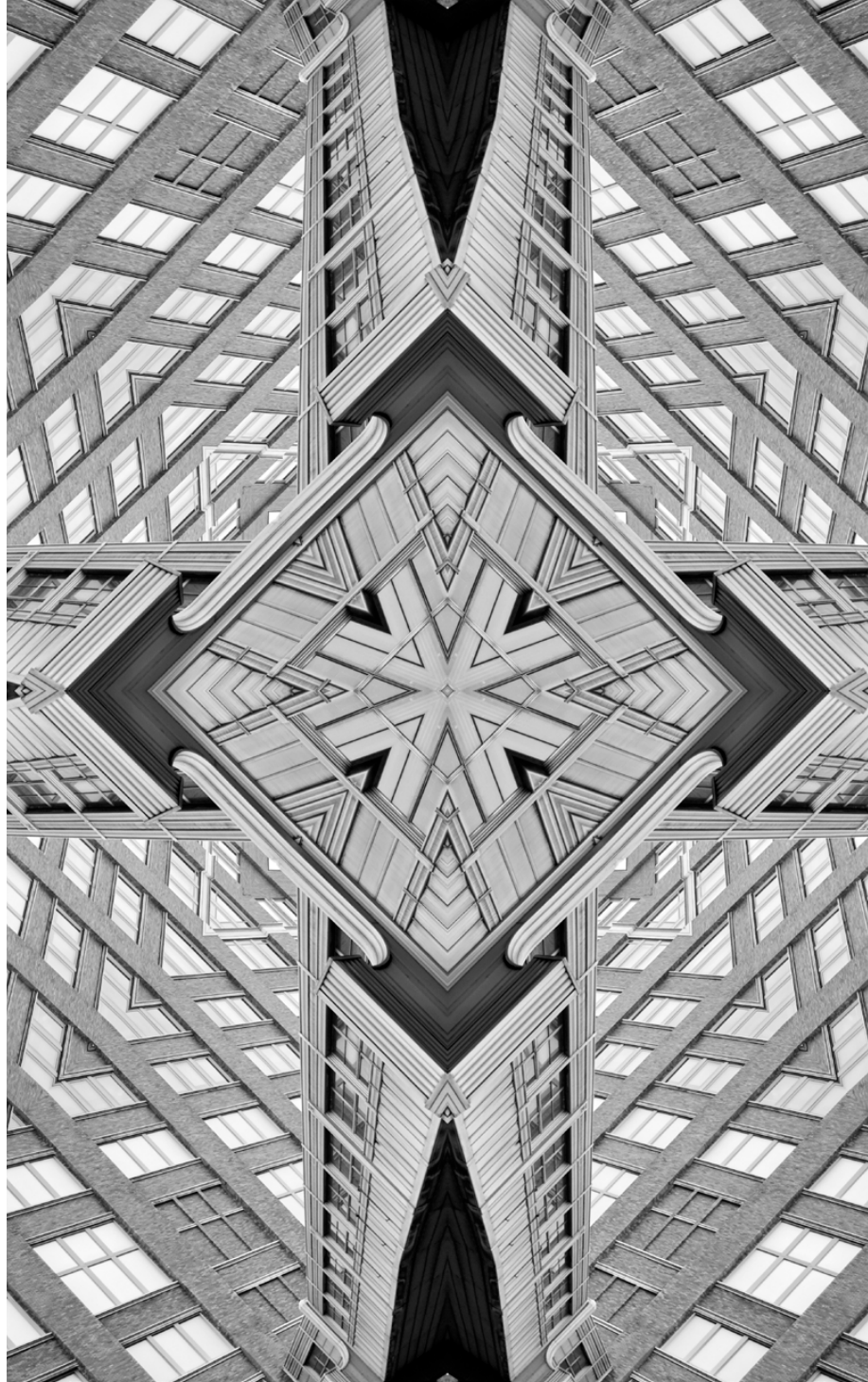


Issue

Brief

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Towards Universal Access to Clean Cooking Fuels and Technologies: The Role of Policy, National Incomes, and Social Behaviour

