Energy and Health in Low-Income and Middle-Income Countries 1

Powering health with energy in low-income and middle-income countries

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Energy is central to human health, powering essential activities from cooking food, heating, and cooling in the home to operating equipment and refrigerating medicines and vaccines in health-care facilities. Despite progress in expanding access, many low-income and middle-income countries (LMICs) still experience energy poverty, forcing billions of people to breathe contaminated air from cooking with biomass fuels and walk to health centres that have difficulty keeping lights on and electrical equipment running. The result is a heavy disease burden that exhibits the same inequity that characterises other poverty-related deprivations. In this paper, we introduce this Series on energy and health in LMICs by highlighting persistent disparities in energy access, use, quality, and reliability in LMICs; the associated disease burden; the salient opportunities to mitigate disease by providing clean, affordable, and reliable energy to households, communities, and health-care facilities; and the major policy, technological, and financial constraints that need to be overcome.

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This is the first in a **Series** of five papers on energy and health in low-income and middle-income countries. All papers in the Series are available at www.thelancet.com/series-do/energy-health-2026

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Introduction

Energy is essential for advancing global health and human wellbeing. Energy powers nearly every aspect of life: it enables food production, transportation, and preservation; it supports water management and waste treatment; and it fuels the construction and operation of homes, workplaces, and public buildings. Energy improves the quality of health care and education. It also drives infrastructure development, from roads and railways to airports and waterways, and powers the vehicles, ships, and aircraft that transport goods. Energy also generates jobs and economic growth across industries such as manufacturing, mining, agriculture, and finance. Additionally, it advances science, communication, and the arts. Although energy use provides numerous benefits, energy extraction, transportation, and processing also negatively impacts the environment and human health through environmental contamination, work-related risks, and local and global emissions, and by enabling unhealthy lifestyles (figure 1).

The role of energy and health was explored in depth almost two decades ago in a previous Series in *The Lancet*.[4–10] The Series examined the production and use of energy across various sectors, including agriculture, transportation, and the built environment. It highlighted the need to reduce greenhouse gas emissions stemming from fossil fuel combustion and livestock production, particularly in affluent societies, to mitigate the adverse effects of climate change on human health,[4,5] and stressed the importance of improving access to clean energy in low-income and middle-income countries (LMICs), as defined by the World Bank, to avert substantial health risks and support socioeconomic development.[2] The Series concluded with recommendations on policy options and technologies, including energy efficiency measures, renewable energy development, and improved urban planning and transportation.[6–8]

In the current Series,[11–14] we conduct an expert synthesis to integrate the decades of research since 2007. We reinterrogate the relationship between energy and health in LMICs, because these countries face the greatest burden of disease from inadequate energy access and because their disproportionate burden is expected to

Key messages

- Despite massive increases in energy consumption globally over the past seven decades, access remains highly unequal, with billions of people in low-income and middle-income countries still experiencing energy poverty, which contributes to a large and persistent disease burden
- Air pollution from cooking with biomass fuels accounts for more than 3 million deaths annually; burning fossil fuels is also the primary driver of climate change, increasing heat-related mortality and the spread of vector-borne diseases to which low-income and middle-income populations are especially vulnerable
- Disparities in energy access disproportionately affect vulnerable populations, particularly women and girls who are often responsible for fuelwood collection and cooking with polluting fuels, restricting their opportunities for income-generating activities and education while exposing them to greater health risks
- Although a clean energy transition is expected to provide meaningful health and development benefits, this transition faces substantial hurdles, including political and regulatory barriers, technological challenges, and financial constraints
- This Series highlights key areas in energy and health in low-income and middle-income countries, including current energy access and trends, household energy and health, the need for reliable electricity in health-care facilities, and priorities and opportunities for clean energy transitions

