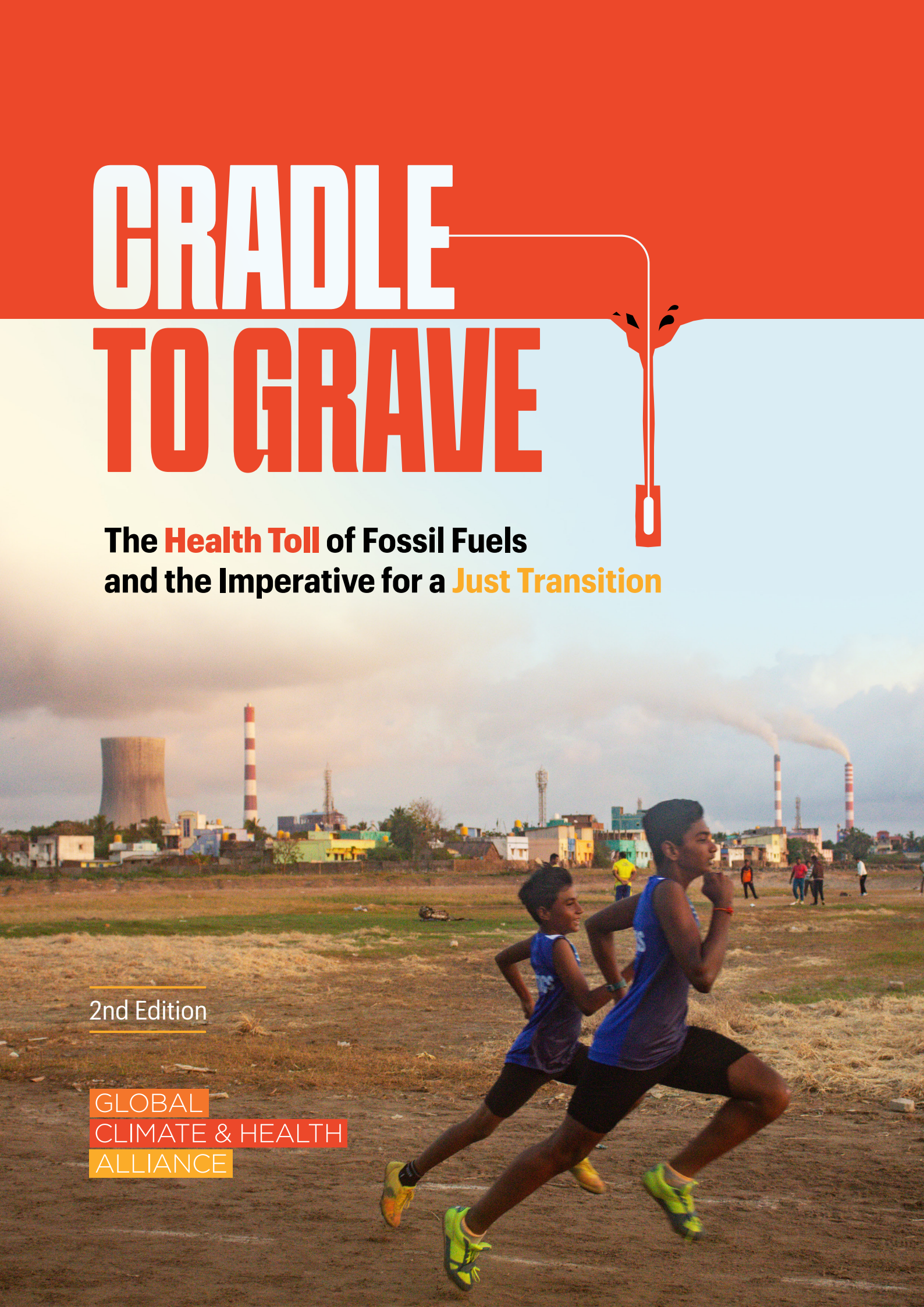
CRADLE TO GRAVE

The Health Toll of Fossil Fuels and the Imperative for a Just Transition



2nd Edition

GLOBAL CLIMATE & HEALTH ALLIANCE

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Case Studies:

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About GCHA:

The Global Climate and Health Alliance (GCHA) unites and mobilizes the health community worldwide and accelerates climate action to protect and improve health for all. With 200+ organizational members, from every region and reaching over 125 countries, we work at the frontline of a global movement of health professionals and health and development organizations dedicated to promoting a healthy, equitable, and sustainable future for all. We address the climate crisis through evidence-based advocacy, policy, movement building, research and strategic communications.

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#CradleToGrave

Acronyms

A&E	*Accident an d Emergency*
ALL	*Acute Lymphoblastic Leukaemia*
ASEAN	*Association of Southeast Asian Nations*
BC	*Black Carbon*
BOGA	*Beyond Oil and Gas Alliance*
BPA	*Bisphenol A*
CCS	*Carbon Capture and Storage*
CCUS	*Carbon Capture, Utilisation, and Storage*
CEMS	*Continuous Emission Monitoring Systems*
CFPPs	*Coal Fired Power Plants*
COPD	*Chronic Obstructive Pulmonary Disease*
CO_2	*Carbon Dioxide*
COPs	*Conference of Parties*
DEHP	*Di(2-ethylhexyl) phthalate*
DNA	*Deoxyribonucleic Acid*
ED	*Emergency Department*
FABA	*Fly Ash and Bottom Ash*
FPIC	*Free, Prior and Informed Consent*
GDP	*Gross Domestic Product*
GHG	*Green House Gas*
GMP	*Global Methane Pledge*
HAP	*Hazardous Air Pollutants*
HIA	*Health Impact Assessment*
HiAP	*Health in All Policies*
IEA	*International Energy Agency*
IPCC	*Intergovernmental Panel on Climate Change*
LNG	*Liquified Natural Gas*
LPG	*Liquified Petroleum Gas*
NHS	*National Health Service*
NO_2	*Nitrogen Dioxide*
OECD	*Organisation for Economic Co-operation and Development*
PAHs	*Poly Aromatic Hydrocarbons*
PBDE	*Polybrominated diphenyl ethers*
PFAS	*Perfluoroalkyl Substances*
PM2.5	*Particulate Matter 2.5*
POPs	*Persistent Organic Pollutants*
PPCA	*Powering Past Coal Alliance*
SO_2	*Sulphur Dioxide*
TENORMs	*Technologically Enhanced Radioactive Materials*
TRAP	*Traffic Related Air Pollution*
UNFCCC	*United Nations Framework Convention on Climate Change*
US EPA	*U.S. Environmental Protection Agency*
UV	*Ultraviolet*
VOCs	*Volatile Organic Compounds*
WHO	*World Health Organization*

Foreword

The connection between the health of humanity and the health of our planet is undeniable and inescapable. As a physician and the immediate past president of the World Medical Association, I have witnessed the devastating impacts of environmental harm on the most vulnerable communities. This report, ***Cradle to Grave: The Health Toll of Fossil Fuels and the Imperative for a Just Transition***, sheds light on one of the gravest public health crises of our time—the lifecycle of fossil fuels and their profound and far-reaching impacts on human health, equity, and survival.

From the first extraction to the final emission, fossil fuels are the silent architects of suffering, claiming lives and undermining the quality of countless others. Air polluted by coal plants fills the lungs of our children. Rising temperatures caused by greenhouse gases push vulnerable populations to the brink of survival. Entire communities are displaced, their livelihoods destroyed, as fossil fuel extraction devastates ecosystems. These impacts are not abstract. They are felt in the lives of families, in the hospitals overwhelmed by preventable illnesses, and in the cries for climate justice that echo from every corner of the globe.

This report goes beyond documenting the toll of fossil fuels—it is a powerful call to action. It challenges each of us (and our governments) to take responsibility, as stewards of health, policy, and justice, to accelerate the transition toward a sustainable future. This transition must be just and inclusive. It must center the needs of the marginalized, the displaced, and the disproportionately affected, ensuring that no one is left behind in the move to cleaner energy systems.

Importantly, this report also offers hope. It highlights the immense opportunity before us: to redefine what it means to safeguard health, to create resilient systems, and to embrace solutions that can mitigate the climate crisis while fostering health equity. This is not merely an environmental imperative—it is a moral one, and it speaks to the very heart of why we, as medical professionals, as policymakers, and as global citizens, must act with urgency.

The stakes could not be higher, and the time for half-measures is long past. The findings of this report are a rallying cry to governments, businesses, institutions, and individuals alike to rise to the challenge of this defining moment in history. Fossil fuels may shape the crises we face, but they need not shape our future.

Lujain Alqodmani, *MD, MPH*
Immediate Past President
World Medical Association

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Musawenkosi Dhlamini
EMpumelelweni,
eMalahleni, South Africa

Dylan Paul
Center for Environmental Rights

My name is Musawenkosi Dhlamini. I am 22 years old. In 2010 I was diagnosed with asthma. I grew up as a child who could not participate in sports, and other activities children partake in. My chest would close up and I wouldn't be able to do anything. The older I got I could tell what the cause of my asthma was. The place where I live is surrounded by mines. The asthma affected many things in my life. I was always being admitted to hospital, and had to carry my asthma pump everywhere I went. Living in Witbank is something else because even these mines surrounding us do not help us to get better medication at the clinics we go to. The only thing they do when your chest closes up is give you an asthma pump. They do not follow up. Living in a polluted area like this has affected me and put me in the condition I'm in right now.

R. L. Srinivasan
Fisherman, Kattukuppam,
Ennore (North Chennai),
India

Global Climate and Health Alliance (GCHA)

Our waters are more than just a source of livelihood—they are the heart of our culture, the keeper of our traditions, and the essence of our identity. But relentless coal and oil refinery pollution and frequent oil spills have poisoned these waters, destroying the ecosystems we depend on and making fishing no longer viable. Stripped of our sustenance, many of us are forced to leave behind generations of tradition and take up menial jobs elsewhere just to survive. It doesn't just end our way of life—it erases our connection to the land and sea, our dignity, and the very fabric of our community. This is not just environmental harm—it is an attack on our identity and existence.

Executive Summary

When we think of fossil fuels, we often focus on the moment they are burned - when coal powers a plant, petrol fuels a car, or gas heats a home. However, the impact of fossil fuels starts far earlier than combustion, and extends long after it. From the moment oil, coal, and gas are extracted from the earth, through refining, transport, and distribution, to the eventual shutdown and cleanup of industrial sites, every stage of this process leaves a footprint on human health as well as the environment. Air and water pollution, habitat destruction, toxic waste, and long-term public health crises are woven into the value chain of fossil fuel production. This report maps the full lifecycle of fossil fuels, exposing the often-overlooked consequences that impact our ecosystems, economies, and communities long before and after a single drop of oil or lump of coal is burned.

Cradle to Grave: The Health Toll of Fossil Fuels and the Imperative for a Just Transition provides a comprehensive global overview of the health consequences associated with fossil fuel use at every stage of their lifecycle. It collates existing scientific evidence, and gathers personal testimonials and case studies, to explore the multidimensional interactions between fossil fuels and human health and social wellbeing, particularly for the world's most vulnerable people and communities.

Our approach to examining these health impacts follows the broad definition set out in the World Health Organization (WHO) Constitution: health as a state of complete physical, mental, and social well-being, not merely the absence of disease. Accordingly, this report pairs rigorous data on health outcomes with the lived experiences of communities and health professionals on the front lines, showing how social and environmental conditions shape people's capacity to live healthy lives.

Our collated research aims to equip policymakers, health professionals, advocates and labour movements with the necessary evidence to push for transformative action and a healthy, just transition (see Principles of a Just and Health Based Transition, p.80).

Key Findings

Fossil fuel-related pollution affects every stage of life, from fetal development to old age.

Exposure has been linked to increased risk of low birth weight, childhood cancer, asthma, neurological disorders, cardiovascular disease, and premature death. For instance, during the prenatal period, when vital organs are forming, exposure to pollutants from coal, oil, and gas extraction and combustion is linked to low birth weight, preterm birth, miscarriage, and a range of congenital abnormalities. Many of these health harms are permanent, impairing the child throughout their lifetime. Children are also particularly vulnerable due to their faster breathing rates, narrower airways, and developing organs. Fossil fuel pollutants are linked to a wide range of health harms across multiple body systems. They impair lung function and exacerbate asthma and other respiratory diseases; increase the risk of cardiovascular disease and hospitalizations; disrupt cognitive function and mental health through impacts on the brain and nervous system; elevate the risk of cancers such as leukemia; cause reproductive damage; and contribute to premature mortality. Older adults face unique vulnerabilities due to declining organ function, pre-existing chronic diseases, and cumulative exposure.

At every stage of their lifecycle, fossil fuels cause severe health harms.

Each phase – extraction, refining, transport, storage, combustion, and disposal – introduces harmful pollutants into the environment, many of which are long-lasting and bioaccumulative.

Antero Resources drilling rig in Beaver, Ohio

Ted Auch
FracTracker Alliance, 2017

Key health impacts include:

Extraction (e.g., fracking, coal mining, offshore drilling) releases benzene, heavy metals, radioactive materials, and particulates, driving up rates of respiratory disease, cardiovascular illness, cancers, adverse birth outcomes, and neurological disorders in surrounding populations.

Refining and processing have been shown to emit carcinogenic chemicals such as benzene, toluene, and Volatile Organic Compounds (VOCs), posing serious risks to workers and nearby residents, especially in densely clustered industrial zones.

Transport and storage involve risks of chemical leaks and spills, which contaminate air and water and trigger acute and chronic health effects, including respiratory and neurological damage.

Combustion, whether in power plants, vehicles, or homes, generates particulate matter 2.5 (PM2.5), nitrogen oxides, and other pollutants, significantly increasing risks of asthma, heart disease, stroke, cancer, dementia, and premature mortality.

Post-combustion waste (e.g., coal ash, gas flaring) continues to expose communities to heavy metals and toxins, contributing to long-term environmental degradation and chronic disease.

Legacy pollution from abandoned fossil fuel sites causes sustained harm decades later.

Fossil fuels are the largest source of greenhouse gas emissions, driving the climate crisis that fuels extreme weather, spreads disease, and causes lasting and devastating harm to human health.

It's crucial to note here that many health harms remain dangerously understudied—often unfolding over decades, by which time the damage is irreversible. Worse still, the cumulative toll of multiple projects in the same region is rarely accounted for, leaving entire communities exposed without adequate scrutiny or protection.

Coal plants in central India are associated with emissions that affect local air quality.

Amirtharaj Stephen

The health impacts of fossil fuels are persistent and systemic.

Fossil fuel harm doesn't end with exposure. The persistent nature of many pollutants, such as heavy metals, benzene, and particulate matter, means that they linger and build up in the environment and harms endure long after operations cease and can cause chronic health issues. Pollutants remain in soils, water systems, and food chains for decades or even centuries, causing continuous exposure and multiplying the health risks through the lifetime and for future generations. Exposure to heavy metals like mercury, lead, and arsenic has cumulative health impacts – damaging neurological development in children, causing cognitive impairment, kidney dysfunction, cardiovascular diseases, and multiple cancers long after fossil fuel activities have ceased.

Fossil fuel health harms are unevenly and unjustly distributed in communities and across nations.

Social determinants—conditions in which people are born, grow, live, work, and age, shaped by the distribution of power, resources, and opportunity—significantly influence exposure to fossil fuel pollutants and their impacts. Economic, political, racial, and geographical factors compound these risks. Marginalized groups, including Indigenous peoples, racial minorities, low income populations and migrant workers, disproportionately live near polluting infrastructure and face systemic barriers to healthcare, housing and a safe environment. These communities experience heightened rates of respiratory illness, cancer and cardiovascular disease, often in 'sacrifice zones' where a power imbalance between project proponents and the local community mean that people are forced to live in the midst of pollution.

Coal mines in Mozambique are located in close proximity to residential areas.

Justiça Ambiental, Mozambique

Fossil fuels drive wider societal health impacts and exacerbate other pre-existing health disparities in communities and between nations.