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Abstract

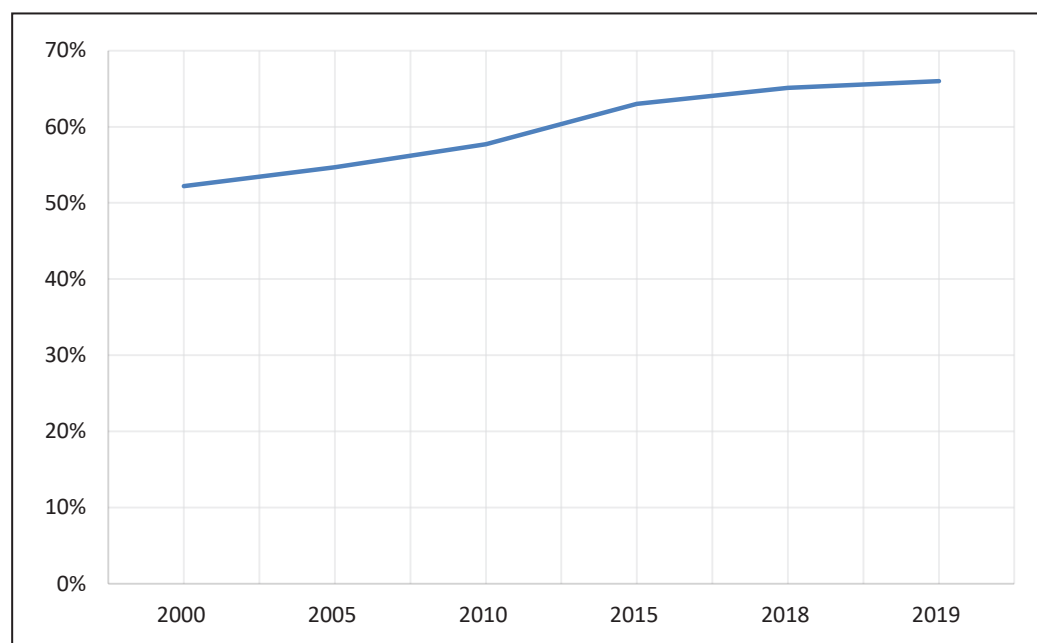
Goal seven of the United Nations Sustainable Development Goals (SDGs) commits the international community to providing access to clean cooking fuels and technologies to all by 2030. Progress has been slow, however, and in about 40 of the UN's 189 member countries for which data is available, more than 80 percent of the populations continue to lack such access. Using case studies, this brief analyses the role of a country's policies, institutions, and national incomes, as well as social behaviour, in determining access to, and use of clean cooking fuels and technologies. It argues that more than policies that focus on subsidising clean fuel, what would help in wider transition to clean fuels is concerted government effort that considers the affordability of fuel and users' cooking behaviour, along with supportive infrastructure.

In 2015, the United Nations (UN) General Assembly adopted a set of 17 interlinked Sustainable Development Goals (SDGs), aiming to bring peace and prosperity to all people by 2030.¹ Among the agenda is universal access to energy. SDG 7, in particular, aims to “ensure access to affordable, reliable, sustainable and modern energy for all” by 2030. (The goal is further sub-divided into three targets, of which the first reiterates the overall aim, while the other two deal with encouraging the use of renewable sources of energy.²) Indicators have also been created to measure advancement towards targets: Indicator 7.1.2 looks at the “proportion of population with primary reliance on clean fuels and technology”—^{a,b,3} this is the focus of this brief.

According to *SDG 7 Tracking Report 2021*, about 2.6 billion people in the world lack access to clean cooking fuels^c and technologies.^{d,4} It notes that global access to clean fuels increased by just 1 percentage point annually between 2010 and 2019, and that at this pace, only 72 percent of the population will have access to such fuels and technologies by 2030. To achieve the target of universal access, the rate of increase needs to be more than 3 percentage points per year.⁵ To be sure, there are certain countries that have shown encouraging results in moving towards this target. This brief explores the variations in access across the globe through different lenses – those of policy, economics, and social behaviour. It offers specific recommendations on increasing access.

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- a The proportion of population with primary reliance on clean fuels and technology is calculated by dividing the number of people using clean fuels and technologies for cooking, heating and lighting by total population reporting any cooking, heating or lighting, expressed as percentage.
 - b “Clean” is defined by the emission rate targets and specific fuel recommendations included in the normative guidance WHO guidelines for indoor air quality.
 - c Clean fuels are LPG, natural gas, solar, electricity, biogas and cleaner fuels like pellets for forced draft stoves. Fuels that are not considered clean include firewood, coal, charcoal, kerosene, and agricultural residues.
 - d Clean technologies are improved cookstoves (forced draft stoves following WHO norms), solar based cooking technologies, LPG and natural gas stoves, induction stoves, electric heaters/cookers/plates, biogas technologies.

