POLICY BRIEFS IN SUPPORT OF THE UN HIGH-LEVEL POLITICAL FORUM 2025

Air Pollution From Energy Systems – Addressing a Critical Burden on Global Health

SDG7 POLICY BRIEFS IN SUPPORT OF THE UN HLPF 2025

This document is part of a series of policy briefs compiled by the multistakeholder SDG7 Technical Advisory Group (SDG7 TAG) in support of the review of SDG7 at the High-level Political Forum (HLPF) 2025. Convened by UN DESA, the SDG7 TAG is composed of over 40 experts from governments, UN organizations, international organizations and other stakeholders. The HLPF is the central United Nations platform for the follow-up and review of the 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs) at the global level. More information on the SDG7 TAG, including previous editions of the annual SDG7 Policy Briefs, is available here.

This work is a joint product of various SDG7 Technical Advisory Group members. The findings, interpretations, and conclusions expressed in this publication do not necessarily represent those of the United Nations or the organizations represented in the SDG7 Technical Advisory Group.

Published by the United Nations

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Air Pollution From Energy Systems – Addressing a Critical Burden on Global Health

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KEY MESSAGES

- Energy production and use are the dominant sources of anthropogenic air pollution—the top environmental risk factor for health globally.
- Air pollution is responsible for 6.4 million deaths every year, with the greatest burden falling on low- and middle-income countries.
- Immediate and substantial health gains can be delivered by a just and inclusive energy transition. This is especially so in regard to sectors such as power generation, household cooking, heating and lighting, transport, industry, agriculture, and waste.
- Reducing air pollution from energy sources improves health now, while also supporting longer-term environmental and climate goals.
- The benefits of achieving the targets set by Sustainable Development Goal (SDG) 7 extend beyond reductions in exposure to air pollution. They also include other aspects related to health, such as enhanced safety, clean cooking, delivery of quality health services through solar-powered facilities, and climate-resilient cooling for communities, buildings, and food.
- Equity must guide all actions, ensuring that the most affected communities benefit from feasible, scalable, cleaner, safer, and more affordable energy.
- Health-centred energy planning creates triple-win solutions: it simultaneously advances SDG3 (health), SDG7 (energy), and SDG13 (climate).

1. Introduction

Air pollution from inefficient energy is a universal health risk. Worldwide, it leads to millions of deaths, as well as hundreds of millions of years of productive life being lost to illness. By ensuring affordable, reliable, sustainable, and modern energy for all via a reduction in energy demand and an increasing reliance on renewables, substantial health benefits can be provided. A just and inclusive energy transition targeting key polluting sectors, therefore, offers one of the most high-impact strategies available for the improvement of health, the advancement of climate goals, and the promotion of equity.

Priority Actions:

- Accelerate clean and sustainable energy transitions in the major polluting sectors – power generation, industry, transport, households, agriculture, and waste.
- As a key priority for protecting health in the energy transition, prioritize context-sensitive and equity-centred solutions, such as clean cooking access.
- Integrate health impact assessments into energy and development planning and implementation, including within Nationally Determined Contributions (NDCs), while strengthening cross-sector coordination to embed health protection across the energy value chain.
- Support energy transitions in and beyond health systems. These range from electrifying health care facilities and ensuring clean household energy use to the rollout of sustainable cooling infrastructure and developing 'health-wise' standards for energy efficiency and renewable technologies.
- In order to inform actions and demonstrate impacts, strengthen monitoring and accountability mechanisms for tracking emissions, exposure, health outcomes, and the progress of implementation.
- Ensure inclusive policies and financial schemes protect vulnerable populations, support affected workers, and enable sustained use of clean technologies.
- Scale up investment in both the energy and health sectors. This should include results-based financing (RBF) in which health impacts are explicitly accounted for.
- Strengthen the knowledge and capacity of health professionals, decision makers, and other stakeholders around health and energy linkages. Their trusted voices should be leveraged to advocate for and shape energy-related policies and investments.

2. Interlinkages Between SDG7 and SDG3: The Energy-Air Pollution-Health Nexus

2.1 The central role of air pollution

The most consequential linkage between the sustainable energy (SDG7) and human health (SDG3) goals is air pollution. Energy production and use—across power systems, industry, household, transport, agriculture, and waste—remain the largest source of harmful air pollution emissions globally.