Fossil fuel operations have profound societal consequences, often linked to rising inequality, disruptions to community well-being and human rights violations. Across the world, extraction projects have displaced Indigenous and marginalized communities, disrupting traditional livelihoods, and becoming linked to long-term mental and physical impacts. Fossil fuel operations can destabilise local economies and social structures, and have been linked to increased rates of substance abuse, violence, human trafficking, and mental health crises, particularly in communities surrounding extraction zones.

Climate policy and health policies have largely ignored these multidimensional health harms of fossil fuels.

While climate negotiations have focused on CO_2 and, more recently, methane emissions, they have overlooked the broader health consequences of fossil fuel dependence. Carbon capture technologies and emission offsets cannot mitigate the full range of health, social and ecological damages. Nor can they address the lasting legacies of toxic contamination or exposure. Furthermore, the fossil fuel industry's disproportionate political influence has eroded environmental and labour protections, weakened regulation, and permitted misinformation, compounding health impacts.

The cost of inaction is rising by the day.

In 2022, global fossil fuel subsidies reached an estimated US$7 trillion, according to the IMF, including explicit subsidies such as tax breaks and price caps (US$1.3 trillion) and implicit subsidies of US$5.7 trillion. The latter are due to the unpriced societal costs of fossil fuel use including air pollution, climate change, traffic congestion and other health and environmental damages. Phasing out fossil fuel subsidies and investing in clean, renewable energy could prevent millions of premature deaths, unlock over US$4 trillion in public revenue currently lost to unpriced pollution and climate impacts, and deliver long-term economic and health benefits.

A rapid and just transition away from fossil fuels—and to clean, renewable energy—is imperative for health.

A just transition not only implies shifting toward renewable, clean and healthy energy sources but ensuring equitable access to these resources, particularly for historically marginalized and disproportionately impacted communities. It necessitates robust social policies, substantial investment in public healthcare, comprehensive environmental remediation, community involvement in decision-making, and fair economic opportunities for transitioning workers. Only through such integrated approaches can we address the root causes of climate injustice, improve overall community resilience, and secure long-term health benefits for all populations.

This report offers a cautionary framework as the world accelerates the extraction of critical minerals. We must apply the lessons of fossil fuel exploitation – prioritizing transparency, human rights, and environmental protection – to avoid repeating the same mistakes and prevent yet another cycle of harm disproportionately affecting the world's poorest and most vulnerable.

Ultimately, shifting from fossil fuels toward health-focused, energy efficient and just renewable energy systems is economically advantageous, ethically necessary, and essential for global health and climate resilience. To address these issues, we make several policy recommendations.

Women near coal mines in Mozambique carry biomass for household cooking and heating needs.

Justiça Ambiental, Mozambique

Key Policy Recommendations

Halt New Fossil Fuel Exploration and Development

Ending new fossil fuel exploration and development is essential for meeting global climate targets, particularly the 1.5°C threshold set by the Paris Agreement. Despite mounting scientific evidence and economic concerns, including over stranded assets, new projects continue to receive approval.

Initiatives such as the Beyond Oil and Gas Alliance, the Fossil Fuel Non-Proliferation Treaty, and the Powering Past Coal Alliance signal a growing international commitment to ending fossil fuel expansion. However, these efforts must be reinforced by legally binding commitments to phase out existing production and provide structural support for a just transition, including support for workers, communities, and countries dependent on fossil fuels. Precedents set by countries like Costa Rica, Colombia, France, and the Small Island Developing States illustrate political feasibility, yet persistent policy contradictions underscore the need for coordinated, comprehensive global action.

End Fossil Fuel Subsidies and Redirect Savings to Health

Despite all the science, fossil fuel subsidies continue to increase, reinforcing dependence on polluting energy sources and undermining health and climate goals. Phasing out subsidies and redirecting funds toward renewable energy, resilient infrastructure, and pollution mitigation would yield major public health gains and long-term savings. While some international commitments exist, stronger enforcement and accountability are needed to ensure funds support a healthier, more sustainable future.

Clean Up Existing Fossil Fuel Production

Immediate actions to mitigate harms from existing fossil fuel production, particularly methane emissions (e.g. the Global Methane Pledge), are essential but must not replace the ultimate goal of fully phasing out fossil fuels. Reducing methane through ending flaring, plugging leaks, and stricter regulations can quickly decrease climate impacts and improve public health, though these interim measures should not justify prolonged fossil fuel extraction.

Beyond methane, fossil fuel production releases toxic chemicals harming frontline communities. Governments should enforce stringent emission standards, mandate real-time pollution monitoring, strictly limit flaring and hazardous waste disposal, enhance environmental enforcement and community-led oversight, require cumulative environmental and health impact assessments for new facilities, and support targeted pollution remediation programs. Remediation efforts and stricter regulation must be accompanied by transition planning and economic alternatives for workers and communities historically dependent on fossil fuel industries

Make Polluters Pay: Internalize the Health Costs of Fossil Fuels through the “Polluter Pays” Principle

The “Polluter Pays” principle asserts that those responsible for environmental harm should bear the associated costs. Currently, these costs - including respiratory diseases, cardiovascular conditions, and premature deaths - are externalized onto public health systems, allowing fossil fuel companies to profit without accountability.

Internalizing these costs creates clear financial and regulatory incentives to reduce toxic emissions and accelerate the transition to clean, renewable energy. Legal instruments, including the internationally recognized right to a clean, healthy, and sustainable environment, provide a foundation for enforcing such accountability. Strengthening this principle - through policy mechanisms such as reversing the burden of proof to require companies to demonstrate safety - can help ensure greater environmental and public health protection, while easing the economic strain on health systems.

Initiate Community-Led Health Research and Action for Fossil Fuel-Affected Areas

Prioritize community-partnered research to assess the health harms of fossil fuels and climate change on highly impacted communities, integrating both Western scientific methods and Traditional Knowledge. These studies should examine physical, mental, and cultural health impacts in a holistic manner. Crucially, the findings must lead to concrete policy changes, resource allocation, and remediation efforts that reflect the priorities identified by the communities themselves.

Regulate, Limit and Counter Fossil Fuel Industry Advertising and Disinformation

Banning fossil fuel advertising and sponsorship, alongside evidence-based counter-marketing, can reduce industry influence, challenge disinformation, and shift public norms, as seen in successful tobacco control campaigns. Policies implemented in France, Amsterdam, and Canada demonstrate that such measures help build cultural and political momentum toward clean energy transitions.

Fossil fuel companies and petrostates have long used their presence at climate and pollution conferences to undermine policy progress. As tobacco companies are excluded from health conferences on lung disease, fossil fuel entities should likewise be barred from COPs and other international forums focused on environmental and public health protection.

End Fossil Fuel Finance: Align Global Institutions with Climate Goals

Global financial institutions, including the World Bank and major investment banks, continue to fund fossil fuel projects, undermining climate goals and delaying the transition to renewable energy. Redirecting these funds to clean, renewable energy is essential, with the International Energy Association (IEA) calling for a tripling of renewable investments to US$4.5 trillion annually by 2030. Additionally, continued funding risks creating stranded assets worth up to US$1 trillion, making fossil fuel investments financially unsound.

Lead by example in the Health Sector

The health sector holds considerable influence as a trusted voice and major economic actor. By decarbonizing healthcare systems, divesting from fossil fuels, and adopting sustainable practices, it can play a critical role in accelerating the fossil fuel phase-out and leading by example. Health professionals can humanize the impacts of fossil fuels by sharing firsthand accounts from patients and communities. Through these actions, the sector can lead a transition toward a healthier, more equitable, and sustainable future and inspire a society-wide transformation.

A Call for Collective Action

Fossil fuel dependence is driving a triple crisis—devastating the environment, inflicting widespread harm on human health, and reducing the stability required for health systems to function. The extensive health impacts outlined in this report, from respiratory illnesses to long-term chronic diseases, provide an undeniable imperative for urgent, collective action. While scientific research highlights the scale of the crisis, lived experiences reveal a deeper toll, particularly on marginalized communities living near polluting infrastructure.

At the same time, the world stands at a turning point. The falling cost of renewable energy and battery storage has made clean electricity cheaper than fossil fuels in much of the world. The IEA now projects oil and gas demand will peak before 2030. When the hidden health costs of fossil fuels are considered, the case for transitioning becomes even more urgent. Yet, fossil fuel companies continue to delay this shift to protect their profits—at the expense of ecological, economic, and human wellbeing.

This moment demands bold leadership from governments, civil society, businesses, and the global health community to swiftly transition away from fossil fuels. By prioritizing public health, safety, health system stability, social justice, and environmental sustainability, this transition can not only mitigate harm but also create transformative change—protecting the most vulnerable and building a healthier, more equitable future for generations to come.

Adobe Stock

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Lancet Countdown

University College of London

The science is clear: our persistent dependence on fossil fuels is claiming lives and livelihoods today, and putting the world on track to a potentially catastrophic future of climate change. A prompt and just transition away from fossil fuels and towards renewable energy and energy efficiency is essential to ensure our world can continue to support healthy human lives. It can also help save over 2 million lives every year from improved air quality, enable a transition to more affordable and reliable energy, support the generation of healthier jobs, and enable a thriving and more equitable future for all. With this burden of evidence, there are no more excuses for further delays.

U.S. Steel Plant in Clairton, Pennsylvania.

Mark Dixon

01 Introduction

Fossil fuels have powered economies and societies for over a century. Since coal became a driver of the industrial revolution in the mid-1800s, fossil fuels have powered homes, hospitals, and cities, have enabled travel to work, school and vital services, and have contributed to the production, delivery and preparation of food, medicines, and all manner of consumer products[1]. However, the health costs of this energy system – across its entire life cycle have been profound and are accelerating[2,3].

In 2024, fossil fuel combustion and related industries contributed 90% of global CO_2 emissions[4]. Increases in atmospheric gases, including CO_2, have resulted in a global rise in temperatures since the turn of the last century[5]. Also well established is that this increase in temperatures is changing weather patterns, with devastating consequences.

As twelve-month temperature averages breach the Paris Agreement target of limiting global warming to 1.5°C, communities around the world are facing deadly heat waves, droughts, storms, floods, wildfires, sea level rise, extreme weather events, biodiversity loss and species extinction. More subtle health impacts, including shifting regional disease patterns, and increased food and water scarcity, are also being felt[6]. As global temperature rise puts peoples' safety and well being at risk, health systems are struggling to meet the novel and worsening challenges caused by the climate crisis[7,8].

In addition to the health impacts of climate change, a myriad negative health impacts are directly associated with fossil fuels. Throughout the entire fossil fuel cycle — exploration, extraction, processing, transport, storage, use, waste disposal and site reclamation — and throughout the course of a human life, fossil fuels exert impacts from "cradle to grave"[9]. Fossil fuel health risks include an elevated risk of poor birth outcomes, increases in asthma and other respiratory diseases, several cancers, cardiovascular disease and neurodegenerative disorders[10].

Despite clear scientific consensus and the availability of cleaner, more equitable alternatives, fossil fuel development continues to expand. Without an urgent and just transition away from fossil fuels, both planetary stability and public health remain in jeopardy.

1.1 Scope of the Report

Cradle to Grave: The Health Toll of Fossil Fuels and the Imperative for a Just Transition explores the far-reaching health impacts of fossil fuels across their entire lifecycle and the human life course – from birth to old age.

This updated edition builds on a 2022 report of the same name, and incorporates a broader and more current body of evidence. The academic literature remains constrained by funding gaps, industry influence, and access barriers. This report pairs peer-reviewed studies with global case studies, community testimonies, and insights from healthcare professionals to offer a more comprehensive picture of what is happening to our populations.

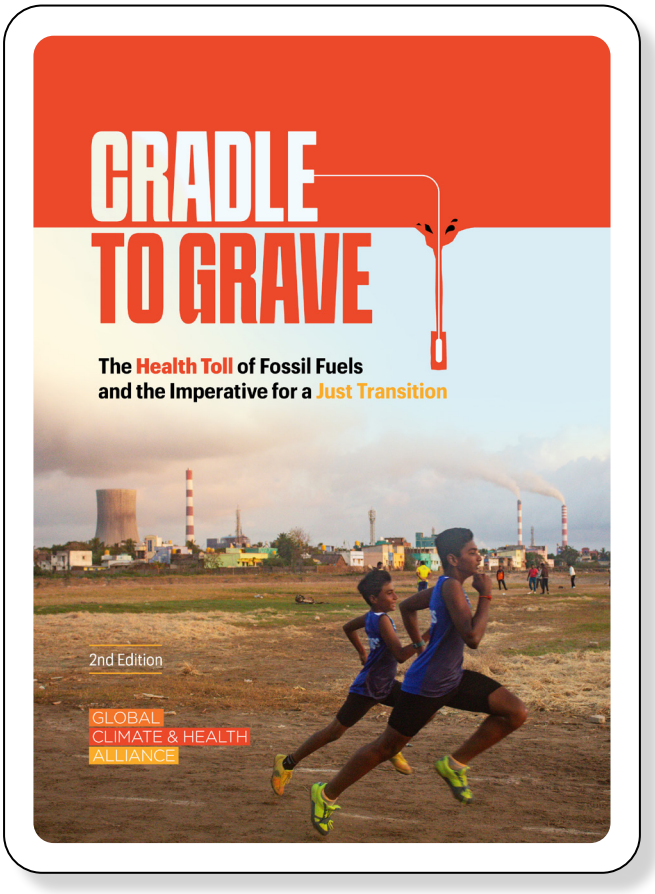
The report is structured around the following **guiding questions:**

- **When and how is the human body most vulnerable to fossil fuel pollution?**

  This section explores susceptibility across the life course, identifying how different stages – prenatal, childhood, adulthood, and old age – face different health risks. It also asks which communities bear disproportionate risks demonstrating socio-political and economic inequality.

- **What are the health impacts at each stage of the fossil fuel lifecycle?**

  It investigates how activities such as exploration, extraction, refining, transport, use, and disposal produce distinct health harms that can persist for decades, and examines the risks associated with fossil fuel-derived products like plastics and petrochemicals.



- **Who is most at risk of harm?**

  This report examines how the health impacts of fossil fuels and the climate crisis, though widespread, are unevenly distributed. It asks why low-income communities, workers, Indigenous Peoples, and people of color face disproportionate health risks shaping their vulnerability and access to care.

- **How do the health risks from fossil fuels and climate change compound?**

  The study analyses the risks to fossil fuel infrastructure from the climate-induced extreme weather events like hurricanes, floods, extreme heat etc and the consequent health risks to people, especially in low-income and climate-vulnerable regions.

- **What are the local and community-level consequences of fossil fuel development?**

  It documents patterns of land conflict, forced displacement, social and economic disruptions, and human rights violations, and considers both the physical and mental health toll on affected populations. The report also assesses the sector's use of disinformation, lobbying, and regulatory capture that distort public debate and erode democratic processes.

- **What would a just and health-centred energy transition look like?**

  This report documents and challenges narrow interpretations of a just transition and outlines principles for a holistic approach that prioritises equity, public health, and long-term sustainability.

THE PRECAUTIONARY PRINCIPLE

By bringing data and lived experience together, the report exposes the often-overlooked health costs embedded throughout the fossil-fuel lifecycle and underscores why public-health principles—especially the precautionary principle—must guide decision-making. The precautionary principle means taking action to prevent harm even when some cause-and-effect relationships are not fully established scientifically—especially when people's health is at stake. Crucially, while data gaps remain in some regions, their existence cannot be allowed to excuse inaction; instead, the stories documented here strengthen the case for urgent, preventive measures and shift the burden of proof away from communities already experiencing harm.

7 year old, Princess, developed asthma from growing up near coal mines in Witbank's Vosman community, Emalahleni, Mpumalanga Province, South Africa.

Dylan Paul
Center for Environmental Rights

CLIMATE JUSTICE IS ESSENTIAL FOR HEALTH EQUITY

The health and economic burdens of fossil fuel production and use are unequally distributed, with marginalized communities, both in the Global South and within industrialised nations, bearing the brunt of environmental degradation and health harms[11,12]. While the Global North has been responsible for 92% of historical excess greenhouse gas emissions[13], the adverse effects of air pollution, climate change, and fossil fuel infrastructure are most acutely felt by those with the least historical responsibility and the fewest resources to respond.