Figure 1
Percentage of Population in the World with Access to Clean Cooking Fuels and Technologies (2000 – 2019)

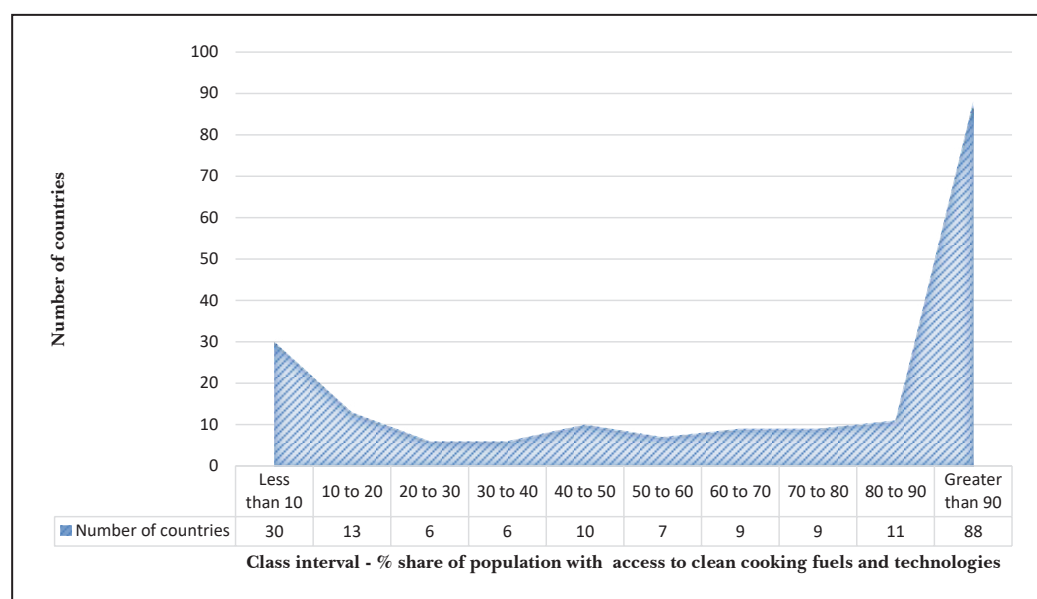


Source: Author's own based on the data available from the IEA^{6,7}

“About 2.6 billion people in the world lack access to clean cooking fuels and technologies.”

This analysis studies 189 countries for which data is available for the past 20 years.⁸ The countries have been segregated into 10 equal class intervals based on the percentage share of their populations with access to clean fuels and technologies (see Figure 1). In a majority of these countries (88 out of 189), more than 90 percent of the population have access to clean cooking fuels and technologies. However, there are 30 countries with less than 10 percent of their population having such access.

Figure 2
Distribution of Countries Based on Percentage of Population with Access to Clean Cooking Fuels and Technologies



Source: Author's own, based on data from the World Bank⁹

The countries where less than 10 percent of the population have access to clean cooking fuels and technologies are mostly in sub-Saharan Africa. As of 2018, there were more than 900 million people in this region without access.¹⁰ The countries where the population with access varies between 10 and 50 percent are also mostly in sub-Saharan Africa, though there are also some such countries in South Asia, and East Asia and the Pacific.

Varied Access across Countries: Overview

In 17 of the 30 countries where access rates are below 10 percent, the population share with access increased by barely 1 percent, or less, between 2000 and 2016. At the same time, the number of countries where more than 90 percent of the population today do have access has increased from 58 in 2000 to 88 in 2016.

Sound government policy has played a key role in the countries that have made the most progress. For example, in Indonesia, the access rate has risen by more than 8 percent between 2012 and 2014 due to the government-supported Indonesian Kerosene to Liquefied Petroleum Gas (LPG) Conversion programme that saw 56 million households and micro-businesses switching from kerosene to LPG use between 2007 and 2014.¹¹

In June 2021, the UN held its first preparatory ministerial-level thematic forum on energy, followed by a high-level dialogue in September.¹² At both these events, various aspects of generation, transition, and access to clean energy were discussed by about 40 ministers and 300 speakers from different countries.^c It was found during discussions that the challenges for the least developed countries were far different from those of the high-income economies.

In 43 countries,^f 80 percent or more of the population still lacked access to clean fuels and technologies, which made it essential to expedite access growth rates. It was also seen that these countries had shown little improvement in access patterns over the years.

“The countries where less than 10 percent of the population have access to clean cooking fuels and technologies are mostly in sub-Saharan Africa.”