Indeed, energy-related activities emit a wide range of health-damaging pollutants. These include fine particulate matter ($PM_{2.5}$), black carbon, carbon monoxide (CO), sulphur dioxide (SO_2), and nitrogen oxides (NO_x). Once released, these pollutants can travel long distances, enter the air people breathe and trigger or exacerbate serious health conditions, from acute lower respiratory infections in children to chronic obstructive pulmonary disease (COPD), heart disease, stroke, and lung cancer.[1] In 2021 alone, exposure to $PM_{2.5}$ was linked to approximately 6.4 million premature deaths globally.[2]

The causal pathway is clear: energy activities lead to emissions, emissions contribute to ambient and household air pollution, and polluted air causes ill health. This energy-air pollution-health nexus does, however, offer a strategic opportunity to design and implement integrated policies that advance both SDG7 and SDG3. Reducing air pollution by improving energy access and efficiency not only delivers immediate health gains but also addresses broader climate and equity goals.

In addition, beyond air pollution, other energy-related factors also pose direct health risks. A lack of reliable, safe, and sustainable energy access increases the risk of injury, limits access to clean water, and impedes the delivery of essential health services. Health facilities need stable electricity for lighting, cold chains, life-saving equipment, and digital health systems. Yet, many in low-resource settings face frequent power outages or shortages. Ensuring reliable, sustainable energy is therefore essential not only for health service delivery but also for building resilient systems that are able to respond to emergencies, climate risks, and future health challenges.

2.2 Sectoral contributors

Power generation

Much of electric power generation (EPG) relies on fossil fuels, especially coal. This poses significant risks to both health and the climate. In 2022, 61 per cent of global electricity generation was fossil fuel-based, particularly coal (36 per cent) and natural gas (22 per cent). Coal alone was responsible for 76 per cent of global carbon dioxide (CO_2) emissions, reaching nearly 10 gigatons annually.[3,4]

The public health case for coal-fired EPG transition is clear. Fossil fuel combustion emits significant amounts of $PM_{2.5}$, which is linked to severe health outcomes, including many noncommunicable (e.g., cardiovascular and respiratory) diseases.[2] Globally, approximately 200,000 deaths per year are attributable to $PM_{2.5}$ from coal-fired power plants alone.[5] The health benefits of replacing coal-fired power are therefore immediate and directly experienced by the affected communities.

Country-specific evidence reinforces these global findings. In Canada, a study of deaths related to air pollution in 2015 found that those deaths caused by the coal-fired electric power generation sector were equivalent, in Canadian dollar (C$) terms, to C$1 billion in annual economic losses.[6] Canada's coal phase-out combined strategic policy reforms, cleaner technology investment and worker transition support, including retraining and consumer protection measures.[7,8] The Canadian experience therefore shows that coordinated policies can maximize the health and climate benefits of the clean power generation transition, while also ensuring social equity.[9]

Industry

Industrial sectors—including mining, manufacturing, refining, chemical production—emit a wide range of air pollutants, such as $PM_{2.5}$, SO_2, NO_x, volatile organic compounds (VOCs), heavy metals, and dioxins that harm health and the environment. Industrial activities are often concentrated, creating high-exposure areas for nearby populations, where pollution levels and health risks are elevated. Although industries have reduced emissions in some regions, they remain a major source of SO_2, NO_x, and greenhouse gases globally.[10,11,12]

In addition, industrial pollutants such as benzene, arsenic and polycyclic aromatic hydrocarbons (PAHs) are linked to cancers, respiratory diseases and asthma, while they also impact child development.[13,14] Strong evidence also connects specific industries to particular health outcomes. Examples include petrochemical complexes linked to childhood respiratory diseases and adult cancers, and linkages between the steel industry and lung cancer.[15] Financially, in euro (€) terms, industrial air pollution cost Europe up to €433 billion in 2017.[16]

Addressing these major impacts requires stricter emission controls, the application of the best available technologies, transitions to cleaner energy, enhanced air quality and health monitoring, and health-centred industrial practices.[17]

Transportation

Relying predominantly on fossil fuels such as gasoline and diesel, the transport sector contributes substantially to air pollution and climate change. Transport-related air pollution (TRAP) is a significant source of $PM_{2.5}$, NOx, CO, black carbon and other harmful substances, particularly in rapidly urbanizing LMICs.[18,19,20,21]

Globally, transport generates approximately 20 per cent of particulate matter emissions, around 15 per cent of total GHG emissions, and around 23 per cent of energy-related CO_2 emissions.[18,19,20]

TRAP exposure is highest near busy roads and affects drivers, pedestrians, cyclists and nearby residents. Vulnerable populations include children, older adults, and low-income communities, which often face worse health impacts.[22] In 2015, around 385,000 premature deaths worldwide were attributable to transport-related $PM_{2.5}$ and ozone exposure.[23] Exposure to TRAP is strongly linked to cardiovascular disease, lung cancer, asthma onset, and acute respiratory infections in children.[21,24,25,26,27]