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persist over the coming decades.[15] LMIC populations have benefited the least from fossil fuels while experiencing energy poverty (ie, the inability to access or afford sufficient energy to meet basic domestic needs) and vulnerability to climate change.[16] In 2022, there were 685 million people without access to electricity, 82% of which lived in rural areas.[17] Urban–rural disparities have shrunk in all regions except sub-Saharan Africa, where population growth outstripped increasing access.[17] Based on 2023 data from the International Energy Agency (IEA), the standard refrigerator uses three times more energy than the average person in a low-income country.[18] There were also 2·1 billion people without access to clean cooking, including 79% of the population in sub-Saharan Africa and 33% of population in central and south Asia.[17] Insufficient access disproportionately affects women and girls, who are frequently responsible for collecting fuelwood and for cooking on open fires or low-efficiency cookstoves that create substantial household air pollution as a result of burning wood, charcoal, or dung indoors, where cooking and sleeping are often in the same confined space.[19,20] The time spent on domestic chores without timesaving electrical appliances restricts opportunities for income-generating activities and education,[21–23] and potentially exposes them to greater health risks.[24,25] Many people in LMICs are not only deprived of the benefits of clean, affordable, and reliable energy, but also face the health consequences of polluting fuels, making it difficult to avoid health risks and break the cycle of poverty.

In this first paper in the new Series, we present a brief history of energy and energy access and describe the burden of disease associated with energy production and consumption. We then discuss how transitioning to clean energy could allow for the benefits of energy consumption without many of the adverse health outcomes and present barriers that are currently restricting the expansion of clean energy.

In the second paper of this Series,[11] Annelise Gill-Wiehl and colleagues examine the drivers of clean energy adoption at the household level, scrutinise current tools for tracking the energy transition, and emphasise key barriers to abandoning polluting fuels, including economic constraints, supply vulnerabilities, and access limitations. They discuss how binary access indicators misrepresent the health and equity impacts of energy transitions, neglecting fuel stacking and the gendered disparities in the burdens of polluting fuels, and propose policies to reduce initial and recurring costs and improve the reliable provision of clean energy.

The third paper in this Series focuses on current understanding of the energy–health pathway.[12] Ajay Pillarisetti and colleagues critically assess the methods used to quantify the disease burden attributable to household air pollution, synthesise the current epidemiological evidence, and discuss evidence generated by studies of clean cooking interventions. They examine the potential health consequences of energy transition policies, highlighting important gaps in knowledge and identifying key areas for future research.