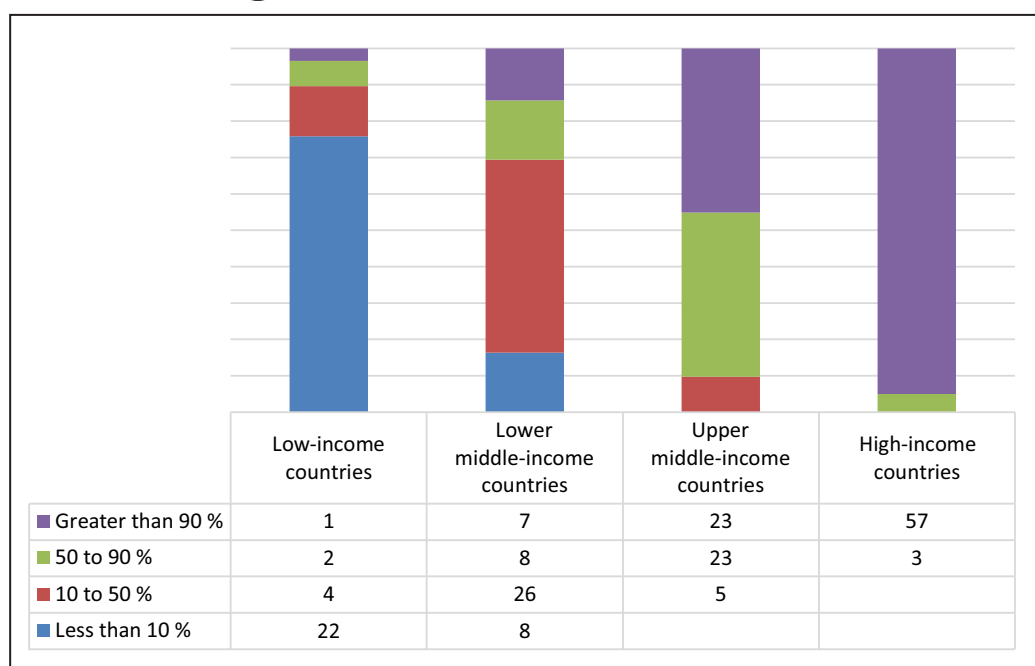
e The author attended all five days of the virtual forum.

f Bangladesh, Benin, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Congo, Dem. Rep., Côte d'Ivoire, Djibouti, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kenya, Kiribati, Dem. People's Rep. Korea, Lao PDR, Liberia, Madagascar, Malawi, Mali, Fed. Sts. Micronesia, Mozambique, Myanmar, Nigeria, Papua New Guinea, Rwanda, São Tomé and Príncipe, Sierra Leone, Solomon Islands, Somalia, South Sudan, Tanzania, Timor-Leste, Togo, Uganda, Vanuatu, Zambia.

Income Levels and Access to Clean Fuels

The income level of a country^g and its share of population with access to clean cooking fuels and technologies have a high correlation of 0.82 (See Figure 3). Low-income countries dominate the group where *less than 10 percent* of the population have access to clean cooking fuels and technologies; lower-middle income countries are prominent in the *10-50 percent* group; and the majority of the countries in the *50-90 percent* group are upper-middle income economies.

Figure 3
Income Level and Share of Population with Access to Clean Cooking Fuels and Technologies



Source: Author's own, based on data from the World Bank^{13,14}

Note: The figure distributes countries into four class intervals based on their share of population with access to clean cooking fuels/technologies as 'Less than 10%', '10 – 50%', '50-90%' and 'Greater than 90%'.

^g The World Bank classifies countries into four groups based on Gross National Income (GNI) per capita in current USD as Low income (< 1,036), Lower-middle income (1,036- 4,045), Upper-middle income (4,046- 12,535), and High income (> 12,535).

Income Levels and Access to Clean Fuels

Case Study 1: The Maldives

In 2000, only 32 percent of the population in Maldives had access to clean cooking fuels and technologies. The country graduated from Least Developed Country (LDC) status to 'Lower Middle Income' position in the year 2011, with a per capita income of over USD 6,300.^{15,16} Today it is an upper middle-income country, and 93 percent of its population have access to clean cooking fuels and technologies.¹⁷ A 2018 report by the World Health Organization (WHO) notes that about 90 percent of Maldives households use gas for cooking.¹⁸ The country is an example of simultaneous improvement in economic status alongside increased access to clean fuels and technologies.

Therefore, initiatives for providing access to clean cooking fuels and technologies need to be customised according to each country's income level. Opportunities for cooperation with other countries should be explored. The initiatives of low-income countries with high access rates may be considered as examples to be followed by other low-income countries.