Reducing TRAP requires technological and behavioural solutions. Measures such as cleaner fuels, improved emission standards, and vehicle electrification can lower TRAP levels. Promoting public transit, active mobility – such as walking and cycling – and integrated urban planning can reduce vehicle use, enhance physical activity, and improve road safety.[27]

Household cooking and heating

Globally, around 2.1 billion people still rely on polluting fuels and inefficient technologies to meet their cooking needs. This results in high exposure to household air pollution.[28] Combustion of wood, charcoal, dung, and coal in poorly ventilated homes releases a mixture of health-damaging pollutants, including $PM_{2.5}$, black carbon, and CO.[29] $PM_{2.5}$ exposure levels in such settings can be more than 250 times higher[30] than the WHO's guideline value of 5 micrograms per cubic metre.

Evidence links household air pollution to a wide range of adverse health outcomes. These range from non-communicable diseases such as heart disease, strokes, COPD, and lung cancer, to emerging outcomes such as diabetes, cognitive impairment, and decreased renal function.[32] In 2021, household air pollution caused 3 million premature deaths, including about 310,000 children under five years old.[2]

Solid fuel combustion also contributes to poor outdoor air quality, accounting for around 20 per cent of global $PM_{2.5}$ pollution.[31,32] Unsafe cooking also causes burns and burn-related injuries. Women and girls face additional risks from fuel collection and cooking. These risks include gender-based violence and reduced time for education and income generation. Such risks are particularly high in displacement and fragile contexts, where around 81 per cent of displaced people rely on firewood, charcoal, and open fire for cooking.[33]

Clean household energy transitions that address all household energy needs offer a critical opportunity to deliver substantial health, environmental, and gender co-benefits. Policies and interventions must go beyond access and distribution and focus on enabling sustained, exclusive use of clean fuels and technologies at the point of use, such as electricity,

liquefied petroleum gas (LPG), biogas, and ethanol.[34] Policies should also be integrated to address affordability, access, and user preferences. While electricity from renewable sources remains the ideal long-term solution, it may not be achievable for many households immediately. A flexible "clean stack" approach – which combines multiple less-polluting fuels and technologies suited to different household energy needs – can help ensure immediate health gains while advancing toward longer-term energy and climate goals.

In addition to households, advancing clean energy solutions, energy efficiency, and improving ventilation in institutions such as schools, healthcare facilities, and workplaces bring additional health benefits.

Agriculture and waste burning

Agriculture and waste burning are closely linked to energy use and contribute significantly to air pollution and its health impacts. Agricultural activities often rely on fossil energy for machinery, irrigation, and fertilizer production, resulting in emissions of ammonia, methane, and $PM_{2.5}$.[35,36,37]

In addition, the widespread practice of crop residue burning emits $PM_{2.5}$, including black carbon and methane.[38,39] In India alone, agricultural residue burning is estimated to cause an average of 68,000 premature deaths per year due to exposure to particulate matter.[40]

Approximately 93 per cent of collected waste in LMICs is openly dumped or burned, releasing pollutants such as $PM_{2.5}$, CO, black carbon, and toxic chemicals, such as heavy metals and dioxins.[41,42,43] $PM_{2.5}$ exposure due to open waste burning has been linked to around 270,000 annual deaths globally[44] and is a major contributor to outdoor air pollution. In Lagos, Nigeria, for example, it accounts for more than 50 per cent of emissions.[45]

Addressing agricultural and waste-burning emissions requires an integrated response that combines cleaner on-farm energy solutions and sustainable waste management.[46,47] In agrifood systems, emissions and environmental impacts can be reduced by renewable energy solutions, such as solar-powered irrigation and cold chains, and bioenergy from residues. In this way, food security, rural livelihoods, and health can all be enhanced.[48]

2.3. Beyond air pollution: other energy-health linkages

While a major health benefit from clean and sustainable energy transitions is a reduction in air pollution, other energy-health linkages are equally important.

Reliable energy access in healthcare facilities, for example, is fundamental to safe, effective service delivery. From operating theatres to basic lighting and sterilization, electricity supports nearly every function of a modern health facility. Yet, more than 1 in 10 facilities in South Asia and sub-Saharan Africa lack any electricity, and many more face unreliable supply. This affects nearly 1 billion people in LMICs.[49] In sub-Saharan Africa, only half of hospitals are reliably electrified, while more than 90,000 healthcare facilities either

have no electricity access or only have access to unreliable electricity.[49] These gaps critically undermine maternal care, emergency services, and the safe delivery of vaccines and medicines.