Fossil fuel activities often occur in so-called "sacrifice zones," defined by the Special Rapporteur on the issue of human rights as "extremely contaminated areas where vulnerable and marginalized groups bear a disproportionate burden of the health, human rights and environmental consequences of exposure to pollution and hazardous substances"[14]. Indigenous peoples, communities of color, low-income populations, and youth[14] face heightened exposure to air pollution, increased rates of respiratory and cardiovascular disease, displacement, economic instability, and erosion of cultural practices[15]. One US study found that communities of color were exposed to 1.25 times more particulate matter than white communities[16]. Advocates have long raised concerns that low income communities and communities of color are at disproportionate risk of air pollution related health harms[17–20].

Bill Salazar, Pexels

Climate change further compounds these injustices. The Intergovernmental Panel on Climate Change (IPCC) has highlighted how vulnerable populations are at higher risk of extreme weather, food and water insecurity, and worsening health inequities. Fossil fuel extraction on Indigenous lands, in particular, undermines both environmental integrity and community health, prompting repeated calls for stronger protections of Indigenous rights, including from the United Nations Permanent Forum on Indigenous Issues[21].

Addressing these systemic injustices requires robust policy interventions: equitable distribution of environmental benefits and burdens, stringent emissions regulation, inclusive decision-making, and targeted financial and technical support for affected communities. Legal safeguards for Indigenous and marginalized populations must be strengthened to uphold health and human rights in the face of expanding fossil fuel infrastructure.

Winnie and Pfuluwani
Phola, Ogies, South Africa

Dylan Paul
Center for Environmental Rights

A lot of people think the chest problems are family illnesses but it is because we are all breathing the same polluted air. Pfulu has had asthma since he was a few months old. As you can hear, he breathes loudly and sometimes you can see he is struggling. I don't have money to take him to doctors because they ask for R700 per session and he gets sick often. I just want him to be like other children.

Dr. Amanda Millstein
Pediatrician and Co-founder of Climate Health Now, California, United States

I am a primary care pediatrician, working in community-based clinics in the California Bay Area since 2015. My current clinical practice is primarily in Oakland, where I work in urgent care and Teen and Adolescent Clinic. I am a mother of two school-aged children and the co-founder of Climate Health Now.

I practiced primary care pediatrics in Richmond, California from 2018-2023. Richmond is home to an oil and gas refinery and there are multiple refineries in nearby cities. One of the very first experiences I had shortly after I started working in Richmond was when there was an explosion at a nearby refinery and the community and our clinic had to shelter in place. There was dark smoke visible outside and for the next two days families came in to have their kids checked out, concerned about what sorts of toxins their children were exposed to during the explosion and if it might have impacted their kids' lungs.

Perhaps most profoundly, there have been times when I've been administering albuterol treatments at the same time the refinery is flaring, making it all the more obvious that the treatments I offer my patients in the clinic are a mere bandaid compared to what they are being exposed to in the community.

In Contra Costa County, where Richmond is located, about 1 in 6 people (17.9%) has been diagnosed with asthma, higher than the statewide prevalence of 15.1%. A comparison of Emergency Department (ED) visits for asthma for people living in the zip code containing the refinery and the next zip code over to people living two other zip codes in the same county without a refinery show a difference in ED visit rates for asthma of 10-fold. Children in Richmond are estimated to visit urgent care for asthma at triple the rate of kids across California.

02

Stones extraction process is going on in the coal mine in Jharia, Dhanbad, India,

iStock

Cradle to Grave: Fossil Fuels and the Human Body

2.1 Health Harm by Pollutant

Fossil fuel activities—from extraction and processing to combustion and waste—release a range of pollutants detailed below. Such pollutants can enter the human body in **three ways**[21,22]:

Contact or Absorption – materials come in contact with and are absorbed through the skin and eyes

Ingestion – materials are swallowed and are absorbed by the digestive system

Inhalation – materials are breathed in and are absorbed by the respiratory system

The harm caused by toxic chemicals and heavy metals depends on the dose, duration of exposure, and the individual's age, size, and health. Some fossil fuel pollutants can cause serious effects even at low doses, while others require prolonged or higher exposure. Certain pollutants, like lead and mercury, accumulate in the body over time, a process known as bioaccumulation. In addition, some fossil fuel processes, such as fracking and firefighting operations, contribute to the spread of per- and polyfluoroalkyl substances (PFAS), commonly known as "forever chemicals". They do not break down over time, persist in soil and water, and accumulate with each exposure—earning them the name "forever." As these toxins move up the food chain, their concentration increases, a phenomenon called biomagnification.

These chemicals do not break down over time, they persist in soil and water, and accumulate with each exposure—earning them the name "forever".

Oil well contamination in Nigeria pollutes ecosystems, leaving land, water, and communities at risk.

HOMEF, Nigeria

2.1.1 *Major Health Impacts of Toxicants Produced by Fossil Fuel Production, Transport and Use*

Toxicants	Linkages	Health Impacts
Particulates: Fine particulate matter (PM2.5), produced during fossil fuel extraction, refining, and combustion, is small enough to penetrate deeply into the lungs and bloodstream[23,24].		
Particulate Matter 2.5 (PM2.5)	Extraction, refining, combustion	Preterm births, premature death, reduced respiratory function, cardiovascular disease, strokes, cancers[23,24].
Black Carbon (BC)	Combustion	Cardiopulmonary hospitalizations, increased risk of all-cause and cardio pulmonary mortality[25].
Poisonous Gases		
Sulphur dioxide (SO_2)	Combustion, especially coal and petroleum power plants	Respiratory challenges, increased risk of developing asthma and asthma exacerbations in children, premature death[26–29].
Nitrogen dioxide (NO_2)	Combustion, gas extraction and transport	Airway inflammation asthma and chronic obstructive pulmonary disease (COPD) exacerbations requiring hospitalization[30]. Reduced lung function in children and with increased risk of pre-eclampsia in pregnant women[31,32].
Volatile Organic Compounds (VOCs)[33]: VOCs are primarily released during fossil fuel extraction, refining, storage, and transportation (including leaks in pipelines and equipment). VOCs can be found in air and water close to gas wells, refining and fracking sites[34,35]. VOCs, combined with oxides of nitrogen and exposed to sunlight produce ground level ozone (O3)[36] linked to asthma and COPD exacerbations. Long term exposure is associated with cardiovascular mortality respiratory disease and COPD[37,38].		
Benzene[39]	Extraction, refining, leaks	Linked to leukaemia and lung cancer[40] including in children[41,42], as well as anemia, immune suppression and other serious non-cancer outcomes[43]. No safe level for cancer prevention has been found.
Toluene[44]	Extraction, refining, leaks	Neurological symptoms like headaches, dizziness, and memory loss at low to moderate exposure levels. Prolonged exposure can result in hearing and vision loss, and developmental effects in children if exposure occurs during pregnancy.

Toxicants	Linkages	Health Impacts
Ethylbenzene[45]	Extraction, refining, leaks	Short-term exposure can irritate the eyes and throat, while chronic exposure may damage the liver, kidneys, and respiratory system.
Xylene[46]	Extraction, refining, leaks	Dizziness, confusion, and respiratory distress. Prolonged exposure affects the liver and kidney.
1,3 Butadiene[47]	Extraction, refining, leaks	A human carcinogen particularly blood and lymphatic cancers.
Poly Aromatic Hydrocarbons (PAHs)[48]	Combustion of coal, oil, gas, and diesel; also present in flaring, vehicle exhaust, and coal tar	Linked to various cancers, respiratory and cardiovascular diseases, reproductive health problems, immunosuppression, and endocrine disruption[49].

Heavy Metals: Coal contains heavy metals[50], which are released into the environment when coal is mined or burned. Wastewater generated during oil and gas production contains heavy metals. These heavy toxicants can cross the placental barrier and are associated with adverse neurological and other developmental outcomes[51].

Arsenic (As)[52]	Coal mining, burning; oil and gas wastewater	Potent carcinogen linked to skin, lung, and bladder cancers. Chronic exposure can cause cardiovascular disease, diabetes, developmental issues, neurological effects, and reduced cognitive function.
Chromium (Cr)[53]	Coal mining, burning; oil and gas wastewater	Linked to lung cancer, kidney and liver damage, and respiratory problems. Skin contact with chromium can lead to ulcers and allergic reactions. Inhaling chromium fumes can result in “metal fume fever”, a flu-like condition. Prenatal chromium exposure may be associated with increased risk of orofacial clefts[54]. Coal ash ponds are known to leach hexavalent chromium, a form of chromium that is extremely toxic at very low doses.
Lead (Pb)[55]	Coal mining, burning; oil and gas wastewater	A neurotoxin that impairs cognitive development in children, linked to reduced IQ and behavioural problems. Chronic exposure can harm the kidneys, cardiovascular system, reproductive health, and contribute to anaemia and hypertension.
Mercury (Hg)[56]	Coal mining, burning; oil and gas wastewater	A neurotoxin that can cause brain and kidney damage and developmental issues in foetuses and young children. Prenatal exposure may lead to developmental disability, brain damage, and sensory or motor impairments.

Toxicants	Linkages	Health Impacts
Selenium (Se)[57]	Coal mining, burning; oil and gas wastewater	Pollutants released in power plants are linked to respiratory issues, gastrointestinal symptoms, and potential reproductive effects, as well as skin and eye irritation, hair and nail loss, and neurological symptoms such as irritability and fatigue.
Cadmium[58]	Coal mining, burning; coal, oil and gas wastewater	Acute cadmium exposure, through ingestion or inhalation, can cause gastrointestinal distress, respiratory irritation, and at high doses, damage to the kidneys, liver, and nervous system—sometimes leading to organ failure and death. Chronic exposure harms kidney function, disrupts vitamin D metabolism, and can lead to bone disease. Long-term inhalation may cause bronchitis, lung damage, and obstructive lung disease. Cadmium is a known human carcinogen.
Technologically Enhanced Radioactive Materials (TENORMs)[59] **(uranium, thorium and radium)**	Coal mining, burning; coal, oil and gas wastewater	Increase the risk of cancer, particularly lung, stomach, esophagus, bone, thyroid, brain, and nervous system cancers, and may cause radiation-related damage to organs and tissues with prolonged exposure[60].
Tropospheric ozone[36]	Combustion in power plants, vehicles and industrial facilities	Contributes to respiratory problems, particularly among vulnerable populations such as children, the elderly, and individuals with pre-existing lung conditions, and is a key component of urban smog[37,38].
Methane[61]	Extraction, processing, and transportation of gas, coal, and oil	High methane levels reduce oxygen in the air, leading to symptoms like headache, nausea, vision and memory issues, and in severe cases, breathing problems, unconsciousness, and death with prolonged exposure[62]. Emerging research shows that methane leaks from fossil fuel operations are more widespread than previously believed and often accompanied by harmful pollutants such as VOCs and NO_2[63]. One study linked prenatal exposure near a major methane leak to low birth weight[64].
Novel Entities[65] **(Synthetic chemicals, engineered materials, and modified organisms)**	Extraction and use.	Linked to adverse human health outcomes including respiratory illnesses, cancer, and endocrine disruption.

FOSSIL FUEL HARMS ON THE HUMAN BODY

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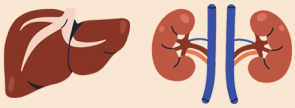
Brain and Nervous System

Cognitive decline, developmental delays, lower IQ, dementia, Parkinson's disease, depression

Lungs and Airways

Asthma, COPD, lung cancer, reduced lung function, chronic bronchitis



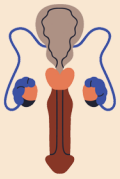
Liver and Kidneys

Kidney disease, liver toxicity, organ damage

Heart and Cardiovascular

Heart disease, stroke, high blood pressure

Reproductive Systems

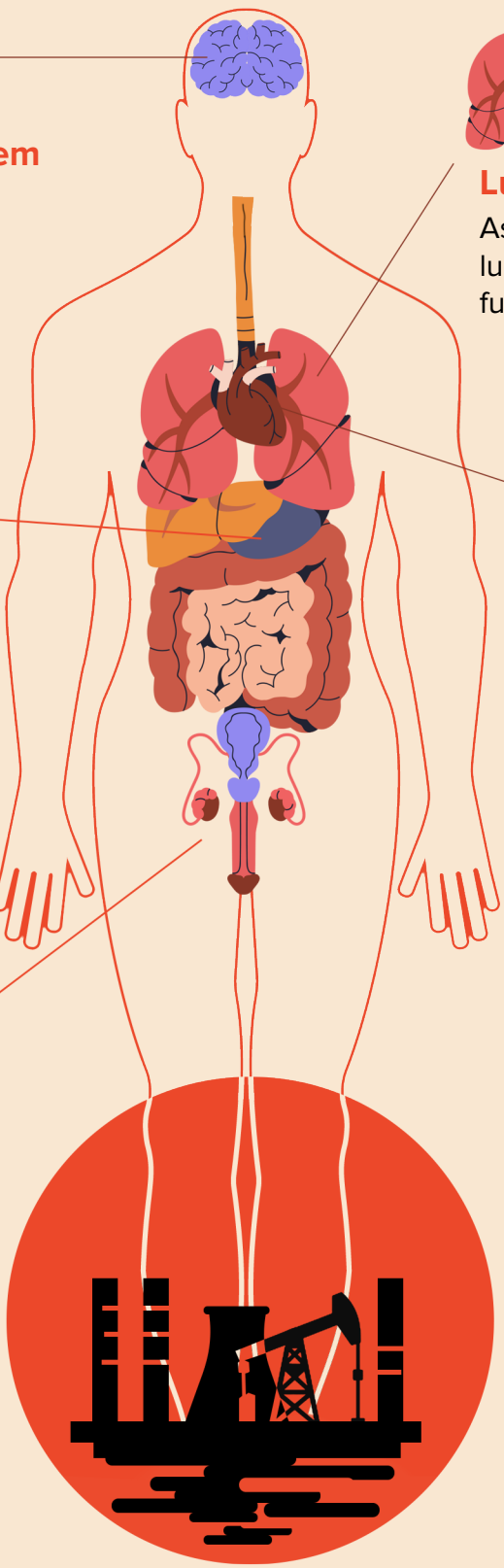


Male: Reduced fertility, hormonal disruption

Female: Infertility, miscarriage, preterm birth, birth defects

Blood / Bone Marrow

Leukemia, lymphoma, other blood cancers



Mental Health

Anxiety, depression, PTSD (disasters, displacement), developmental impacts

Immune System

Weakened immunity, higher infection risk

#Cradle2Grave

2.2 Harms by Age and Stage

While exposure to fossil fuel pollutants puts health at risk for people of all ages, there are stages of life when the human body is particularly vulnerable to harm.

2.2.1 *Before Birth*

The prenatal months are a critical window during which an infant's brain, lungs, heart and other organs are developing. Exposure to fossil fuel pollutants during this time can have a detrimental impact on a person's long term health[66].

The prenatal months are a critical window during which an infant's brain, lungs, heart and other organs are developing. Exposure to fossil fuel pollutants during this time can have a detrimental impact on a person's long term health.

Prenatal proximity to coal mining is associated with early births and low birth weight as well as with gastrointestinal congenital abnormalities[67,68]. Similarly, proximity to unconventional oil and gas activities, including fracking and flaring, has been correlated with increased risk of preterm birth, low birth weight, miscarriage and infant death, as well as congenital abnormalities including anencephaly, spina bifida, neural tube defects, orofacial clefts and heart defects[69–81].