“The income level of a country and its share of population with access to clean cooking fuels and technologies have a high correlation of 0.82.”

Across the 189 countries for which there is available data, 85 percent of the population in urban areas have access to clean cooking fuels and technologies compared to 42 percent of rural dwellers.¹⁹ Overall, the urban-rural access gap has been declining in most regions of the world since 2000, except in sub-Saharan Africa.²⁰

There have been efforts to popularise LPG in many countries, but most of them have been more effective in urban areas than in rural. For example, Senegal began providing subsidies for LPG in the mid-1970s, alongside increasing the license fee for woodcutting (to discourage firewood use) and building LPG refilling centres in remote regions.²¹ The government also manipulated charcoal prices to make LPG costs more competitive.²² This caused the LPG market to grow to an annual consumption of 170,000 MT in 2017, which is 56 times what it was when the programme began.²³ However, LPG use in Senegal has remained concentrated in urban areas²⁴ and began to slow down after the removal of LPG subsidy in 2009.²⁵ Indeed, the access rate has remained at 30 percent from 2000 till 2016. Similarly, India introduced LPG subsidies from the 1960s. India's census data for 2011 showed that only 11 percent of the rural population had access to LPG, compared to 65 percent of the urban population.²⁶

The subsidies on LPG and natural gas introduced by governments have helped improve access rates in urban locations more significantly than in rural regions. There are various factors associated with the slow adoption of LPG/natural gas in rural areas, especially the limited distribution infrastructure, while fuels such as firewood and agricultural residues are available in abundance.

In the past, rural-centric approaches to popularising clean fuels and technologies have mostly involved providing improved cookstoves or biogas fuel. India introduced improved cookstoves in the 1980s. However, adoption has remained a challenge as people combine devices and fuels depending on which suits each separate cooking task best.²⁷ Households also consider whether repair services are easily available and the extent of user friendliness of the different devices.^h

An important offshoot of using non-clean fuels is increased air pollution. WHO guidelines recommend that particulate matter (PM) in indoor emissions should be less than 2.5 mg/min.²⁸ Many countries are failing to achieve this because of

^h Based on author's interactions with users.

the kind of fuels that populations use. Bhutan, for example, continues to face challenges in indoor air quality, despite the country having made progress in increasing access rates to clean fuels and technologies in the last three decades by providing improved cookstoves and LPG, particularly in the rural regions.²⁹ If biomass is used as fuel, only ‘forced draft cookstoves’ⁱ can, to some extent, meet the WHO guidelines; using natural biomass cannot. Forced draft cookstoves are mostly biomass pellet-based, which means a market for such pellets at competitive prices first has to be created before they are adopted on a large scale. Selecting the model of improved cookstove which meets WHO’s emission criteria continues to be a difficult task.

Case Study 2: Kyrgyz Republic

Kyrgyz Republic is a lower-middle income country in central Asia where 52 percent of the population have access to piped gas network. It aims to provide natural gas to 60 percent of its population by 2030. At present, piped gas is used more in urban areas. A study of the country’s fuel use concluded that households with access to natural gas and LPG are less likely to use solid fuels for cooking. Since Kyrgyz has a cold climate, heating is also crucial. The study indicated that access to clean energy for space heating (be it using natural gas, LPG or electricity) promotes the use of clean energy for cooking as well. Conversely, use of coal and wood for heating increases the chances of the same fuels being used for cooking too.

Source: ADB Institute³⁰

Government policies other than those directly related to access to clean cooking fuels and technologies can also impact such access. Vietnam, for instance, introduced a tree-planting program on small plantations managed by rural households and communities, whose main thrust was to improve rural household incomes. However, the programme resulted in increased access to firewood, causing a setback to clean fuel use: firewood use for cooking by rural households rose from 66 percent in 2006 to 71 percent in 2011.³¹ Overall, however, Vietnam has shown consistent increase of 2-4 percent^j (rural and urban usage combined) in its access rate to clean fuels every year from 2000.³² In 2009, it installed 40,000 biogas digesters in rural locations, with funding from the Asian Development Bank (ADB) and the Netherlands’ SNV, which greatly boosted clean fuel usage.^{33,34}

i Where the biomass is first converted to a gaseous fuel through partial combustion.

j Rural and urban combined. Percentage of population in Vietnam with access to clean cooking fuels/ technologies was a mere 15 percent in 2000 but increased to 67 percent by 2016.