Energy is also critical for public health cold chains, which maintain the safe storage and transport of temperature-sensitive vaccines and medications. Reliable and sustainable cold chain systems are essential in reaching remote populations, avoiding product spoilage, and maintaining the effectiveness of treatments, particularly during pandemics.

At the same time, global temperatures are rising, and climate-related weather extremes are becoming more frequent. Under these conditions, sustainable, climate-resilient energy solutions are becoming increasingly important in order to protect vulnerable populations from heat-related illnesses, as well as to maintain thermal comfort in care settings, safeguard supplies, and ensure uninterrupted health service delivery. Such sustainable, climate-resilient energy solutions include decentralized renewable energy, solar-powered refrigeration, energy-efficient air conditioning, passive building design, and nature-based cooling methods.

3. Policy Implications

Reducing air pollution through energy policies and actions is one of the most immediate ways to protect health, advance climate goals, and accelerate sustainable development.

At the same time, energy-related health risks and opportunities differ significantly across regions, depending on the levels of development, energy access, and regulatory capacity. To align SDG7 (energy) actions with SDG3 (health) outcomes, policy responses must therefore be integrated, equity-focused, and informed by contexts and evidence.

This section discusses important policy implications for maximizing the health co-benefits of clean and sustainable energy transitions.

- **Energy planning needs to prioritize health in order to deliver integrated air quality and climate benefits.** Moving beyond access and efficiency, energy planning and policies should explicitly address pollution reduction and health improvement. Incorporating health into energy strategy design and implementation enhances the effectiveness and sustainability of the clean energy transition.

- **Targeted actions in energy-related sectors are essential to reduce pollution and achieve health benefits.** Such actions include the promotion of clean household fuels and technologies for cooking, as well as for other domestic energy needs. These actions must also include coal phase-out in power generation and the replacement of diesel generators where power is unreliable. They should also include the improvement of urban transport systems with regulatory measures. Examples of such regulations include emissions and fuel quality standards, vehicle electrification, and bans on high-emission vehicles. In addition, targeted actions should include an end to the open burning of waste and crop residues, along with urban planning to reduce hotspots. Combining technical and fiscal tools, such as subsidies, taxes, and incentives, with social and cultural considerations is key to success.

- **Health considerations must be embedded in energy planning, regulation and investment.** This includes conducting full life-cycle health impact assessments of energy sources. Fossil fuels pose health risks at every stage, from extraction to combustion to waste. These risks must be assessed and considered when making planning and investment decisions. Governments should establish interministerial coordination to identify synergies, support joint planning across energy, health, environment, and urban development ministries, and scale solutions that provide multiple benefits.

- **A just and inclusive energy transition is essential.** Policy design should recognize and respond to diverse contexts, energy needs, and capacities at the regional and country level, with specific attention to vulnerable populations. Gender-responsive policies, targeted subsidies, retraining, and other forms of support for affected workers and communities all help ensure a fairer transition.

- **Mobilizing financing and partnerships is essential to implement clean energy-health solutions at scale.** Public-private partnerships, targeted subsidies, and innovative financing mechanisms – including carbon markets and results-based financing – can support implementation. Governments should engage international organizations, development banks, and the private sector to scale clean energy access, efficiency, and pollution control. This must also occur in fragile and conflict-affected settings.

- **Better data, monitoring and accountability mechanisms are key to track progress and guide actions.** Governments and partners must invest in robust monitoring systems for energy use, emissions, exposure and health outcomes. Public reporting of results and transparent indicators can help maintain momentum and ensure that policy translates into real-world improvements.

Box 1: Strong Commitments to Energy and Clean Air for Health

From 25 March to 27 March 2025, the 2nd WHO Global Conference on Air Pollution and Health was held in Cartagena, Colombia. This represented a pivotal moment in global efforts to align clean and sustainable energy transitions with public health priorities. The conference brought together over 700 government officials, partners and stakeholders from 100 countries and concluded with strong commitments to reduce the health impacts of air pollution by 2040. In achieving this, the importance of clean household energy, sustainable transport and fossil fuel phase-down was highlighted. Central to these efforts, too, was the recognition that energy policy. Shortly after, in May 2025, Member States at the 78th World Health Assembly unanimously adopted the Updated WHO Road Map for an Enhanced Global Response to the Adverse Health Effects of Air Pollution (2025–2030).[50] The roadmap sets an ambitious target: to achieve a 50 per cent reduction in mortality attributable to anthropogenic sources of air pollution by 2040, relative to 2015 levels. Together, the conference and roadmap sent a clear message: reducing air pollution through clean energy transitions is one of the most high-impact strategies for saving lives, improving well-being and accelerating progress across multiple SDGs.

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Published by the United Nations