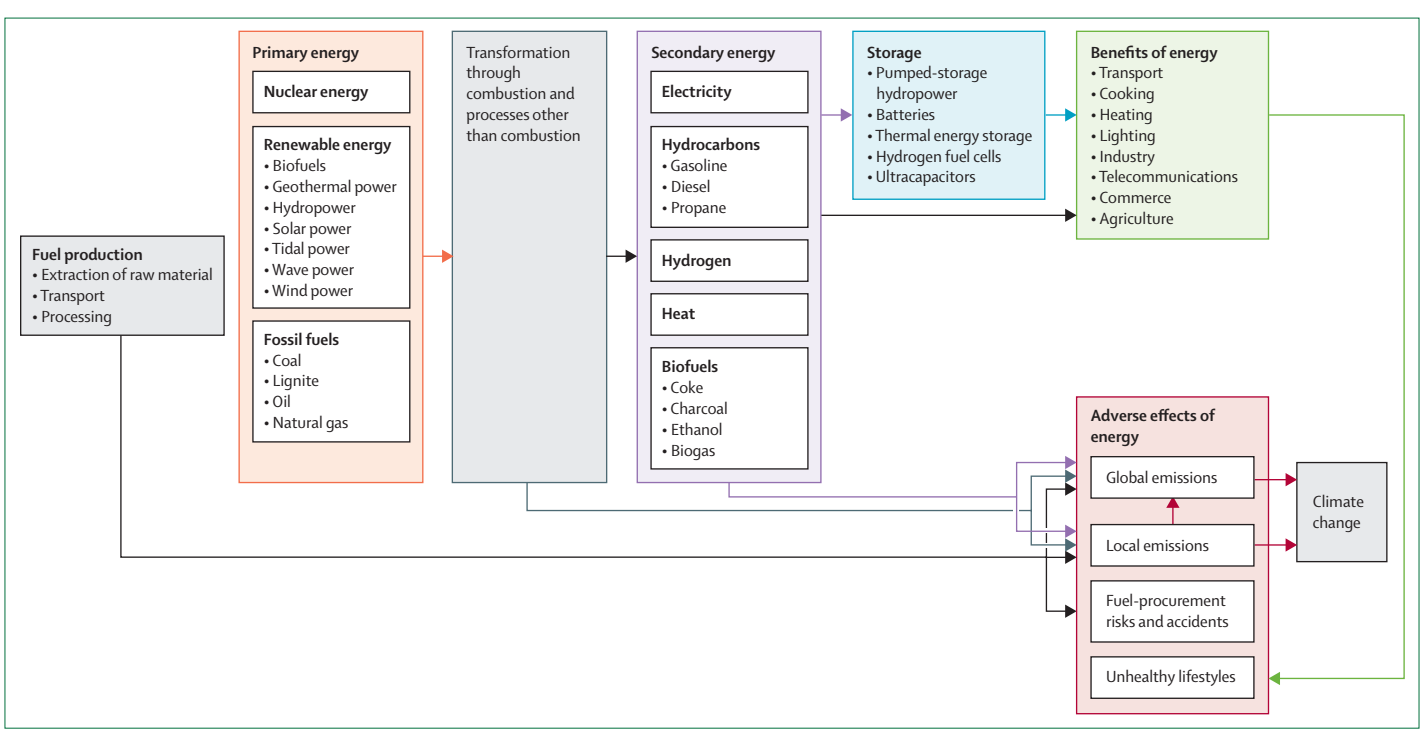

Figure 1: **Beneficial and adverse effects of energy production, transformation, and use**
Adapted from Myers and Frumkin,[1] Wilkinson et al,[2] and Jaccard.[3]

The fourth paper in this Series focuses on health-care facilities.[13] Salvatore Vinci and colleagues describe how reliable, affordable, sustainable, and equitable electricity access in health-care facilities is necessary for achieving universal health coverage. They offer a new framework for standardised indicators of electrification and electrified services in health-care facilities, and advocate for increased, equitable investment; building local capacity to instal, operate, and maintain energy systems at health-care facilities; and increased access to biomedical equipment suitable for harsh conditions.

In the fifth paper in the Series,[14] Carlos F Gould and colleagues focus on four priority topics for clean energy transitions in LMICs, aiming to maximise health and equity impacts. The paper highlights the need for targeted clean energy support, coupling clean energy interventions with other welfare-enhancing goods and services, and harnessing digital tools for advancing clean energy as strategic opportunities for expanding clean energy access, while noting that this expansion also requires a supportive political climate, strong local commitment, and robust cross-national research capacity.

Finally, in an accompanying Article,[26] Noah Scovronik and colleagues assess different approaches for reducing CO_2 emissions, and consider the avoided harms from future climate change, the health benefits that result from improved air quality, and the cost of CO_2 mitigation policies (which might burden LMICs).

A brief history of energy supply, access, and tracking

Dominant sources of energy have changed over time, shifting the profile of adverse health outcomes associated with energy production and use. Rural households in LMICs continue to primarily rely on their own procurement of decentralised, locally available sources of biomass fuels, such as wood, dung, and crop residues, for cooking, heating, and some small-scale commercial and industrial applications, resulting in household and ambient air pollution with adverse health effects.[27] In countries that were colonised, infrastructure development before independence focused on resource extraction, transportation, and exportation, with little or no effort made to expand energy access for local populations.[28] For example, the first electricity generation–distribution systems in Africa were deployed in the 1950s by industrial facilities to power industrial operations and street lighting in small urban municipalities to support colonial rule.[29] Colonial powers had little interest in expanding access to the local population, especially for household use, and in some cases even prevented it.[30] By the end of the colonial period in Africa in the 1960s, there was little electricity access outside of the major cities, and even in cities, household access was scarce.[28]