The Interplay of Policies, Institutions, and the Socio-economic Environment

Many countries have been promoting use of clean fuels and technologies in various ways. Unlike that of electricity, their uptake has been much slower. India launched its Pradhan Mantri Ujjwala Yojana in 2016 to provide 80 million LPG connections to poor households in rural areas by 2020.^{k,35} The scheme achieved its ambitious target on time. However, more than a year after the launch, an analysis of about 32 million Ujjwala consumers showed that about 18 percent of them had never sought a refill of their gas cylinder, and another 33 percent had taken only one to three refills.³⁶ This implied that they were continuing to meet their fuel needs primarily with the non-clean fuels they were used to. Some of the reasons for the poor refilling rate were found to be easy availability of biomass (such as firewood and agricultural residues) which did not cost the families anything unlike the refills which had to be paid for. There were also difficulties associated with refilling in remote locations.

In a pilot study in 2015, electric induction stoves were also provided to rural households to gauge if they would bring any change in their cooking fuel mix. It was found that these stoves replaced LPG as a prominent secondary cooking means. The study also found, however, that use of these stoves increased families' electricity bills, while they also found power quality problematic due to frequent voltage fluctuations.³⁷

In Indonesia, the reasons for slow uptake of clean fuels were different. Kerosene retailers presented the biggest hurdle to the LPG conversion programme as they were reluctant to change their business model.³⁸ Again, both LPG and kerosene had associated costs, unlike firewood.

Case Study 3: Indonesia

In Indonesia, the share of population with access to clean cooking increased from 5 percent in 2000 to 58 percent in 2016. The oil price spike of the 1970s enabled the country, which is a major oil exporter at the time, to introduce an energy subsidy of which that on kerosene was a significant component. Weaning the population off kerosene was a massive challenge: after all, it was being used by the urban poor for both cooking and lighting, and, for the rural poor, was regarded next only to firewood. Subsidies on household energy consumption (primarily kerosene) were also politically sensitive. The government introduced a programme for conversion from kerosene to LPG in 2007, through which each household was given a 3-kg LPG canisters; some 55 million kg were distributed in all. The kerosene subsidy was gradually withdrawn.

Source: United Nations University³⁹

^k It waived the deposit fee usually sought for the gas cylinder supplied, and ensured that the woman in the family was the beneficiary.

The Interplay of Policies, Institutions, and the Socio-economic Environment

In Ghana, the government began promoting LPG through a subsidy in the 1990s. LPG consumption thereafter increased, though firewood remained the primary cooking fuel for 74 percent^l of households.⁴⁰ A 2011 study also revealed that vehicles consumed about 37 percent of the LPG supply in the Ghanaian market.⁴¹

Affordability is obviously a key factor in determining the rate of transition to cooking fuels. There are many options available, in terms of both technology and delivery business models, to facilitate the transition.

“Many countries have been promoting use of clean fuels and technologies in various ways. Unlike that of electricity, their uptake has been much slower.”

^l As per population and housing census 2010 in Ghana. As per World Bank Data, the percentage of population with access to clean fuels and technologies increased from 5 percent in 2000 to 22 percent in 2016.

To promote LPG use, governments in many countries are offering subsidies. However, the success of these initiatives also increases the financial burden on the state. Indonesia, for example, faced the same budgetary strains with LPG as it had earlier done with kerosene.⁴² India initiated the “Give it Up” scheme in 2016 whereby households that could afford to, were urged to give up their subsidies voluntarily so that these could be diverted to poor households.⁴³ About 10 million households complied. In Nigeria, removal of fuel subsidies led to protests in 2012, eventually forcing the government to partially roll back its decision.⁴⁴

Case Study 4: Ecuador

Ecuador started an LPG subsidy in the 1970s, making 15-kg LPG cylinders available for USD 1.60. In 2012, the country ranked fifth globally in energy subsidies. More than 90 percent of its households primarily use LPG as cooking fuel. This has increased the fiscal burden on the government. Ecuador generates mostly clean power, with hydropower contributing almost 80 percent to its electricity basket. To reduce the deficit caused by the LPG subsidy, the government, in 2014, introduced a large-scale Induction Stove Programme (PEC), encouraging a switch to induction stoves for cooking. It led to 740,000 induction stoves being sold till 2017, against a target of 3.5 million by 2023. The government arranged for loans to pay for the induction stoves in installments at an interest rate of 5.5 percent, while also providing 80 kWh per month of free power for cooking purposes. Despite these incentives, the sale of induction stoves fell in 2017, while LPG use continued to rise. A study revealed that induction stove adoption has been lower than projected, due to the high cost of not only the stoves themselves, but also of the compatible cookware, and of electricity.

