technologies, particularly for cooking, is routinely collected at the national levels in most countries using censuses and surveys. Household surveys used include: United States Agency for International Development (USAID)-supported Demographic and Health Surveys (DHS); United Nations Children’s Fund (UNICEF)-supported Multiple Indicator Cluster Surveys (MICS); WHO-supported World Health Surveys (WHS); and other reliable and nationally representative country surveys.

The World Health Organization is the agency that has taken responsibility for compiling a database of statistics on access to clean and polluting fuels and technologies harvested from the full global body of household surveys for cooking, heating and lighting. Currently, the WHO Database covers cooking energy for 170 countries and one territory for the period 1960-2018 and is updated regularly and publicly available. For lighting, the WHO database includes data for 77 countries for the period 1963=-2018. For heating, the WHO database includes data for 55 countries for the period 1977 – 2018.

Presently WHO is working with national surveying agencies, country statistical offices and other stakeholders (e.g. researchers) to enhance multipurpose household survey instruments to gather data on the fuels and technologies used for heating and lighting.

Data availability

Description:

For cooking fuels, coverage of 170 countries is available through the WHO Global Household Energy Database.

For lighting fuels, the WHO database includes data for 77 countries.

For heating fuels, the WHO database includes data for 55 countries.

Time series:

From 1960 to 2018

Disaggregation:

Disaggregated estimates for different end-uses (i.e. cooking, heating and lighting; with expected improvements in household surveys, this will be possible for heating and lighting for all countries with survey data.

Disaggregation of access to clean fuel and technologies for cooking by rural or urban place of residence is possible for all countries.

Gender disaggregation by main user (i.e. cook) of cooking energy will be available with expected improvements in household surveys

Gender disaggregation of head of household for cooking, lighting and heating is available

Energy is a service provided at the household, rather than individual level. Nonetheless, it is used differentially by men and women and has different impacts on their health and well-being. What will be possible, in principle, is to report energy access disaggregated by the main user of cooking energy.

In addition, WHO's Household energy database includes country data from thirty countries on the time spent by children collecting fuelwood and water disaggregated by sex. With the improvements in data collection via the below mentioned survey harmonization process, data will be available reporting time spent exclusively on fuel collection rather than in combination with water collection.

Calendar

Data collection:

Summer/Fall 2019

Data release:

1-May-2020

Data providers

Name:

National Statistical Offices

Description:

National Statistical Offices or any national providers of household surveys and censuses.

Data compilers

WHO, Public health, Social and Environmental Determinants of health Department (PHE).

References

URL:

www.who.int/gho/phe

References:

Global Tracking Framework report (2013)

http://trackingenergy4all.worldbank.org/

Global Tracking Framework Report (2015)

http://trackingenergy4all.worldbank.org/

Global Tracking Framework database (2015)

http://data.worldbank.org/data-catalog/sustainable-energy-for-all

Multi-Tier Framework for Measuring Energy Access,

https://www.esmap.org/node/55526

WHO Guidelines for indoor air quality: Household Fuel Combustion, WHO (2014)
http://www.who.int/indoorair/guidelines/hhfc/en/

Stoner O, Shaddick G, Economou T, Gumy S, Lewis J, Lucio I, Ruggeri G, Adair-Rohani H. Global Household Energy Model: A Multivariate Hierarchical Approach to Estimating Trends in the Use of Polluting and Clean Fuels for Cooking. https://arxiv.org/abs/1901.02791