Post-independence, many LMICs established national utilities and programmes to expand access to electricity—which produces no air pollution at the point of use; however, these efforts were often hampered by insufficient financial capital, low-cost recovery, and mismanagement.[31] The 1973 Organization of the Petroleum Exporting Countries oil crisis, followed by the 1979 Iran oil crisis, spurred governments globally to boost energy security by reducing oil consumption, promoting energy efficiency, and transitioning to alternative sources.[32] India began to invest in renewable energy[33] (energy that can be used without reducing its availability in the future, such as wind energy, solar energy, geothermal energy, hydropower, and biomass fuels), Indonesia invested in renewables and domestic coal,[34] and many African governments built hydroelectric dams.[35] LMIC governments also increased their role in the energy sector—for example, by nationalising their oil industries.[36] Loans from the World Bank and other development funders in the 1980s and 1990s often prioritised market liberalisation over energy access, decreasing government investment in energy infrastructure and leaving many low-income communities underserved.[37]

Before the establishment of the UN Millennium Development Goals, the connections between energy, health, and development were well known.[38,39] However, the MGDs, which aspired to eradicate extreme poverty and hunger and ensure environmental sustainability, among other targets, did not directly address energy. In 2015, the Sustainable Development Goals (SDGs) emphasised energy access as a fundamental component of sustainable development; SDG 7 aims to ensure access to affordable, reliable, sustainable, and modern energy for all by 2030. The goal implicitly defines sustainable energy as energy from renewable sources and modern energy as electricity and WHO-defined clean fuels.[17] In addition to targets for renewable capacity, energy intensity, and investment, SDG 7 established targets to increase access to electricity (SDG 7.1.1) and clean cooking (SDG 7.1.2). However, at the current pace, 1·8 billion people will rely on pollution fuels for cooking and 660 million people will have no access to electricity by 2030.[17]

In 2015, the World Bank's Energy Sector Management Assistance Program (ESMAP) proposed a shift from a binary definition of energy access to a definition that more closely aligns with energy use.[40] In the ESMAP Multi-Tier Framework (MTF), energy access is defined as the ability of an end user to consume electricity for desired services and is characterised by the degree to which end users have access to power of varying capacity, and the daily and evening availability, reliability, quality, affordability, formality, health, and safety of this power. The lowest tier (Tier 0) includes households with no access or access for less than 4 h per day (or <1 h per evening), and Tier 3 includes households with electricity for 8 h or more per day (including ≥3 h per evening), with enough capacity to power

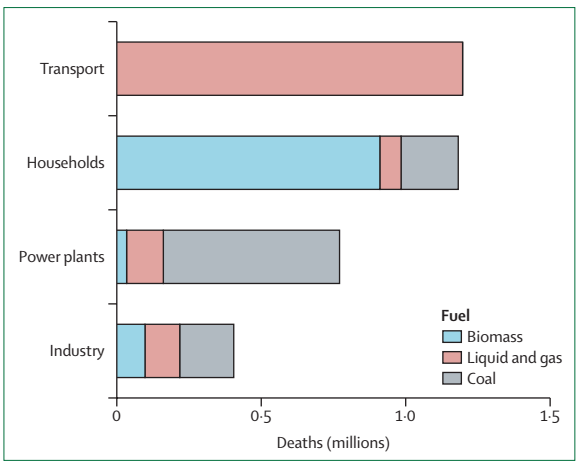

Figure 2: **Estimated deaths from $PM_{2·5}$ exposure, by fuel and sector in 2022**
Liquid gas includes light and heavy oil, diesel oil, and natural gas. Coal includes hard and brown coals and coal coke. Biomass includes wood, charcoal, dung, and agricultural residue. Data are from *The Lancet*'s 2025 Countdown on health and climate change indicator modelling premature mortality from air pollution. The model estimates concentrations and exposures by use of emissions inventories and chemical dispersion models and estimates health impacts by use of $PM_{2·5}$ exposure–response relationships.[15]