Sources: Inter-American Development Bank⁴⁵ and Energy Policy⁴⁶

Peru, for its part, introduced LPG subsidy in 2004.⁴⁷ By 2011, LPG subsidies accounted for 0.15 percent of the country’s GDP. It was observed that the energy subsidy scheme was favouring the wealthy more than the poor. In 2012, the government launched the Fondo de Inclusión Social Energético (FISE) scheme to encourage poorer households to switch to LPG. They were given both LPG cookstoves and vouchers to refill LPG cylinders. LPG subsidy provides a cushion against fluctuating oil prices and makes LPG more affordable. Phasing it out could affect the poor adversely.

As discussed briefly earlier, there are wide variations in the use of clean fuels and technologies – between urban and rural dwellers, and between the rich and the poor. Countries with higher income levels also have higher access rates. Key to bridging the gaps are investments in infrastructure that enable a reliable supply of clean cooking fuels and technologies, and steps to enhance the affordability of such fuels. At the same time, however, it is difficult to pinpoint precisely which practices from among the many initiatives that have been undertaken, will work best in a universal manner. The success of each initiative depends on various aspects such as affordability, reliability of supply, local cooking behaviour, effectiveness of the institutions involved, and the comparative advantage of other available cooking fuels. Each country has its unique scenario, and there is no one-size-fits-all solution to increasing access rates.

The World Bank has established a USD 500-million Clean Cooking Fund (CCF)⁴⁸ aimed at scaling up public and private investments in clean fuels through results-based financing (RBF).^m RBF has been successfully implemented in 10 countries.ⁿ The pilot experience in Indonesia showed that RBF was an effective tool for developing a sustainable clean cooking market.⁴⁹

Case Study 5: Rwanda

Inyenyeri is a Rwandan company that offers gas-based cookstoves that use biomass-based pellets as fuel. The stoves are leased for free to those who agree to buy the pellets from Inyenyeri. The pellets are locally produced. However, the company has struggled to find funding that would take it beyond the pilot stage. It has entered into a contract with the Carbon Initiative for Development (Ci-Dev), a World Bank trust fund that mobilises private funds for clean energy access in low-income countries. The Ci-Dev is committed to buying 1 million certified emissions reductions (carbon credits); it is one example of RBF. The contract with Ci-Dev is helping Inyenyeri expand its customer base.

Sources: World Bank⁵⁰ and Technology Exchange Lab⁵¹

^m Grants or incentives are paid to the market aggregators after an independent verification of pre-agreement targets. Market aggregators could be stove or fuel producers/manufacturers, wholesalers, importers, distributors, cooperatives, retailers or any other market players associated with the chain (or any combination of market players).

ⁿ Bangladesh, China, Ethiopia, Indonesia, Kenya, Lao PDR, Madagascar, Mongolia, Rwanda, and Uganda

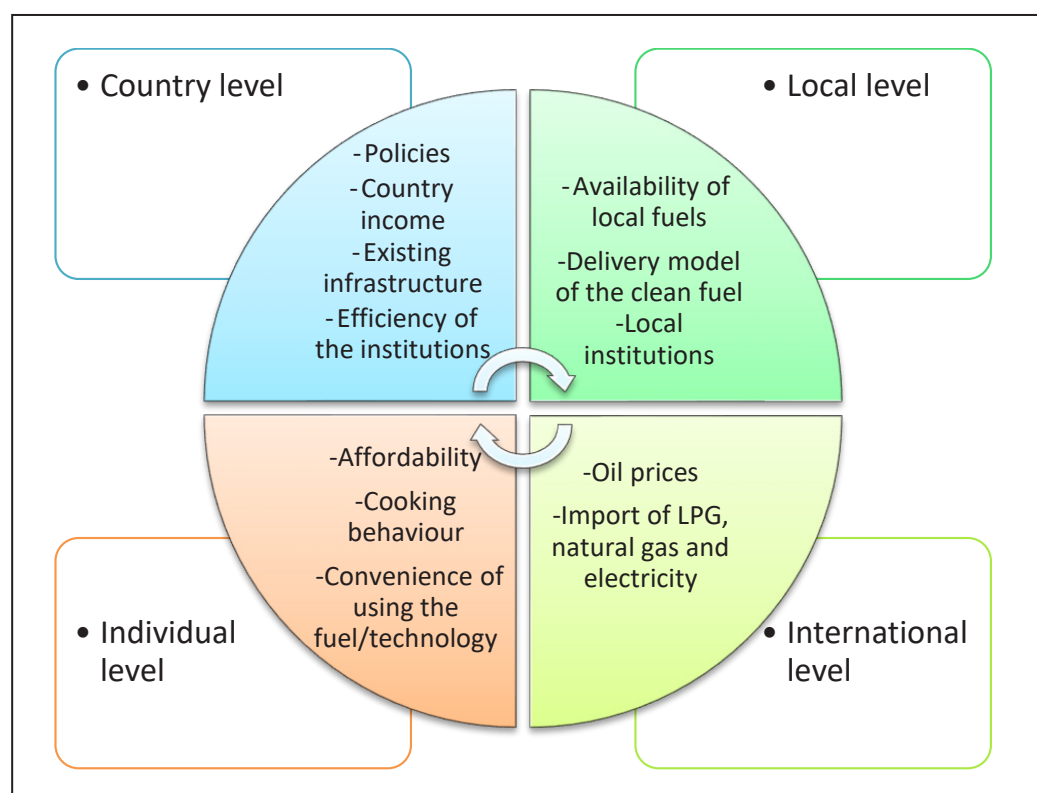
RBF is helping the private sector enter the market for cooking technologies, as well as to expand its base of already existing players. Most companies entering the space are selling improved cookstoves.⁵² These cookstoves are not by themselves a clean cooking technology, though they provide a cleaner cooking option in countries where clean fuel remains unaffordable for many. These high-efficiency cookstoves generally use pellets or briquettes made of processed biomass. The processing can be done locally and thus imposes no import burden, as using LPG or natural gas does.