Health risks associated with exposure to the byproducts of fossil fuel combustion are also concerning. Prenatal exposure to coal smoke, when coal is burned indoors for cooking or heating, may be associated with increased risk of oral clefts as well as with low birth weight[54,82,83]. Maternal residential proximity to a major roadway, a proxy measure for traffic related air pollution (TRAP) is associated with lower birth weight, smaller gestational size and may increase the risk of cardiometabolic ill-health in later life[84–87]. Higher in-utero exposure to diesel pollution may impact cognitive development as measured by test scores in third grade[88]. Prenatal exposure to benzene and other chemicals associated with gasoline and diesel combustion have been found to increase the risk of childhood cancers[42,89].

While most recently published research on fossil fuel exposures during pregnancy focuses on birth outcomes and infant health, some studies do explore the health impacts for the pregnant person. Some evidence suggests exposure to coal air pollution may make it more challenging to successfully conceive and may increase the risk of miscarriage, outcomes that can negatively impact a potential parent's physical and mental health[90,91]. Studies from Denmark and Sweden suggest that exposure to TRAP increases the risk of pre-eclampsia and pregnancy induced hypertension[32,92]. Some association has been found between residential proximity to unconventional natural gas development during pregnancy and increased risk of poor mental health[93,94]. Exposure to particulate matter from a coal mine fire in Australia was found to be associated with an increased risk of developing gestational diabetes[95]. Studies have also noted that exposure to endocrine disruptors from fossil fuels may put the long term health of pregnant people at risk[96].

2.2.2 *Childhood*

Children are especially vulnerable to health harms caused by fossil fuel pollution. Children breathe more rapidly than adults and inhale more air, and therefore airborne pollutants, relative to their body weight than adults do, and once inhaled, pollutants may be more damaging to children's narrower airways[97]. Children are less able to metabolize many pollutants than adults[98]. In addition to air pollution risks, when fossil fuel pollutants settle on surfaces, young children may ingest toxins due to their being closer to the ground and more likely to engage in hand-to-mouth behaviours. Toxic exposures in childhood, when cells are dividing and a child's brain and organs are developing put

children at increased risk of developing cancer and other illnesses in later life[99].

Exposure to various fossil fuel activities is associated with childhood cancers, most consistently with leukemia. Studies suggest that children living in close proximity to petroleum facilities, unconventional oil and gas developments, major roads, petrol stations and other sources of fossil fuel benzene, are at an increased risk of developing acute lymphoblastic leukemia and acute myeloid leukemia[100,101,89,102–104]. Children with parents who are occupationally exposed to hydrocarbon solvents or engine exhaust are additionally at risk of lymphomas, epithelial tumors and soft tissue sarcomas[105,106].

Exposure to various fossil fuel activities is associated with childhood cancers, most consistently with leukemia.

Fossil fuel pollution is also connected with childhood respiratory illness. Proximity to fossil gas development, to coal fired power plants and to major roads are all associated with increased asthma exacerbations and hospitalizations in children[107–110]. Children exposed to VOCs during an oil spill exhibited lung function loss up to 5 years after the spill[111].

Exposure to fossil fuel pollution may hamper neurological development and negatively impact mental health. British children with intellectual disabilities were more likely to live in areas with high levels of TRAP, and exposure to elevated levels of black carbon was found to be associated with slightly lower test scores in elementary school aged children[112,113]. American children exposed to coal fly ash had higher scores on the Depressive Problems Diagnostic and Statistical Manual of Mental Disorders (DSM)[114]. A recent review and meta-analysis of PM 2.5 exposure in young children showed significant reductions in IQ by age 9[115]. This effect must be considered in the context of all of the other neurotoxic exposures faced by children from lead, mercury, arsenic, tobacco smoke, pesticides, perfluoroalkyl substances (PFAS) and other common exposures[116–119].

Social inequities may put some children at greater risk than other children. Children from lower-income families or from communities that face discrimination and oppression, may live closer to extraction sites, industrial areas, or busy roads. Limited access to healthcare and poor nutrition in these communities can further exacerbate these effects, as children may not receive adequate medical care or nutrition that might counteract some of the damage from pollutants[120–122].

2.2.3 *Adolescence*

Adolescence is a time of important neurological and physical development, and there is evidence that exposure to stress and environmental contaminants during this time can have lasting negative consequences for health[123–125]. Research exploring the health risks of fossil fuels for adolescents is sparse, however lack of available research does not indicate lack of risk. In some instances, study design may obscure adolescent focused data, if, for example, adolescents are included in studies that look at health risks for children broadly[110,126]. There is some evidence that exposure to Poly Aromatic Hydrocarbons (PAHs) may impact the timing of puberty onset[127–129].

2.2.4 *Adulthood*

The vulnerabilities of adulthood are frequently less related to a unique form of physiology and more related to life circumstances. During this stage of life, people may take on jobs or live in places that increase their exposure to fossil fuel pollutants. Notably, it is often young adults who take on the most hazardous, high-exposure jobs in the fossil fuel industry — work that is so physically demanding and harmful that most people cannot continue it for long[130]. Risks to workers and other socially vulnerable groups are outlined in the next section.

2.2.5 *Elderhood*

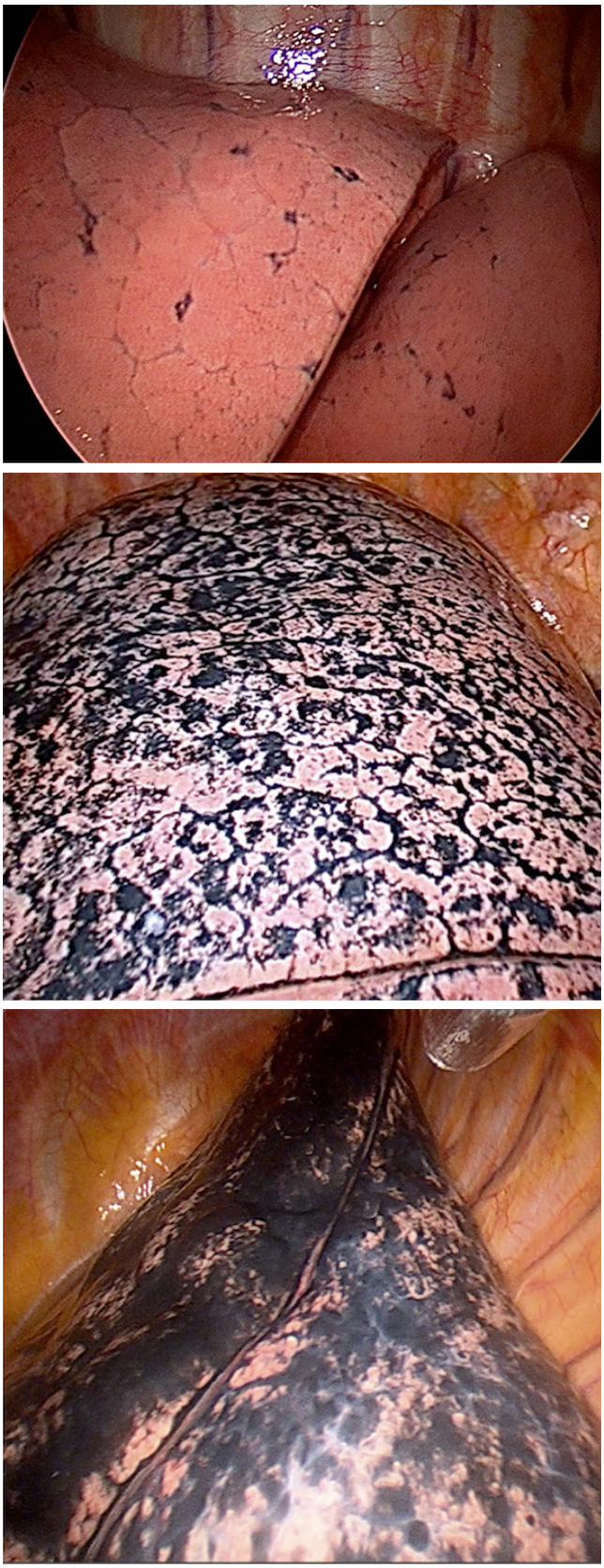
Elders are also vulnerable to fossil fuel pollutants due to intertwined physiological, health, and socioeconomic factors. As people

age, their respiratory and cardiovascular systems become less efficient in their work of providing well oxygenated blood to vital tissues. Cumulative exposures over a lifetime may contribute to additional morbidity[131,132] Elderly individuals frequently develop chronic conditions including heart disease, stroke, asthma, and COPD, dementia and metabolic diseases that are exacerbated by air pollution[133]. For these people, fossil fuel driven air pollution may increase the risk of complications, with one study showing PAHs reduced small airway function in patients with COPD, and another noting an increase in medical visits on days with higher air pollution[134,135]. Exposure to fossil fuel pollution causes premature death[136]. Another study of older adults in China found that increased exposure to SO_2, mostly from burning coal and oil, was associated with premature mortality[137].

In addition to premature death, exposure to fossil fuel pollutants over a lifetime increases the risk of developing health conditions that make aging well more difficult. Several studies show exposure to PM2.5, NO_2 and nitrogen oxide (NO) can contribute to cognitive decline and increase the risk of developing dementia[138–140]. Studies suggest that exposure to PM2.5, NO_2, CO_2 and black carbon, as well as residential road proximity, are also associated with an increased risk of developing dementia and Parkinson's disease[141–144].

Several studies show exposure to PM2.5, NO_2 and nitrogen oxide (NO) can contribute to cognitive decline and increase the risk of developing dementia.

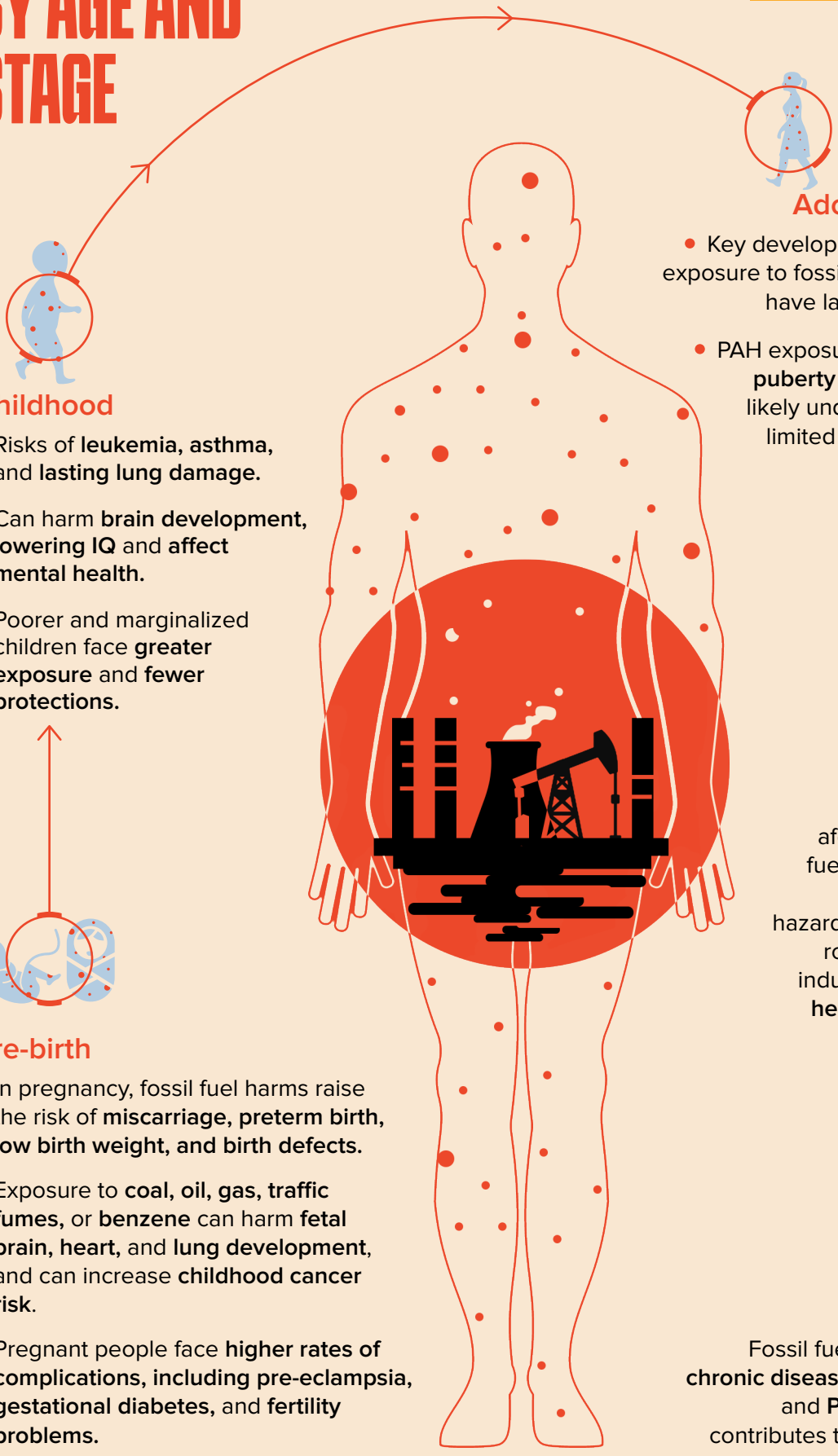
Image shows healthy lungs (top), teenage lungs affected by air pollution (center), and adult smoker's lungs (bottom).



Lung Care Foundation, India

FOSSIL FUEL HARMS BY AGE AND STAGE

GLOBAL CLIMATE & HEALTH ALLIANCE



Childhood

- Risks of **leukemia, asthma,** and **lasting lung damage.**
- Can harm **brain development, lowering IQ** and **affect mental health.**
- Poorer and marginalized children face **greater exposure** and **fewer protections.**

Pre-birth

- In pregnancy, fossil fuel harms raise the risk of **miscarriage, preterm birth, low birth weight, and birth defects.**
- Exposure to **coal, oil, gas, traffic fumes,** or **benzene** can harm **fetal brain, heart,** and **lung development**, and can increase **childhood cancer risk**.
- Pregnant people face **higher rates of complications, including pre-eclampsia, gestational diabetes,** and **fertility problems.**

Adolescence

- Key developmental stage where exposure to fossil fuel pollutants can have lasting health effects.
- PAH exposure linked to **altered puberty timing**; overall risks likely underestimated due to limited adolescent-specific research.

Adulthood

In addition to aforementioned fossil fuel harms, adults tend to take the most hazardous, high-exposure roles in the fossil fuel industry, with **long-term health consequences.**

Elderly

Fossil fuel pollution worsens **chronic diseases, raises dementia** and **Parkinson's risk,** and contributes to **premature death.**

#Cradle2Grave

Dr. Nicholas J. Talley
AC – Chair of the Board,
Doctors for the Environment,
New Castle, Australia

I live in Newcastle, Australia, home to the largest coal exporting port in the world. My family's property with horses is nestled amongst coal mines that feed the port. On the land I can see the worsening health impacts of climate change. More and more excess heat days. Droughts. Bushfires. Floods. All worsening! Not only is the science clear that global warming is worsening from our use of fossil fuels, my family and many others are personally experiencing it.

It has been estimated that combustion of coal and other fossil fuels releasing fine particulate matter, directly results in the premature deaths of over 8 million people a year globally. The coal Australia exports is a major contributor here (over 4% of the world total). According to a research paper in the prestigious journal Science (2023; 382: 941-6) exposure to particulate matter from coal burning power stations results in twice the death rate compared to other sources of particulate matter.

As a physician I see the impact of burning fossil fuels including coal on health. Air pollution near where I live close to coal mining for example is putting my community and many others at risk. Mining, transporting and burning coal releases tiny invisible tasteless particulate matter that we breathe in, is absorbed, and results in inflammation in our bodies leading to increased risks of heart and lung disease, stroke, asthma, diabetes, cancer, damage in utero, impaired neurodevelopment and learning in children, and premature deaths. There is compelling evidence there are spikes in hospital admissions when particular matter (for example, from bushfire smoke) engulfs our region, and frontline doctors and nurses see daily the devastating outcomes of fossil fuel pollution.