medium-load appliances such as a water pump, refridgerator, or air cooler. Categorising household energy access in this way therefore provides a more nuanced understanding of the energy available for use. For example, in 2019, 57·6% of people in Zambia had no access to electricity; an additional 2·1% had access, but less than 4 h per day (or <1 h per evening) and were therefore also in the MTF Tier 0 category.[41]

In 2019, UK Aid's Modern Energy Cooking Services programme was established to shift from the historical focus on transitioning households from traditional biomass stoves to more efficient biomass cookstoves to a focus on clean cooking with electricity-based solutions. Such solutions include pressure cookers and induction stoves, along with fuels that are expected to provide much larger reductions in disability-adjusted life-years (DALYs) and greenhouse gas emissions, such as liquefied petroleum gas (LPG) and ethanol.[42,43]

Energy prices spiked in 2022 after Russia's invasion of Ukraine and subsequent sanctions on purchasing Russian energy. The short-term spike in energy prices could push 166–538 million people into energy poverty and 78–141 million into extreme poverty;[44] the long-term effects of the war are unclear as the war has simultaneously redirected Russian liquified natural gas sales from Europe to India and China while accelerating the EU's transition to renewable energy sources through the REPowerEU programme.

As population growth continues in LMICs and standards of living increase, the demand for energy is only expected to increase. Southeast Asia is projected to contribute more than 25% of energy demand growth in the next decade—driven primarily by an increase in use of air conditioning, transportation, and industry[45]—a contribution exceeded only by that of India (40%).[46] Much of this increase in energy production will be met with the combustion of fossil fuels, particularly in LMICs,[46] posing direct risks to human health and indirect risks due to climate change. For example, in 2023, two-thirds of energy in Latin America was from fossil fuels[46] and half of electricity in southeast Asia, where economic development continues to be carbon intensive, was from coal.[45] As such, the evidence from mid-2020 onwards strongly suggests that what is unfolding is not so much an energy transition as an energy addition, with the growth of renewable energy coming on top of that of conventional fuels.[47] Renewable energy currently accounts for 40·4% of installed electrical generating capacity in LMICs,[17] with hydropower providing over 50% of electricity in 28 LMICs;[48] nuclear power also provides a substantial portion of electricity in Pakistan (16·7%),[49] and China is set to become the leading nuclear power producer globally by 2030.[50]

Energy and the burden of disease

Although energy access offers profound benefits to health and wellbeing, the production and use of energy, particularly from fossil and biomass fuels, is also a major cause of death and disease (figure 2). By far the largest adverse impact of energy on health is from air pollution. In 2023, it is estimated that ambient particulate matter caused 4·3 million (95% uncertainty interval 3·4–5·3) deaths and 111 million (90·0–134·4) DALYs in LMICs.[51] The burden of disease from $PM_{2·5}$ exposure is primarily from residential heating and cooking, windblown dust, industry, power generation, and transportation.[52] Although there is wide heterogeneity between countries, an average of 20% of ambient air pollution is generated by households due to the primary source of household air pollution: combustion of wood, charcoal, dung, and agricultural residue for cooking.[53]

Household air pollution from solid fuels is estimated to have caused 2·8 million (95% uncertainty interval 2·0–3·8) deaths and 104·7 million (81·0–132·3) DALYs in LMICs in 2023.[51] Household air pollution causes the most harm in sub-Saharan Africa (3286 age-standardised DALYs per 100 000 people) and south Asia (2330 age-standardised DALYs per 100 000 people).[51] These numbers, and all those produced by the Global Burden of Disease studies, are estimates subject to exposure misclassification and regional and temporal variability in exposure–response curves and severity estimates;[54] however, in 2021, particulate matter pollution was highly likely to be the leading environmental contributor to the global burden of disease and the third leading cause of DALYs worldwide for children younger than 5 years.[55]