Meanwhile, Bangladesh set up the Household Energy Platform (HEP) in 2016 to bring together the different stakeholders in clean cooking.⁵³ HEP is helping to identify challenges faced by the clean cooking sector from various perspectives.

“Each country has its unique scenario, and there is no one-size-fits-all solution to increasing rates of access to clean cooking fuels and technologies.”

The rate of increase in access to clean cooking fuels and technologies so far has been much slower than required to achieve the goal of universal access by 2030. The percentage of population with access to clean cooking fuels and technologies varies across countries, owing to various factors. At the household level, availability and affordability are both crucial. At a broader level, access is influenced by government policies, a country's economic status, as well as availability of infrastructure (see Figure 4).

Figure 4
The Interplay of Policies, Economic Conditions, and Social Behaviour



Source: Author's own

Conclusion


Dr. Manjushree Banerjee has 20 years of experience as a researcher and practitioner on *Energy Access*.

Considering the complex interplay of forces that influence access to, and adoption of, clean fuels and technologies, no single fuel or initiative taken by a particular country can be highlighted as a singular model for all others to emulate. However, one guiding principle emerges from the various case studies discussed in this brief. The issue of affordability must be addressed to sustain and increase the use of clean cooking fuels and technologies. State-funded programmes, such as subsidies on clean cooking fuels and/or technologies, have been among the initiatives taken by many countries. However, more substantial state-led interventions are needed in countries where the majority of the population still lack access to clean cooking facilities.

In such countries, especially the low-income ones, investments in overall infrastructure associated with the import, processing, supply and distribution of clean cooking fuels such as LPG are also required. Improved cookstoves which meet WHO guidelines are one solution for the immediate future. Subsidies or low-interest loans could be provided to the poorer households to facilitate the uptake of clean fuels.

Local cooking behaviour, the economic status of citizens, as well as existing infrastructure need to be assessed before framing policies and programmes. The ideal scenario would be to provide clean fuels like LPG, natural gas and electricity for cooking to all, and households should continue to use these fuels through regular refills and payments of tariff. However, such a scenario appears ambitious considering there are countries where more than 80 percent of the population are yet to receive any form of clean cooking fuel or technology. It has also been seen in different parts of the world that mere subsidy on LPG leads to limited transition. A mix of clean cooking fuels and technologies to increase the share of clean fuel use should be considered – LPG, electricity-based technologies, solar cookstoves, biogas and improved cookstoves which meet WHO standards.

In the rural regions, focus should be given to technological innovations that enable the use of available biomass to make clean fuel, alongside supplying fuels like LPG or natural gas, or electricity. Some countries have combined policies promoting clean cooking fuels and technologies with others discouraging use of non-clean fuels for cooking. Policies and delivery models suited to local needs have to be developed.

There are 65 countries where less than 50 percent of the population have access to clean cooking fuels and technologies. Barely eight years are left to achieve the SDG of providing clean cooking options to all. The huge access gap has to be overcome through a combination of policies, business and delivery models, and the right mix of clean fuels and technologies. 

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