Fossil fuels including coal are a serious health hazard for Australians. And fossil fuels are feeding climate change. We know quitting smoking is life-saving. We now know quitting our dependence on and export of coal and other fossil fuels will not only reduce greenhouse gas emissions, it will save Australian lives.

2.3 Communities most likely to be Harmed

In addition to the specific risk posed throughout a person's life, social factors may increase one's likelihood of exposure, and/or vulnerability in the face of exposure. Vulnerabilities are multiple and may be overlapping.

2.3.1 *Workers*

Working with or in proximity to fossil fuels puts people's health at risk as a result of exposure to fossil fuel products and byproducts, proximity to chemicals used or released through the extraction and processing of fossil fuels, and hazardous work conditions. A community already facing poverty can face pressure to work in hazardous jobs in the fossil fuel industry due to limited work options. These conditions are most prevalent in rural areas.

Workers exposed to fossil fuels face an elevated risk of developing cancer. A systematic review conducted by the International Agency for Research on Cancer found working in the petroleum industry was associated with "an increased risk of mesothelioma, skin melanoma, multiple myeloma, and cancers of the prostate and urinary bladder" and that workers at offshore petroleum sites were also at "an increased risk of lung cancer and leukaemia"[100]. Offshore workers exposed to crude oil and benzene also may be at increased risk of developing skin cancer on their hands and forearms[145]. Workers in the petrochemical plants may be exposed to high levels of benzene and other health harming pollutants, and a study in Korea found these workers were at an increased risk of developing oral cancers[146,147]. To reduce freshwater use, the fracking industry often relies on toxic produced water[148]—putting workers at risk of skin disorders, chemical burns[149], and long-term harms like endocrine disruption and cancer (see 3.3.2 Unconventional Oil and Gas Extraction - including Fracking, p.25).

Workers exposed to fossil fuels face an elevated risk of developing cancer.

Coal mine workers face significant health risks from workplace exposures. Coal dust causes coal workers' pneumoconiosis or black lung and COPD. Coal miners may also be also exposed to crystalline silica dust, which also causes pneumoconiosis and contributes further to cardio-respiratory disease. These lung diseases contribute to impairment, disability, and premature death[150,151]. Coal miners are also at increased risk of lung and stomach cancer compared with the general population[152,153].

Globally, the oil and gas and mining industries are among the most hazardous sectors, with high rates of workplace fatalities[154]. Mining activity accounts for approximately 8% of fatal work-related injuries worldwide, making it one of the most hazardous occupations[154]. National statistics in the U.S. show that the oil and gas extraction industry has a higher fatality rate than many other sectors[155]. For example, in the U.S., oil and gas workers are approximately seven times more likely to die on the job compared to workers in other industries, though in more recent years safety measures have improved[156].

Mining activity accounts for approximately 8% of fatal work-related injuries worldwide, making it one of the most hazardous occupations.

In fossil fuel regions, the rate of road traffic collisions is often higher due to increased motor vehicle activities. For example, one study found that counties in Pennsylvania with high levels of shale gas drilling saw up to 23% more vehicle crashes and over 60% more heavy truck crashes than counties without drilling[157]. Heavy machinery, frequent transportation of materials, and the influx of transient workers all contribute to greater traffic congestion, road wear and risk of collisions. Motor vehicle collisions are the leading cause of death in fossil fuel industries, with long hours, demanding work, and inadequate safety measures[158].

According to the Centers for Disease Control and Prevention, vehicle-related incidents accounted for more than a quarter of worker deaths in the oil and gas extraction industry from 2014 to 2019[159].

Long shifts, heat and physically demanding work can cause fatigue, increasing the risk of accidents and long-term health issues[160,161]. High-pressure environments, job insecurity, and isolation (especially on offshore rigs and remote fly-in job sites) can lead to stress, anxiety, depression, and other mental health problems[162,163]. Irregular work hours and night shifts disrupt sleep patterns, leading to sleep disorders and related health problems[164].

These hazards extend beyond workers, affecting families and communities. Health problems resulting from workplace risks lead to increased medical expenses, loss of income, and reduced quality of life. The mental and physical toll on workers also affects community stability, leading to broader social issues such as increased healthcare costs, economic strain, substance abuse, domestic violence and social disruption[165]. Although many countries have workers' compensation systems, they are often difficult to navigate, provide incomplete compensation, and fail to adequately cover illnesses linked to toxic exposures[166].

Migrant workers in the fossil fuel industry often face heightened vulnerabilities due to their precarious legal status, which can undermine their access to protections against workplace harms. This vulnerability enables employers to exploit regulatory loopholes, particularly regarding occupational health and safety standards[167,168]. As climate change drives an increase in migration, with many individuals unrecognized as "climate migrants," the number of migrant workers subjected to such legal and workplace precarity is likely to rise, further exacerbating their exposure to occupational risks and limiting their ability to seek justice and compensation[169,170].

While they may not be the first group that one considers when thinking about fossil fuel workers, people working to deliver and distribute fossil fuels, most notably gas station attendants, are also at risk. Studies have found that gas and petrol station attendants showed more signs of oxidative stress, genotoxic damage, and hematological changes than control subjects[171–173].

2.3.2 *Marginalized Communities*

Racially, ethnically, socially, economically, and politically marginalized communities around the world face greater exposure to climate impacts and fossil fuel pollution, resulting in disproportionate health, economic, and social harms[6,174–176].

While pollution affects all populations, marginalized groups bear the brunt due to limited access to healthcare, clean technologies, alternative employment, and safe relocation options. Health risks are often under-researched in these communities, and even when studies exist, critical information may be inaccessible—particularly for ethnic minorities facing language barriers. Chronic stress from persistent pollution and socioeconomic hardship further worsens health outcomes[174–176]. With limited political and social power, these communities are less able to oppose the siting of industrial facilities, landfills, and extractive operations, or to demand health impact assessments. As a result, they experience higher rates of disease, disability, and premature death—fueling a cycle of vulnerability, declining health, and reduced resilience[177,178].

While pollution affects all populations, marginalized groups bear the brunt due to limited access to healthcare, clean technologies, alternative employment, and safe relocation options.

This pattern is a global issue, often affecting minority and/ or low-income populations worldwide. In the U.S, fossil fuel facilities[174] like coal plants[175], refineries, and hazardous waste sites are more frequently located near African American, Hispanic, Native American, and low income communities than near

In the U.S, fossil fuel facilities[174] like coal plants[175], refineries, and hazardous waste sites are more frequently located near African American, Hispanic, Native American, and low income communities than near higher income and White communities[176–178].

higher income and White communities[176–178]. In Africa, communities near coal mining and power generation sites face environmental and health challenges, including deforestation, water contamination, and air pollution, which devastate local ecosystems and livelihoods while causing chronic respiratory and other health problems[179,180]. In India[181] and China[182,183], poor, and socially marginalized groups often reside in the most polluted urban areas or near industrial zones, facing daily exposure to hazardous air[184] and water pollution. Similarly, in Chile, communities in the area Quintero[185] and Puchuncaví[186] endure toxic emissions from coal plants and refineries, leading to health crises and environmental destruction.

Areas that have been allowed to become extensively polluted, and that are not being remediated by industry or government, have been referred to as "sacrifice zones" — (see Climate Justice Is Essential for Health Equity, p.4). Health impacts in these communities include higher rates of asthma[187,188], bronchitis, lung cancer, heart disease, and other respiratory and cardiovascular conditions due to chronic pollution exposure[189,190]. Emerging research indicates that air pollution also negatively affects mental health and cognitive development, exacerbating educational and social challenges[191,192]. Marginalized communities experience higher rates of adverse birth outcomes, such as preterm births, low birth weight, and developmental disabilities linked to environmental exposures[193,194]. Social and psychological factors, such as chronic stress from constant exposure to environmental hazards and socioeconomic challenges, further exacerbate health problems. Additionally, higher poverty and lower levels of health literacy and awareness about pollution risks can hinder protective behaviors and advocacy for cleaner environments.

Residents of Pennsylvania community protest against the health and environmental impacts of fracking.

Mark Dixon

ON THE FRONTLINES

Health Impacts of Oil Extraction and Production in Bayelsa, Nigeria [195]

Bayelsa State is located in the core of the Niger Delta region and is a major center of Nigeria's oil and gas industry, hosting a significant proportion of the country's crude oil reserves and production facilities. Despite its resource wealth, Bayelsa faces substantial environmental and health challenges linked to the intensive oil extraction activities that have taken place over several decades.

The Governor of Bayelsa State commissioned an independent report into the impacts from oil extraction in the region. It revealed that more than 100 million gallons of oil have been spilled since 1950 – equivalent to approximately 1.5 barrels per resident. It found that groundwater samples exceeded WHO safety limits for petroleum hydrocarbons by up to 1 million times.

Prolonged exposure to pollutants such as sulfur dioxide, nitrogen oxides, and heavy metals has been associated with high rates of respiratory disease, skin disorders, cancer, and chronic illnesses. Contaminated water and food sources have contributed to malnutrition and stunted growth in children. Environmental degradation has also been linked to increased mental health challenges among affected communities.

Bayelsa records one of Nigeria's highest infant mortality rates (31 deaths per 1,000 live births), and oil spills across the Niger Delta are estimated to have caused over 16,000 additional neonatal deaths in 2012 alone. Life expectancy in the region is approximately 50 years, compared to Nigeria's national average of 53 years and 80 years in OECD countries; some estimates place it even lower.

Community testimonies reveal the extent of the suffering. Residents of oil-impacted areas recount how oil spills have led to widespread sickness and death, with inadequate relief efforts compounding their plight. In one community, an oil spill in 2018 resulted in severe water shortage in the community, with many children dying due to contaminated water and food. Another incident in 2017 caused skin peeling and burning sensations among residents, who were also unable to fish in their polluted waters.

More information: www.bayelsacommission.org

Provided by:
Nnimmo Bassey,
Executive Director,
HOMEF, Nigeria

Pipelines carrying coal ash slurry from power plants in Ennore, North Chennai, India

Shweta Narayan

03 The Fossil Fuel Life Cycle Impacts: Health Harms from Exploration to Closure

The life cycles of coal, oil, and gas—from site preparation to site decommissioning—present risks to the health of families, workers, communities and ecosystems at every stage. Understanding and addressing these risks and impacts is crucial for developing any strategy to protect the environment and public health. It is also crucial for developing regulatory structures, accountability mechanisms, and to inform responsible policies and governmental decision making.

Prudence
Waya-waya, Ogies,
South Africa

Dylan Paul
Center for Environmental Rights

We have a big problem with this mine for their reckless blasting. When they blast, the air blows our way and we are affected because our children are always sick. If you look inside my fridge, it is full of medicine. I am a single parent with no money to always be taking my children to a doctor.

It is better for these mines to leave because they never consulted us in the first place before they mined and not that we are getting sick they are not helping us. I think it is better that they leave.

3.1 Site Preparation

The exploration and site development phase for coal, oil, and gas often results in environmental destruction, which can have health impacts before extraction even begins. For example, coal mining is a major driver of deforestation, and as trees are cleared to access coal, this may lead to soil erosion, disrupted clean water access, and increases in flooding all of which put health at risk[196,197]. Dust and other air pollution associated with site development, from increased traffic and site preparation, may also present increased health risks. Researchers noted an increase in hospitalizations for children with asthma during periods of both conventional and unconventional gas drilling[108]. Another study found that "the introduction of drilling [for gas]" was associated with increases in low birth weight among infants born to mothers living near drill sites[198].

Site development may displace people from their homes and communities. While involuntary displacement is likely to negatively impact most people's well-being, it can be especially harmful for Indigenous people that have millennia-long relationships with lands and ecosystems. One recent systematic review re-affirms something Indigenous communities have long highlighted – "land dispossession due to industrial resource development" is associated with negative mental health impacts for Indigenous people[199].

3.2 Coal Extraction

The health risks of coal mining first garnered attention in the mid-1800s when doctors identified coal worker's pneumoconiosis more commonly known as black lung disease[200]. Coal miners around the world are still dying from black lung, and mine workers are also at increased risk of other serious respiratory diseases including COPD, silicosis, and lung cancer[151,152,201–204]. Exposure to coal associated pollutants may also put coal miners at elevated risk of stomach cancer, DNA damage, rheumatoid arthritis and physical injury[153,205–209].

Communities in close proximity to coal mines also face increased health risks. One Australian study found that PM10 air pollution exposure was higher in communities close to coal mines than in non-mining communities and studies on health impacts reflect this increased exposure, with another Australian study finding that increases in regional coal outputs were associated with increased hospitalizations for respiratory and circulatory illness[210,211]. People exposed to open pit mines in Colombia were found to be more likely to have DNA damage and shortened telomeres than control subjects[212]. Coal seam mining is associated with increased hospitalizations for blood and immune diseases in nearby communities and increased respiratory disease in children [126,213]. Maternal residential proximity to coal mining during the prenatal period has been associated with negative birth outcomes including low birth weight and gastrointestinal birth defects[214,215]. Mountaintop removal, a coal mining practice prevalent in the Appalachia and elsewhere significantly alters the landscape, risking water contamination, soil erosion, and reportedly increasing the risk of COPD, heart disease, tooth loss and reductions in health-related quality of life[216–220]. Coal mining may also release heavy metals like Selenium and other pollutants into the environment, potentially contaminating soil and water in the surrounding area[221].

Coal miners around the world are still dying from black lung, and mine workers are also at increased risk of other serious respiratory diseases including chronic obstructive pulmonary disease, silicosis, and lung cancer.

3.3 Oil and Gas Extraction

Oil and gas extraction activities are a significant source of methane emissions, which contribute to global warming and health risks[222]. Oil and gas extraction produces air pollution, which among other things, is associated with asthma exacerbations, premature deaths, and health care costs[223].

Much of the health research on oil and gas extraction has been conducted in wealthy countries, including the U.S, but it should not be assumed that the health implications identified in the current literature exist only in these places. It is possible that the health impacts may be worse in countries or regions where research is more limited, if these places have weaker environmental or health regulations or greater industry capture of regulatory bodies.

3.3.1 *Conventional Oil Extraction*

There is some evidence to suggest that populations living near oil fields, particularly in low and middle income countries, face health risks as a result of long term environmental contamination[224]. Oil industry pollutants have been found in water sources, food and soils around oil sites, however, multi-site research is still limited, highlighting the urgent need for more robust studies.

3.3.2 *Unconventional Oil and Gas Extraction – Including Fracking*

Unconventional oil and gas extraction includes oil sands extraction, directional drilling and hydraulic fracturing (fracking). These extraction methods and their potential health impacts have been a source of concern in recent decades, especially as the expanding use of these technologies has outpaced the ability to evaluate their potential, and increasingly reported, health impacts. As fracking use expands, health professionals have joined frontline communities in raising the alarm[225–227].

Fracking uses a mix of water, chemicals, and sand to break apart rock and release oil or gas[228]. Each fracking event uses between 6 to 60 million litres of freshwater, potentially putting water security at risk especially in drought prone regions[229]. There are concerns about the volume of water used for fracking, the potentially irredeemable contamination of that water once it has been used, and the growing "water footprint" of the industry[225,229,230]. Fracking can also destabilize deep rock formations leading to earthquakes where there was previously no seismic activity. This is concerning because buildings in these regions are less likely to be earthquake proof.

North Dakota's Bakken oil fields

Trudy E. Bell
FracTracker Alliance, 2015

ON THE FRONTLINES

Nalleli's Story: Oil Drilling in Los Angeles

When Nalleli Cobo talks about the neighbourhood where she grew up - she will tell you that she liked all her neighbours, except for one.

Like thousands of Angelenos, Nalleli and her family lived within a quarter mile of an oil well. The well in Nalleli's neighbourhood was just 30 feet from her family home. It made the air smell like rotten eggs, even if the windows were closed. As a child, Nalleli constantly worried that someone working at the plant would forget to release the pressure valve, causing an explosion and killing everyone she loved.