The combustion of fossil fuels for energy is also a major contributor to climate change and its impact on human health. In 2022, top sources of greenhouse gas emissions were power generation for heating (32·8%), transportation

(16·0%), manufacturing/construction (12·4%), and agriculture (12·0%);[56] cooking contributed only 2·0% of emissions.[20,56] Compared with the 1990s and early 2000s, by the early 2020s heat-related mortality of people older than 65 years increased by 63·2%, productive hours lost to heat increased 98%, sleep lost to heat increased by 9%, and deaths from wildfire-derived $PM_{2·5}$ increased by 36%.[15] The transmission potential of mosquitoes that carry dengue increased up to 49% from the 1950s to the 2020s and the length of coastal waters suitable for diarrhoea-causing *Vibrio* increased by 36% from the 1990s to 2024.[15]

Adaptation to climate change and a household's ability to manage its existing basic needs are impeded by energy poverty, defined by the United Nations Development Programme as "the absence of sufficient choice in accessing adequate, affordable, reliable, high-quality, safe, and environmentally benign energy services to support economic and human development".[57] Energy poverty is both a characteristic and cause of poverty.[58,59] For example, in sub-Saharan Africa, energy poverty has been linked to food insecurity and malnutrition, primarily from the lack of electricity, poor access to food markets, and outsized expenditures on energy.[60] Energy poverty can also aggravate depression among older adults, especially those who live in urban areas and those who live alone.[61]

There is also an increasing disease burden in LMICs associated with the extraction of fossil fuels and the mining of energy-related minerals. Coal mining is associated with several serious lung diseases, including pneumoconiosis (black lung), chronic obstructive pulmonary disease, and lung function impairment, primarily due to long-term exposure to coal dust and other airborne particles in mining environments. Crude oil exploration and extraction increase the risk of cancer, liver damage, immunodeficiency, and neurological symptoms for nearly 6 million people who live or work nearby approximately 40 000 oil fields globally.[62] In LMICs, increasing extraction of minerals for energy transmission and storage, such as copper, aluminium, lithium, graphite, nickel, manganese, and cobalt, also contributes to the burden of disease.[63]

Clean energy for health

Opportunities

Expanding clean energy and reducing the combustion of biomass and fossil fuels presents the greatest opportunity for decoupling the adverse effects of energy use and related health impacts, such as respiratory and cardiovascular diseases and cancers.[64] Reaching the IEA Net Zero by 2050 goal of transitioning away from coal, oil, natural gas, and biomass fuels while achieving universal access to sustainable energy would prevent millions of premature deaths yearly.[64]

This effort does not have to come at the expense of economic development. Higher income countries have decoupled economic growth from carbon intensity (ie, the amount of greenhouse gas emissions per unit of activity, calculated as units of carbon dioxide equivalents per unit gross domestic product [GDP]), carbon emissions per capita, and total carbon emissions through reduced energy intensity (ie, the amount of energy required per unit of activity, calculated as units of energy per unit GDP).[65,66] Further, building new clean energy systems is typically less expensive than operating existing power plants that rely on fossil fuels.[67] In many African countries, installing decentralised solar panel systems to replace diesel generators can have a payback period of 6 months or less, a factor that could have motivated the 2025 surge in the importation of Chinese solar panels.[68] Given that Africa has 60% of the world's solar resources but solar power accounts for only 3% of the continent's electricity generation, dramatically increasing solar power across the continent is both feasible and crucial for meeting local energy needs and global clean energy goals.[69]