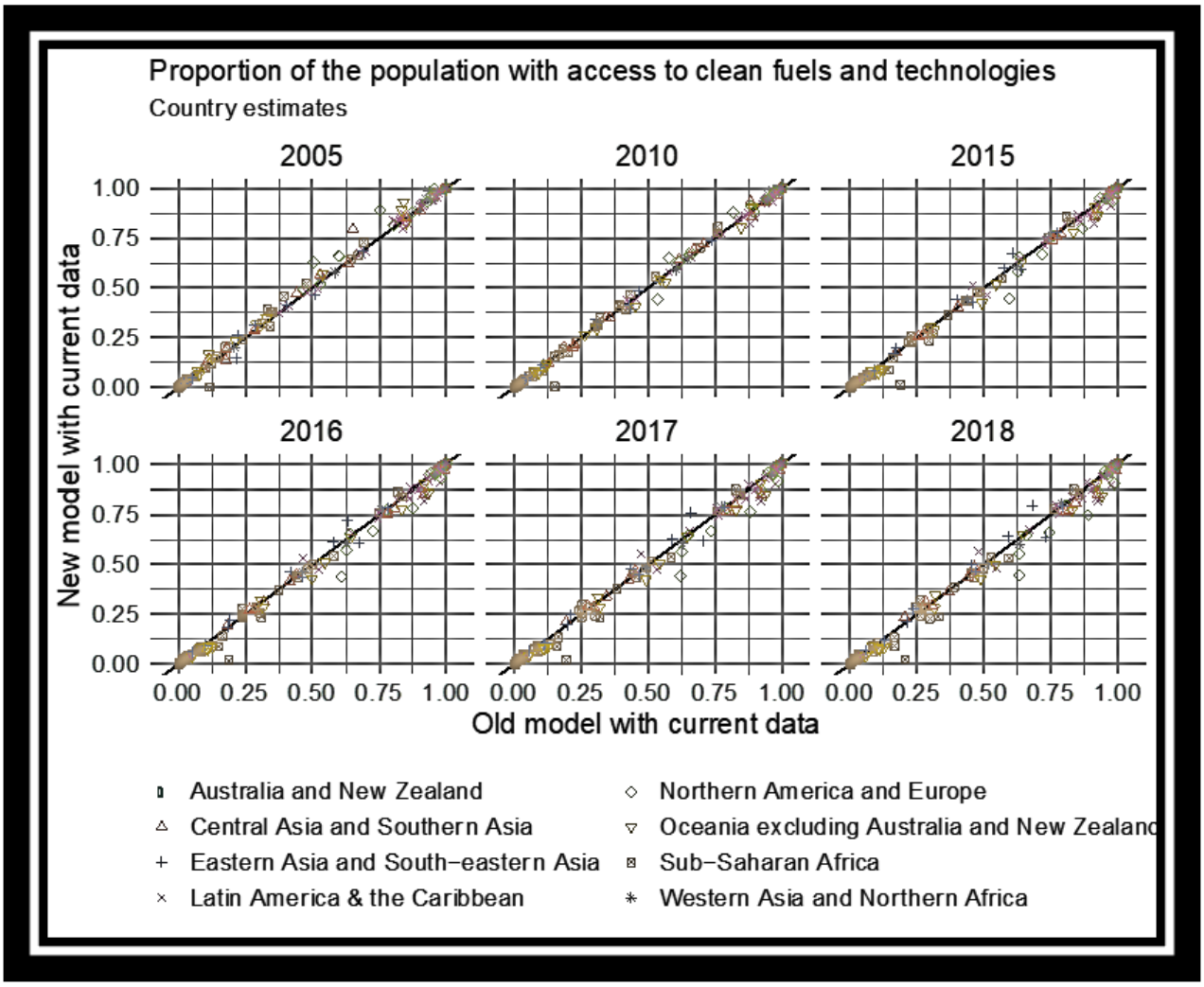
Bonjour S, Adair-Rohani H, Wolf J, Bruce NG, Mehta S, Prüss-Ustün A, Lahiff M, Rehfuess EA, Mishra V, Smith KR. Solid Fuel Use for Household Cooking: Country and Regional Estimates for 1980-2010. Environmental Health Perspectives 121:7 CID: https://doi.org/10.1289/ehp.1205987

Population using solid fuels meta-data, WHO

http://apps.who.int/gho/indicatorregistry/App_Main/view_indicator.aspx?iid=318

Annex

A comparison plot is provided to illustrate the differences between existing model and the candidate model. Estimated values for each of the WHO regions are plotted, showing consistency between the existing model and the candidate model.



Related indicators

3.9.1: Mortality rate attributed to household and ambient air pollution