When she was nine, Naelli started getting severe nosebleeds - she slept sitting up to prevent her from choking on blood. Nalleli had headaches and heart palpitations, and also developed asthma. Other members of her family had similar symptoms, and they soon learned that their neighbours were getting sick too. Nalleli and her mother started organizing. They worked with other members of their community to launch a grassroots campaign called "People not Pozos" (pozo means "well" in Spanish), with Nalleli as the spokesperson. Thanks to the group's activism, the oil company was pressured to temporarily stop operations at the well in 2013. When the well stopped operating, Nalleli's nosebleeds stopped and her asthma improved, but her fight was far from over.

Nalleli knew that many other communities in Los Angeles were dangerously close to oil wells, and that Latino, Black and other People of Color were disproportionately affected. To address this, Nalleli co-founded the South Central Youth Leadership Coalition. In 2015, the group sued the city of Los Angeles for a violation of the California Environmental Quality Act and for environmental racism. They won. Since then, the LA City Council has voted to ban oil extraction in the city. Activism by "People not Pozos" forced the the oil well near Nalleli's home to permanently close in 2020, and company executives are now facing criminal charges for environmental and health violations

Some illnesses associated with fossil fuel exposures develop slowly. At 19, Nalleli was diagnosed with stage two reproductive cancer, and her first thoughts were about the signs on the gate of the oil drilling site, warning about carcinogenic chemicals. After several surgeries and years of treatment, thankfully Nalleli is now cancer free. She continues to champion environmental justice and in 2022 Nalleli received the Goldman Environmental Prize in recognition of her efforts.

More information: https://www.goldmanprize.org/recipient/nalleli-cobo/

Nalleli Cobo stands in front of the closed AllenCo site

Tamara Leigh
Goldman Environmental Prize

THE WATER TRADE-OFF IN FRACKING

Hydraulic fracturing (fracking) demands vast quantities of water, forcing a trade-off for communities and worker health. When companies use freshwater, they often draw from limited community supplies, straining access to clean drinking water, agriculture, and sanitation—especially in drought-prone or marginalized regions. To reduce freshwater use, the industry sometimes turns to *produced water*—a highly toxic wastewater generated during oil and gas extraction. Produced water can contain heavy metals, radioactive materials (TENORMs), hydrocarbons, and chemical additives[148]. Workers handling or exposed to it are at risk of serious skin disorders, chemical burns, rashes[149], and potential long-term effects[231] from chronic exposure, including endocrine disruption[232] and increased cancer risk. Either choice carries significant environmental or health consequences, highlighting the hidden costs of fossil fuel extraction.

In Clearfield County, Pennsylvania, large water impoundments are used for fracking operations

Ted Auch
FracTracker Alliance, 2021

Most research on unconventional oil and gas extraction focuses on extraction sites where fracking is occurring, however many health studies use proximity to oil and gas wells as the measure of exposure. This can make it challenging to determine which observed health impacts are associated with fracking specifically, and which are associated with factors that accompany the arrival and/or expansion of fossil fuel activities, such as increased traffic and traffic related air pollution, increased noise and light pollution, loss of nature, and increased air pollution.

Several studies suggest that maternal proximity to unconventional oil and gas projects is associated with negative birth outcomes. Babies born to birthing parents who lived closer to wells or close to a higher density of wells seem to be at an increased risk of a low birth weight and of birth defects including neural tube defects, anencephaly, spina bifida and heart defects[233–237]. Children whose parents within 2km of at least one fracking well during the “perinatal window (preconception to birth)”, had more than twice the odds of developing acute lymphoblastic leukemia in childhood, compared with children whose parents did not live near

Babies born to birthing parents who lived closer to wells or close to a higher density of wells seem to be at an increased risk of a low birth weight and of birth defects including neural tube defects, anencephaly, spina bifida and heart defects.

a well when they were in utero[101]. One study in Pennsylvania cross-referenced maternal residence, community water source location, and shale gas fracking site location, and found an association between fracking related water quality changes and increased rates of preterm birth and low birth weight[238]. A study in Texas found that periods of increased drilling and production activity at unconventional oil and gas sites were associated with an increased number of preterm births[76].

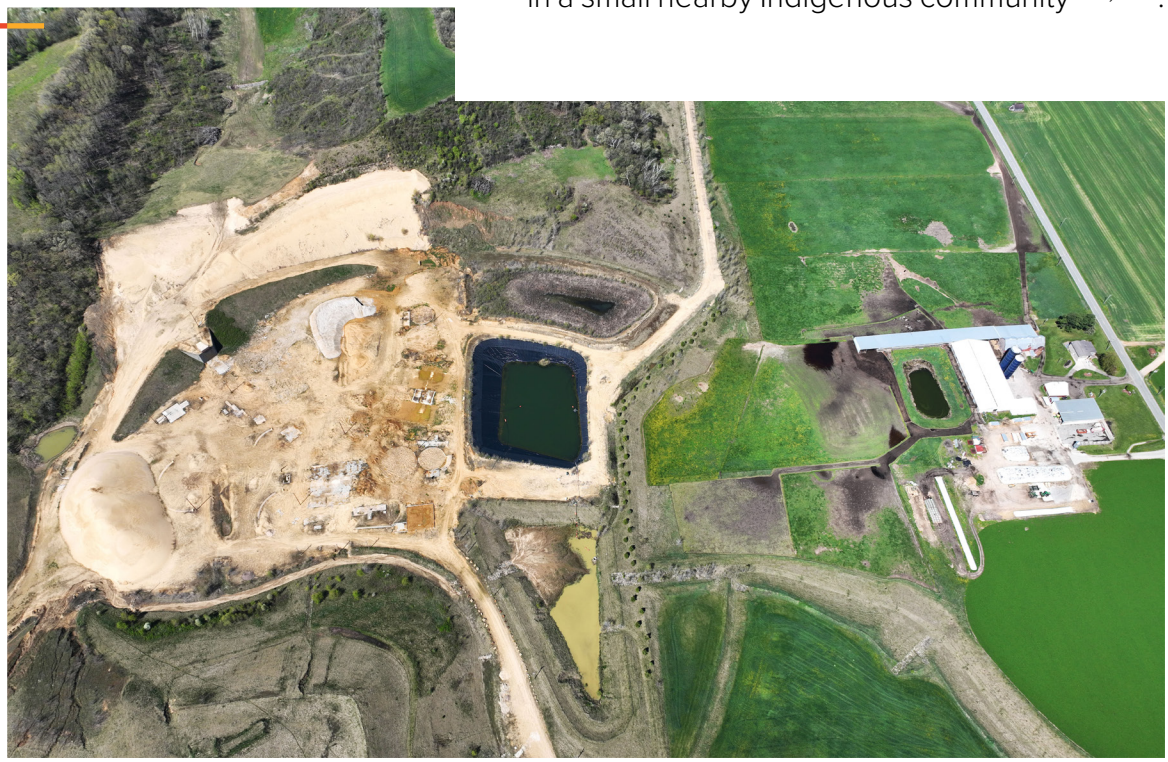
Unconventional oil and gas extraction are also associated with respiratory and cardiovascular health impacts. One study in Pennsylvania found that all phases of unconventional gas were associated with asthma exacerbations and found that pad preparation in particular was associated with hospitalization for asthma exacerbation[239]. Other research in Pennsylvania found that in zip codes with unconventional oil and gas activity, there were more hospitalizations of older adults for cardiovascular diseases when compared with zip codes in a neighbouring state without oil and gas, and that patients with acute myocardial infarction and heart failure were more likely to be hospitalized if they were exposed to unconventional oil and gas activity or increased density of oil and gas activity[240–242].

Residential proximity to unconventional oil and gas may also negatively impact sleep and mental health. People living near unconventional oil and gas sites often report disturbed sleep and other impacts, including stress, that are related to industry noise[243,244]. Some studies suggest an association between proximity to unconventional oil and gas and increased rates of anxiety and depression particularly among adolescent girls and pregnant people[93,94,245].

Water contamination – through spills, waste discharge, and underground chemical migration – has been suggested as a primary mechanism for the health impacts of unconventional oil and gas[225]. Water sampling near extraction sites has identified fracking chemicals in surface and groundwater, some of which are endocrine disruptors[246–248].

Oil sands extraction, where oil is mixed with sand and clay, and must be separated in order to be used, is another form of unconventional fossil fuel extraction that has raised the alarm of frontline communities and health professionals. Residents living near a large oil sands extraction site in Alberta, Canada have reported suffering from headaches, fainting, nasal and throat congestion, and health professionals noted higher than expected rates of several cancers in a small nearby Indigenous community[249,250].

In Trempealeau County, Wisconsin, sand mines supply quartz sand used in fracking.



Ted Auch, FracTracker Alliance, 2024.

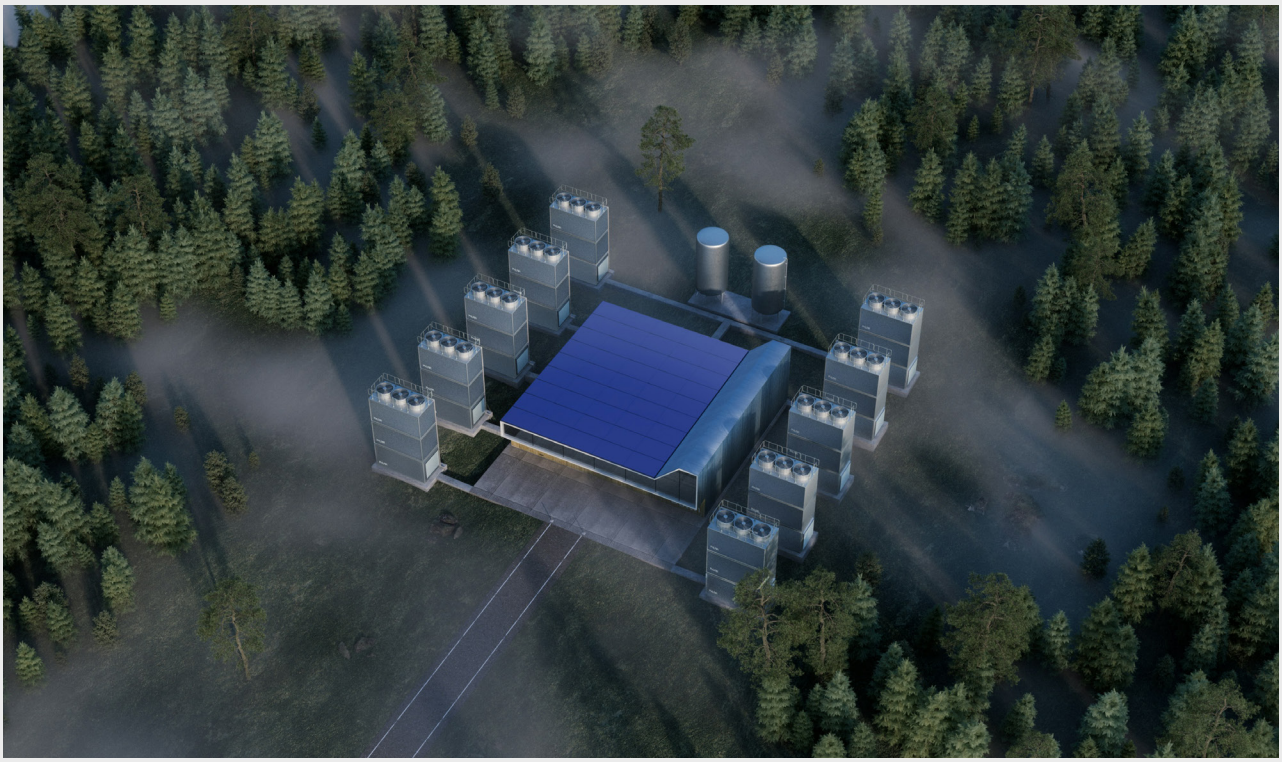
CARBON CAPTURE AND STORAGE – DANGEROUS DISTRACTION

Carbon capture and storage (CCS) is often promoted as a solution for reducing CO_2 emissions in "hard to abate" sectors. While the COP28 cover decision emphasized its role in energy transitions[251], IPCC analysis shows that CCS could contribute only about 2% of required emissions reductions by 2030 and 6% by 2050[5]. By the end of 2023, no CCS project had met its CO_2 capture targets. Among 200 IPCC mitigation scenarios consistent with limiting warming to 1.5°C, none allow continued fossil fuel use at current levels—let alone expansion—through CCS alone[5]. Despite public claims about its promise, industry documents reveal internal acknowledgment of CCS's limitations[252].

Relying on CCS in net-zero plans allows fossil fuel use, and its associated health harms from air pollution and extraction, to persist. CCS also consumes significant energy and materials, meaning fossil-powered CCS can actually increase both greenhouse gas emissions and air pollution[253]. The process poses additional risks across the CO_2 capture, transport, and storage chain. Amine-based solvents release toxic ammonia near capture sites[254], and high concentrations of CO_2 can cause asphyxiation, circulatory failure and death[255]. Pipelines transporting compressed CO_2 create so-called "kill zones," as seen in a 2020 leak in Satartia, Mississippi, which caused vehicles to stall and led to hospitalizations from dizziness and nausea[256]. These risks add to the serious technical and economic challenges facing CCS.

In another irony of the fossil fuel era, CCS is being rolled out in fracking zones. Fracking causes earthquakes, and earthquakes increase the risk of breaches in underground storage. Physics drives the gas to seek an escape into the atmosphere. Faults, cracks, drilled wells and fracking make underground storage dangerous[257] through these escape routes.

Commercial Direct Air Capture facility, Alberta, Canada



PHLAIR, Unsplash

3.3.3 *Disasters at Extraction Sites*

Coal mine fires, oil spills, and other acute disasters at extraction sites have health impacts for workers, for nearby communities and for those who assist with clean up efforts. A review of fatal incidents at US oil and gas extraction sites found that 14% of worker deaths within the study period were caused by explosions[155].

In 2014, the Hazelwood coal mine fire was associated with an increase in cardiovascular deaths in the six months after the fire, and increased emergency room visits for cardiovascular and respiratory disease and increased hospitalizations for asthma and COPD in the years following the fire[258–260].

In 2010, the Deepwater Horizon oil drilling rig exploded, killing 11 people and causing an estimated 4.9 million barrels of oil to spill into the Gulf of Mexico. The disaster exposed coastal communities to elevated levels of PM2.5 and benzene, and had devastating impacts for marine animals and ecosystems[261–263]. Immediately following the spill, oil exposed clean up workers reported coughing, headaches, rashes, and stomach issues among other symptoms. In the years following, oil exposed clean up workers were at greater risk of developed chronic respiratory conditions including asthma and COPD, cardiovascular conditions including hypertension and coronary heart disease, and dermal conditions[264–267].

There is some evidence that exposure to the chemical dispersants used in spill clean up may have further increased the risks of developing respiratory and cardiovascular conditions, and of cellular changes "toward carcinogenesis"[265,266,268].

A blowout in the Oil India Ltd facility in Assam in 2020 led to a fire which came under control after nearly five months[269]. There was a serious impact on local communities including contamination of their soil, water and agricultural land leading to long term health consequences such as breathing difficulties, nausea, noise-induced headaches and chronic anxiety and palpitations[270].

3.3.4 *Other Impacts of Extraction*

All fossil fuel extraction activities may contribute to elevations in local noise pollution from blasting and drilling[271]. Fossil fuel extraction often leads to an increase in the volume of local traffic, and with this an increase in traffic related air pollution, the potential for accidents and injuries of workers and residents in the vicinity of mining and drilling operations[157,160].

Oil exposed clean up workers were at greater risk of developing chronic respiratory conditions including asthma and COPD, cardiovascular conditions including hypertension and coronary heart disease, and dermal conditions.

Workers clean up the oil spill along Chennai's coast in 2017

Shailendra Yashwant

AROUND THE WORLD

Jharia Coal Seam Fires, India (1916-present)

The Jharia coalfields in Jharkhand, India, have been burning underground for over a century, creating one of the world's longest-running coal seam fires. Since 1916, these fires have released a toxic mix of gases, including carbon monoxide, carbon dioxide, sulfur dioxide, nitrogen oxide, coal dust, and particulate matter, leading to ongoing air pollution and posing significant health risks to the local population. The emissions from the fires have been linked to respiratory diseases such as asthma and chronic bronchitis, and life threatening conditions including strokes and pulmonary heart disease[272].