However, expanding access to clean energy in LMICs faces substantial policy and regulatory barriers, technological challenges, and financial constraints (panel). Although seemingly insurmountable due to competing forces, each can be overcome by closing knowledge gaps and pursuing policies and investments that better align energy, health, environment, and climate goals. Progress is not likely to be linear but to proceed at different rates with a different mix of priorities in different regions.[47]

Political and regulatory barriers

Bureaucratic hurdles, including lengthy permitting processes and complex approval procedures, add substantial delays and costs to clean energy projects, discouraging private sector participation.[70,71] Misaligned tariff codes, high taxes on clean fuels and technologies, and insufficient grid integration further impede industry growth and market adoption.[72] For nuclear power, additional barriers include developing strong legal and regulatory frameworks that prioritise safety and non-proliferation, engaging stakeholders to foster a supportive social environment, and the long-term commitment required.[73] Stronger policies could also reduce operational and commercial inefficiencies associated with government-owned, vertically integrated utility structures, representing 70% of utilities in sub-Saharan Africa, which have little competition, transparency, or monitoring.[74] Addressing these regulatory and policy barriers requires political will in the face of resistance from fossil fuel industries and from threats of job losses, power outages, public upheavals, and economic stagnation from changes in energy policies.

Technological difficulties

Although several countries in sub-Saharan Africa have a total electricity generation capacity that exceeds peak demand, solar and wind produce power intermittently and the power might not be available when and where it

Panel: **Summary of policy and regulatory barriers, technological difficulties, and financial constraints facing clean energy expansion**

Policy and regulatory barriers

- Government subsidies, taxes, tariffs, and regulations that support fossil fuels over renewable energy distort markets and hinder competitiveness
- Political support from established fossil fuel industry that outweighs that of renewable energy sources
- Political will that favours short-term wins over long-term infrastructure investment

Technological difficulties

- Inadequate electricity generation from renewable energy sources
- Need for storage to address intermittent renewable energy
- Ageing and inefficient grid infrastructure
- Insufficient grid capacity, particularly for remote populations
- Need for specialised skill for design, installation, and maintenance of renewable energy systems

Financial constraints

- Widespread unaffordability from high upfront and recurring costs of cleaner or greener fuels
- Limited public, private, and international funding to support energy access, climate change mitigation, and adaptation strategies
- Scarcity of long-term private investment in energy transition
- Supply chain constraints
- Existing debt obligations can restrict the fiscal space for new energy investments

is needed due to insufficient energy storage and weak transmission infrastructure;[75] cost-effective battery storage solutions to address the intermittency of renewable energy sources are crucial.[76]

Current energy storage technologies, such as batteries, often do not have the capacity required for large-scale grid integration or are too expensive.[77] Transformation of existing grids into smart grids is essential to accommodate the variable and decentralised nature of renewable energy sources.[78] In the interim, LPG, as a transportable, widely available by-product of fossil fuel production, has been proposed and implemented as a cleaner domestic cooking solution. Indeed, of the 600 million households that gained access to cleaner fuels for cooking between 2010 and 2020, over three-quarters did so with LPG.[19] However, access to LPG continues to be inequitable: in Latin America, LPG expansion allows for clean cooking in 94% of urban areas, whereas 36% of rural populations still do not have access to clean cooking.[17] At the household level, cleaner cooking technologies available to low-income households often fail to or only partly meet their needs, resulting in low acceptability. These challenges are amplified by stoves that break without clear pathways for repair or replacement. In such cases, it is common for households to simultaneously use both the clean technology and their pre-existing, more polluting technology (known as stove stacking) or stop using the cleaner technology altogether. Stove stacking dramatically decreases potential emission reductions from cleaner technology.

Current approaches to cleaner energy solutions pose difficult risk trade-off problems. Clean energy technologies, such as electric vehicles, batteries, wind turbines, and solar panels, rely on minerals that are largely mined in China, Viet Nam, India, Brazil, Russia, and the Democratic Republic of the Congo, with few human and ecological protections;[79] although some certification systems and initiatives have been established to prevent human rights and other violations, they have been deemed ineffective and insufficient.[80] Geopolitical tensions can arise from the supply chain vulnerabilities that result from dependence on these few countries and their attempts to increase revenues by restricting supplies.[81] Additionally, the construction of hydroelectric dams can also result in habitat loss, disrupted water flow, and displacement of communities.[82,83] Solar farms that fill large tracts of land can also compete with natural and agricultural uses.[84] Additionally, end-of-life management of solar panels, wind turbines, and batteries requires proper disposal to minimise environmental harm. Improved efficiency in food production could help offset the increasing energy demands from changing dietary patterns in LMICs, especially the increasing consumption of animal meat and dairy.[85]

Financial constraints

Renewable electrification is further hindered by high upfront costs coupled with inadequate financing. Historically, higher-income countries have driven the current energy-related health and climate burden through the use of fossil fuels; now, these same countries are asking LMICs to make large financial commitments for clean energy infrastructure, despite widespread energy poverty.[86] In the past decade, international financing for clean energy (on the order of US$20 billion annually) has been provided largely (>80%) in the form of debt-based financing (ie, loans, concessional loans, credit lines, or other debt), but the share of funding provided through equity, guarantees, and grants is increasing; however, investment is disproportionately low in places where it is needed the most.[17] In sub-Saharan Africa, a key barrier to scaling up solar power is that the capital required costs three times more to access than it does in higher-income countries, and there is little participation of private sector investors due to high-risk perceptions; de-risking investments, mobilising concessional finance, and deploying

innovative financing models might help increase renewable energy production.[69]

The IEA estimates that to reach universal access to clean cooking, US$8 billion is needed annually from 2024 to 2030 to pay for infrastructure and equipment; half of this investment would be dedicated to sub-Saharan Africa and fuel costs would be an additional $100 billion annually.[87] The IEA projects that closing the electrification gap will require $170–275 billion, which would only provide minimal access to lighting, air circulation, television, and phone charging and thus might not displace use of polluting fuels for more energy-intensive tasks, such as heating and cooking.[17] These high costs, coupled with the perception of investment risk associated with clean energy projects, create a substantial barrier to widespread adoption.[70,88] The challenge is compounded by the need to invest in a variety of infrastructure types—including grid expansion, decentralised solar power, wind power, and hydropower microgrids—to cater to diverse geographical and community needs. The fluctuating prices of renewable energy components, despite a substantial decrease in the overall cost of these technologies, add another layer of complexity for potential investors.[70]

At the household level, clean fuels are currently unaffordable for most rural users in LMICs to adopt, let alone use exclusively.[16] Not only are initial connection fees and the costs of appliances prohibitively high, but recurring fuel costs are also often unaffordable. These financial constraints, often coupled with an absence of financing options,[89] create substantial affordability barriers, particularly for vulnerable populations. This affordability crisis is further exacerbated by the fact that many households in LMICs, particularly those experiencing energy poverty, depend on traditional biomass fuel, which is often available without cost, for cooking, making the transition to cleaner alternatives even more challenging.

Conclusion

The second quarter of the 21st century presents a historic opportunity for advancing health and wellbeing by reducing energy poverty and inequity. A clean energy transition is expected to provide meaningful health and development benefits, and the potential for substantial climate mitigation and adaptation, particularly in LMICs. Scarce clean energy access and use, coupled with continued biomass and fossil fuel dependence, worsens health problems in LMICs and fundamentally challenges equitable energy transitions. This Series aims to clarify the important connections between energy and health in LMICs. In this Series, we will explore the challenges and opportunities associated with expanding access to clean and sustainable energy for human health and wellbeing.

Contributors

Writing (original draft): LHK, MD, AG-W, AP, DMK, and TC wrote the original draft of the manuscript. All authors were involved in the conceptualisation and writing (review and editing).

Declaration of interests

We declare no competing interests.

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