Beyond health impacts, the continuous burning has caused widespread environmental degradation, including land subsidence, destruction of vegetation, and the displacement of entire communities. Many areas in Jharia have become virtually uninhabitable due to these ongoing fires[273]. Despite efforts by the Indian government to mitigate the situation, the total area affected by these fires has continued to increase, with studies indicating a further expansion through 2019[274,275].

This century-long environmental disaster not only underscores the severe consequences of uncontrolled coal extraction but also highlights the urgent need for effective interventions to protect both human health and the environment.

In Jharia, India, children are exposed to smoke from underground coal fires.

Amirtharaj Stephen

3.4 Processing and Refining

Processing and refining coal, oil and gas pose environmental and health risks. A review of Hazardous Air Pollutants (HAP) emitted throughout the various initial stages of oil and gas production found that 1-3 butadiene, benzene, cumene, formaldehyde, hydrogen sulfide, mercury, methanol, styrene, toluene, xylenes, were released during the processing and production phase[276] – all of these chemicals have been found in studies to have significant health impacts. Stack or vent emissions are often identified as the most significant sources of emissions in fossil fuel processing plants. However, fugitive emissions[277] from the storage tanks and yards, cooling tanks, pipe connectors, valves, equipment leaks, flanges, pumps, compressors, pressure release devices etc. can violate the ambient air quality standards and even exceed the stack emissions[278,279]. Pollution control agencies often do not monitor fugitive emissions.

3.4.1 *Coal Processing and Coke Production*

Some coal is heated to very high temperatures in an airless kiln, resulting in porous high carbon fuel called "coke". Coke produces less smoke when burned than raw coal, and while this may make it slightly less harmful at the point-of-use, coke production is associated with health impacts for workers and the surrounding community. Coke oven workers are at an increased risk of lung cancer and possibly kidney cancer[280,281]. Genetic abnormalities associated with poor health outcomes have been found among coke plant workers: workers in Slovakia were found to have higher rates of chromosomal abnormalities than control subjects, and workers in Egypt were more likely to have oxidative DNA damage than control subjects[282,283]. Studies measuring the presence of PAHs and metals in the urine of coke oven workers, found that elevated levels of copper, zinc and 4-hydroxyphenanthrene were associated with increased risk of diabetes[284,285]. On a hopeful note, the closure of a coking plant in the US was found to be associated with "an immediate drop in cardiovascular emergency room visits" as well as a reduction in cardiovascular hospitalizations over time[286].

3.4.2 *Oil Refining*

Petroleum refineries put the health of workers & nearby communities at risk. A 2021 systematic review found that working in the petroleum industry was associated with an increased risk of some cancers including "mesothelioma, skin melanoma, multiple myeloma, and cancers of the prostate, and bladder" as well as lung cancer and leukemia for offshore workers[287]. This same review suggested that living near petroleum facilities was associated with increased risk of childhood leukemia[287].

In Finland, oil refinery workers were found to be at increased risk of kidney cancer, and in Iran, petroleum refinery workers who had been exposed to organic solvents were at increased risk of developing metabolic syndrome[288,289]. People living, working or studying close to refineries are also at risk. Children attending a school near a refinery in Saudi Arabia were found to have higher blood pressure and higher rates of prehypertension than those at schools that were farther from the refineries[290]. A cross-sectional study in Montreal showed that children exposed to higher levels of SO_2 from a nearby refinery had more poorly controlled asthma[28]. In addition, populations in the US living closer to oil refineries were found to have higher prevalence of coronary heart disease, compared with those living farther away[291]. It is likely that some of the health impacts are due to pollutants, including sulphur oxides, nitrous oxides and heavy metals released by refineries[292].

In Finland, oil refinery workers were found to be at increased risk of kidney cancer, and in Iran, petroleum refinery workers who had been exposed to organic solvents were at increased risk of developing metabolic syndrome.

AROUND THE WORLD

Cancer Alley, Louisiana, USA[293,294]

An 85-mile stretch along the Mississippi River is home to numerous petrochemical plants and oil refineries. The area has been nicknamed "Cancer Alley" due to the high incidence of cancer. The residents also face elevated rates and risks of maternal, reproductive, and newborn health harms, and respiratory ailments. These harms are disproportionately borne by the area's Black residents in a situation so egregious that the UN Environment Programme chastised Louisiana state regulators in a public letter, noting that "the Departments' actions or inactions have resulted and continue to result in disparate adverse impacts on Black residents" of the area, as part of an ongoing investigation into civil rights complaints filed by local citizens' groups and others[295,296].

In Louisiana's 'Cancer Alley,' refineries are located near homes and schools.

Ted Auch
FracTracker Alliance, 2024

3.5 Transportation of Fossil Fuels

Transporting fossil fuels—whether by pipelines, trucks, or ships—presents environmental and health risks. These risks are present during routine activities and are magnified when transportation related disasters, like spills and explosions, occur. Explosions may cause injury or death. Spills and leaks may release harmful pollutants including VOCs into the air and can also impact marine[297], freshwater[298], and land ecosystems[299]. Similar risks exist during fossil fuel storage[300,301].

3.5.1 *By Pipeline*

Pipelines that transport oil and gas span tens of thousands of kilometers, endangering the health of people, communities, ecosystems and communities along their routes. Construction can lead to community displacement, habitat destruction, farmland disruption and drinking water contamination[302–304]. Once pipelines are operational, leaks and spills occur somewhat regularly — in the US alone 2,595 gas incidents were reported between 2010 to 2021 — akin to a gas leak every 40 hours[305]. These leaks can result in deadly explosions and threaten food production and water security particularly where pipelines intersect with aquifers[302].

Once pipelines are operational, leaks and spills occur somewhat regularly — in the US alone 2,595 gas incidents were reported between 2010 to 2021 — akin to a gas leak every 40 hours.

In North America, Indigenous communities have frequently and stalwartly opposed pipeline construction on their territories, citing the threats to the land, water, ecosystems, and people as a reason for this opposition, and flagging their internationally recognized right to Free, Prior and Informed Consent for projects on their lands (FPIC)[306]. In response to this opposition, land defenders have often faced harassment, intimidation, and violence from state governments[303].

3.5.2 *By Rail*

Historically, trains were the primary means of fossil fuel transportation, and where railways are prevalent coal and oil are still transported by train. Routine transport of coal by train can lead to increased PM2.5 exposure for people and communities along the rail routes, increasing the risk of PM2.5 related health impacts[311]. In 2013, the derailment and explosion of a train carrying crude oil killed 47 people in Lac-Mégantic, Quebec, an event which caused physical destruction and led to an increase in psychological distress (including increases in anxiety disorders and depressive episodes)[312]. Communities along rail routes are at an increased risk of similar disasters[313].

3.5.3 *By Ship*

Coal, oil and gas are frequently transported across oceans by tankers. During routine activities these ships may leak small amounts of oil in an ongoing way, and in more dramatic instances, can spill large volumes of oil, which can have devastating consequences for the health of marine ecosystems and coastal communities[314–316]. Following the Hebei Spirit oil spill in 2007, when a collision that punctured oil tanks on an anchored crude carrier caused over 10,000 tonnes of oil to spill into a port area, children in high exposure coastal areas and those who were exposed to spill-related VOCs were observed to have increased asthma symptoms and a decline in lung function respectively[111,317]. As with the Deepwater Horizon spill, clean up workers were found to be at a greater risk of negative health consequences – one study found an association between longer time spent cleaning up and increases in the risk of developing thyroid cancer nine years later[318].

AROUND THE WORLD

San Bruno Pipeline Explosion, California, U.S. (2010)

A gas pipeline explosion in a suburban neighbourhood caused an explosion on the scale of a magnitude 1.1 earthquake and a massive fire, killing eight people, injuring dozens, and destroying 38 homes. The explosion highlighted the risks associated with ageing infrastructure and the potential for catastrophic failures in densely populated areas. The utility responsible, PG&E, was found guilty on six felony charges in connection with the event[269]. These charges seem to have been of little consequence to PG&E – in 2018, after their poorly maintained transmission lines caused the Camp Fire in Northern California, it was found that the company had continued to violate safety regulations and to falsify records in the years following the 2010 explosion[307–310].

Burned Home Debris, San Bruno Gas Line Explosion 2010

Thomas Hawk

AROUND THE WORLD

Exxon Valdez Oil Spill, Prince William Sound, Alaska, (1989)[319]

The Exxon Valdez oil tanker spilled around 11 million gallons of crude oil, affecting 1,300 miles of coastline. It resulted in the death of hundreds of thousands of seabirds, thousands of sea otters, and countless fish and invertebrates. The spill had long-term effects on the ecosystem, with some species and habitats still not fully recovered decades later. The Exxon Valdez oil spill jeopardized the long-term survival of resource-dependent fishing communities and Alaska Native villages that relied on commercial fishing and subsistence harvests, leaving a legacy of economic, cultural, social, and psychological impacts.

https://www.arlis.org/docs/vol1/B/243478793.pdf

San Juanico Gas Explosions, Mexico (1984)

A series of explosions at a liquefied petroleum gas (LPG) storage and distribution facility caused one of the deadliest industrial accidents in history. The explosions killed over 500 people and injured thousands. The disaster resulted in extensive environmental damage, including air and soil contamination, and had long-lasting emotional trauma on the surrounding population.

Wreckage from the Norfolk Southern train derailment in East Palestine, Ohio, after the burning of vinyl chloride tank cars.

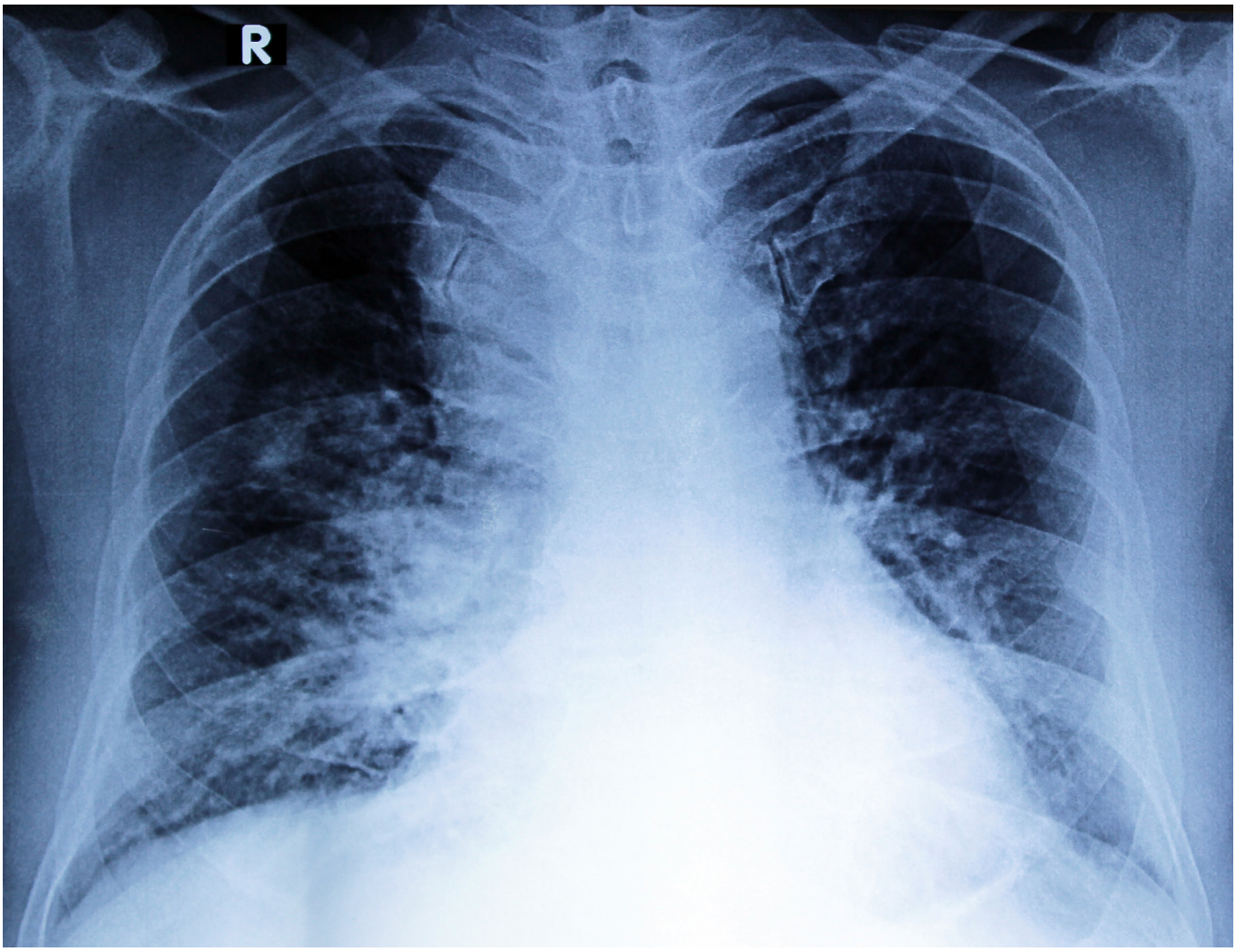
Ted Auch, FracTracker Alliance, 2023

3.6 Combustion and Use

The combustion of oil, gas, and coal to produce electricity, fuel vehicles, heat buildings and power human activity is a major contributor to air pollution globally. A 2016 report by the IEA estimates that fossil fuel combustion releases the majority of health harming air pollutants: "85% of particulate matter and almost all of the sulfur oxides and nitrogen oxides"[320].

The WHO has long raised the alarm about the health risks of air pollution exposure and evidence of the negative health impacts of all-cause air pollution is robust. Exposure to higher levels of air pollution has been found to increase a person's risk of dying from lung cancer, COPD, cardiovascular illness and stroke, and has been associated with an increased risk of type 2 diabetes, developmental delays and other concerning outcomes[321,322]. The International Agency for Research on Cancer has classified air pollution, particularly PM2.5, as a leading cause of cancer[183]. Exposure to higher levels of PM2.5 seems to be associated with an increased risk of developing Parkinson's disease, Alzheimer's disease and related dementias[323]. Increased exposure to PM2.5, NO_2 and SO_2, pollutants that are strongly associated with fossil fuel combustion, has also been associated with an increased risk of chronic kidney disease[324].

X-ray showing lungs damaged by prolonged exposure to air pollution.



Lung Care Foundation, India

Dr. Yasmin Mahfouz
Paediatrician,
Evelina London Children's Hospital,
London, England

I am a Paediatrician working in the National Health Service (NHS) in London, with a focus on air quality and its impact on children's health. My research on air quality around schools in England has been presented at international conferences worldwide. Through my work with a specialised Paediatric Respiratory team in inner London, I became deeply concerned by the number of children admitted to high dependency and intensive care units due to severe asthma and respiratory exacerbations, often triggered by poor air quality despite optimal medical management.

Research has shown that children are especially vulnerable to the harmful effects of fossil fuel emissions and the poor air quality they create. With their less developed immune systems and rapidly growing respiratory tissues, children are more susceptible to damage from these pollutants. Higher exposure to fossil fuel pollution leads to increased rates of allergies, asthma attacks, severe respiratory illnesses, pneumonia, impaired growth, and cognitive delays. These impacts are not just theoretical; they are seen every day in pediatric clinics, on brain MRIs, and in studies tracking biological pathways. Even unborn children suffer, with pregnant women exposed to pollution experiencing intrauterine growth restrictions and changes to the placental network.

For children living in polluted areas, the consequences are severe: more frequent hospital visits, more time in Accident & Emergency (A&E), and less time in school or simply enjoying childhood. It's in the air we breathe, every minute, and yet many families remain unaware of the harmful exposure and long-term effects their children face.

Shockingly, 86% of new schools set to open in England will exceed all three WHO air quality targets, with no UK legislation in place to reduce exposure at these critical sites. This is a public health emergency that demands urgent action. We need compulsory air quality monitoring and alarm systems when pollutants exceed safe levels. We must legislate to fund and enforce modifications to public buildings and schools to protect children's health and development.

This issue impacts every aspect of our lives, and all public agencies must be involved in creating meaningful policy change. The threat is immediate and often invisible, and it's time for us to confront it head-on for the sake of our children and their future.

3.6.1 *Producing Electricity*

Burning coal, oil and gas for electricity, at large power plants or on a smaller scale with a generator, creates air pollution that can be harmful to health.

3.6.1.1 *Coal Fired Power Plants*

Although the share of electricity generated by burning coal has decreased from ~60% in 1900 to 35% in 2024, increases in total energy demand mean that coal combustion for energy production is the highest it has ever been[325–327]. This is concerning because coal combustion emits more particulate matter, pollutants and heavy metals per kilowatt hour than do other fossil fuels, resulting in increased health risks per unit of electricity[328].

Health risks associated with exposure to pollution from coal fired power plants (CFPPs) include respiratory illness (including lung cancer and asthma), increased cardiovascular disease (including heart attacks and strokes), reduced neurological health, increased premature mortality and higher infant mortality[329–332]. One US study estimates that 460,000 deaths between 1999–2020 can be attributed to coal PM2.5 and this same study suggests that coal PM2.5 carries twice the mortality risk of PM2.5 overall[333]. A modelling study focused on South East Asia estimated that if all existing and planned CFPPs are allowed to be operational, pollution from them will contribute to between 20,000 and 70,000 excess deaths in the region per year by 2030[334].

Systematic reviews exploring the impact of CFPP emissions on children's health found associations with negative birth outcomes including lower birth weight, smaller head circumference, and premature birth as well as "adverse effects on pediatric neurodevelopment... and pediatric respiratory morbidity"[335,336]. Studies in India found an association between the number of CFPPs in an area and an increased risk of anemia in young children (337).

Some of the most compelling evidence about the health risks of CFPPs comes from studies showing health improvements after a CFPP closes. After three CFPP closures Chicago, asthma related emergency department visits fell among young children (0–4) who lived near CFPPs, while there was no such change for children who lived farther away[109]. In Tongliang, China, a cohort of children born after a local CFPP closure had larger head circumferences, lower levels of DNA showing signs of alteration by Poly Aromatic Hydrocarbons in their cord blood, and better overall neurocognitive development than the cohort of children born while the plant was still operational[338,339]. Studies in California evaluating the combined closure of coal fire and oil power plants found plant closure to be associated with an increase in fertility and a reduction in preterm births in nearby communities[340,70].

3.6.1.2 *Oil and Gas Power Plants*

Since the 1960s, oil and gas have increasingly been burned to generate electricity[327]. While research on the health impacts of oil and gas power plants seems to be somewhat limited, a report from the Health and Environmental Alliance estimates that gas plant emissions cause 2,800 premature deaths in Europe as well as ~15,000 cases of respiratory illness including lung cancer, COPD, and childhood asthma, and incurring health and productivity costs in excess of 8.7 billion euros (US$9.11 million USD)[341].

3.6.1.3 *Fossil Fuel Powered Household and Single-building Generators*

Air pollution from household and single-building generators poses health risks, particularly in regions with unreliable electricity grids. These generators burn diesel, gasoline, or kerosene, emitting fine particulate matter (PM2.5), carbon monoxide (CO), nitrogen oxides (NOx), and volatile organic compounds (VOCs). Indoor and outdoor exposure to these pollutants increases the risk of respiratory diseases, cardiovascular conditions, and neurological damage, with children, the elderly, and those with preexisting conditions being most vulnerable[342,343].

Coal Fired Power Plant
Testimonial

Sandra Cortés Arancibia
Associate Professor,
UC Chile School of Public Health,
Santiago Chile

I consider myself a protector of nature, since I can remember, that is why I found it very rewarding to study plants, insects, and other animals and that is why I also understood early on that our lives depend on many other living beings.

When I visited the coal-affected communities that I have studied for the first time, I was very struck by their loneliness, the lack of green areas, of safe spaces where children could play. I also found it striking that in these places the color is lost, they turn gray, possibly due to the accumulation of particles, the permanent transit of trucks. On several occasions I have noticed the scarce presence of birds. It seems that in these places other living beings prefer to leave, but when the air improves, or the wind blows, they return.

In Chile there are 28 coal-fired thermoelectric plants, of which 3 were already retired in 2020, in compliance with agreements with the Ministry of Energy, and its Plan for the Retirement and/or

Reconversion of Coal Units. With this plan, it is expected to reach total closure by 2040. While this occurs, it is important to account for the damage to both the environment and people's health for a long period of time, since several of these thermoelectric plants will be closed. installed in the late 60s throughout the country. Exposure to pollutants associated with the burning of fossil fuels in the communities of northern Chile was demonstrated in our study carried out in 2019 for the Sustainable Chile Foundation, where we analyzed a time series of hospital discharges and deaths among the years 2010-2016. These indicators were obtained from public databases collected and validated by the Ministry of Health. In our design, we consider urban areas that are distinguished from others by having coal-fired thermoelectric plants, with known data on Particulate Matter emissions. In our analyses we were able to show that the risk of dying from any cause in the commune of Tocopilla is 22% higher than expected in Chile. Furthermore, people from Tocopilla have a 2.7 times higher risk of mortality from malignant tumors of the trachea, bronchi and lung, when compared to Chile. In the case of Huasco, another commune in the area that has coal-fired thermoelectric plants, its inhabitants have a 70% higher risk of dying from cardiovascular disease compared to the country and the region. Cardiovascular diseases are also part of the consequences of long-term exposure of the people who live in this commune, their occurrence being 4 times higher when compared to Chile and the Antofagasta region. These results represent an alert that we must heed, making it urgent to cut the exposure to emissions from this type of thermoelectric plants, through the replacement of coal with other cleaner fuels for the production of electricity. From international studies we already know that these types of exposures also affect the optimal development of our children. We also already know that there are clean and safe energies, which contribute to improving the respiratory and cardiovascular health of these communities.

In these communities we also face other challenges, it is not only environmental deterioration or their social conditions, we also know that they are more vulnerable to the various changes associated with the climate. It is urgent not only to reduce their vulnerability, but also to prepare them for the challenges associated with their adaptation to these changes, especially by strengthening health teams and carrying out public and private efforts with local authorities and the community.

3.7 Fueling Transportation

Traffic related air pollution (TRAP) describes all pollution created by motor vehicles, a significant proportion of which comes from fossil fuel combustion. TRAP exposure, which is frequently estimated using air pollution modelling or residential proximity to major roads, is associated with myriad negative health outcomes including increased risk of death from ischemic heart disease, lung cancer, and all cause mortality[344,345]. Exposure to TRAP during pregnancy is associated with an increased risk of low birthweight and small size for gestational age for infants, with an increased incidence of markers of cardiometabolic risk in childhood and with an increased risk of hypertensive disorders for pregnant people[85,86,92,346]. Children who are exposed to TRAP are at an increased risk of developing asthma and atopic eczema, and of reduced lung function and altered brain connectivity[31,347–350]. TRAP exposure has also been associated with increases in asthma related pediatric emergency department visits[107]. Prenatal and childhood exposure to high traffic density, and to traffic-associated NO_2 and benzene may be associated with an increased risk of childhood leukemia[89,102,105].

Exposure to traffic pollution poses health risks for adults as well. A UK study found that exposure to higher levels of NO_2 from vehicle emissions was associated with increased risk of heart failure[351]. Studies in China and Taiwan found that residential or activity based proximity to many busy roads was associated with an increased risk of developing COPD[352,353]. Studies in the US and China suggest that increased exposure to traffic related CO and PM2.5 is associated with an increased risk of developing Parkinson's disease[142,354,355]. Residential road proximity may also be associated with an increased risk of developing type 2 diabetes[356]. And while exercise is usually beneficial for health, a 2019 meta-analysis suggests that exercising in places with high traffic pollution may pose more risks than benefits[357].

Some transportation focused research has focused specifically on exposure to diesel related pollution. Diesel exposure in the prenatal and childhood period is associated with increased risk of preterm birth and increased aeroallergen sensitization in early childhood[358,359]. Time limited exposure to diesel exhaust while travelling on diesel powered trains was associated with reduced lung function and altered heart rate[360]. Workers whose work exposed them to elevated levels of diesel exhaust seem to be at greater risk of developing colorectal cancer and dying from lung cancer[361,362].

Communities living near busy roads in Ennore, North Chennai, India are exposed to traffic-related air pollution.

Adhil
North Chennai, India

ON THE FRONTLINES

Rosamund's Story: Deadly Traffic Pollution in London

Rosamund Adoo-Kissi-Debrah's eldest daughter Ella Roberta was a creative, energetic and happy child who loved football, biking, swimming, singing and dancing. A few months shy of her seventh birthday, Ella developed a persistent cough, which was eventually diagnosed as asthma. Ella's asthma caused severe coughing fits and coughing syncope, a condition that caused her to lose consciousness from coughing. Rosamund had to learn how to resuscitate her daughter so that Ella would make it to hospital alive, and her younger siblings had to learn what the warning signs were, when to call for help. After her diagnosis, Ella spent the next two years in and out of hospital, surviving nearly thirty emergency hospital admissions and five comas. Ella had her final, fatal asthma attack shortly after her ninth birthday on 15th February 2013.

While Ella was alive, Rosamund and Ella's medical team struggled to identify her asthma triggers. The first clue came when the pathologist conducting the inquest likened Ella's lungs to those of a smoker and suggested that Ella's lungs had been harmed by "something in the air." No one in the family was a smoker. Rosamund began a years-long battle to discover what that "something" might have been. Finally, through the advice of eminent researchers and scientists, the legal team working on Ella's case found that the timing of Ella's hospital admissions coincided with spikes in air pollution near her home. The night Ella died, air pollution levels were especially high.

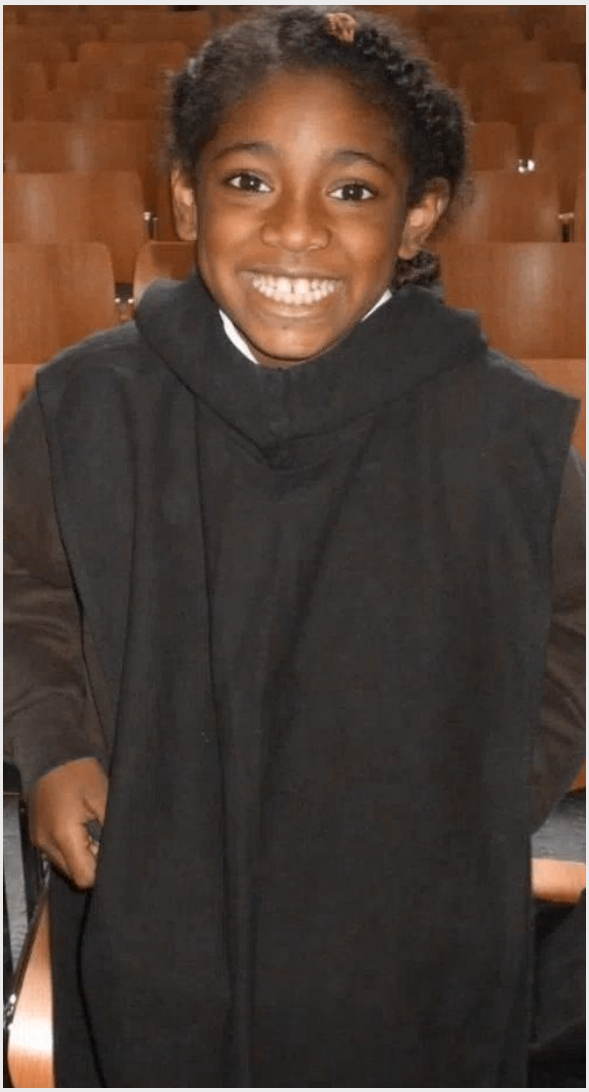
Rosamund's family lives near the South Circular, an extremely busy road in South London. Ella passed the South Circular each day on her way to and from school, and breathed air polluted by the cars, trucks and other vehicles each time she left the house[363]. Rosamund notes that around her family's home, air pollution levels frequently exceed the air quality standards recommended by WHO[364].

Rosamund often reiterates the words of the Coroner from Ella's second inquest: "if it wasn't for the excessive traffic emissions where we live, not only would Ella not have got asthma at all, she never would have died on that fatal night"[364]. Rosamund's tireless advocacy resulted in a remarkable outcome – Ella is the first person in the world to have "air pollution" listed as a cause of death on her death certificate.

No parent should have to bury their child. In Ella's memory, Rosamund has become a powerful advocate for clean air, calling on governments to protect the health of children by ensuring the right to clean air and enacting measures to reduce traffic emissions and other air pollution.

More information: https://www.ellaroberta.org/

Ella Roberta suffered a fatal asthma attack in 2013. The coroner's report listed excessive traffic emissions.



Ella Roberta Foundation

3.8 Residential Heating and Cooking

In recent years, a spotlight has been shone on the health impacts of gas stoves in homes. Estimates from the U.S. and Australia suggest that in-home gas stoves may be responsible for 12% of childhood asthma cases, possibly due to the release of NO_2[365–367]. Indoor NO_2 from cooking with gas, which can exceed the WHO's 1 hour exposure guideline when the stove is in use, also seems to be associated with increased asthma wheeze in children[368,369]. One US study found that families living in smaller homes were more exposed to concerning levels, and found that lower income households and households facing historic racial discrimination (Black, Native and Hispanic households), were more exposed to NO_2 than were wealthier households or white households[367]. Although using the venting hood or opening windows while cooking may reduce the respiratory risk, in places where healthier options are accessible, there is little reason to risk a family's health by installing a gas stove. Given that gas stoves also release methane, a potent greenhouse gas, people should be supported to transition away from gas stoves to non-polluting health protective options as quickly as possible[370].

COOKING WITH COAL HARMS HEALTH, BUT LPG IS NOT THE ANSWER

It is well documented that burning coal indoors for cooking and heating is associated with adverse health outcomes. These include an increased risk of "lung cancer in never smokers", increased risk of death from cancer and cardiovascular diseases and increases in all cause mortality[371–374]. In Mongolia, seasonal increases in coal use for heating are associated with reduced fertility[375]. Prenatal exposure to coal-related indoor air pollution (including chromium and cadmium) is associated with an increased risk of neural tube defects, orofacial clefts and low birth weight[54,82,83,376].

As with coal, burning wood, biomass, and other solid fuels indoors is associated with negative health outcomes[377–379]. International health advocates have called for an urgent move away from solid fuels. Within this effort, liquified petroleum gas (LPG) has been promoted as a "clean" cooking fuel, especially in low income countries.

Some studies suggest there are benefits from switching from solid fuel to LPG stoves, including measured reductions in indoor PM2.5 and NO_2[380–382]. In one large multi-country, LPG stoves did not deliver the hoped for improvements in measured health outcomes, however this may be due to confounding variables including complications related to the COVID-19 pandemic[383–387].

VikramRaghuvanshi
iStock

Some studies have suggested that there are barriers to LPG stove use, with some participants in a study in Ghana noting that LPG is expensive, hard to access, and poses safety concerns[388,389]. Other research suggests that these concerns are warranted – hospital studies in Nigeria, Turkey, India and China note that increasingly LPG stoves are a cause of severe burns, mostly due to gas leaks and explosions[390–395].

Given these risks and access challenges, it seems that any benefits offered by LPG stoves, including asthma reduction and less time spent by women gathering firewood and cooking, could be provided more safely by other smokeless cooking options[396]. Where possible, people should be supported to shift as quickly as possible away from coal and biomass to electric or induction stoves, skipping LPG and its risks, all together.

3.9 Waste: Storage and Disposal

Fossil fuel extraction and processing result in unneeded by-products including coal ash, contaminated water and excess gas. These waste products can pose environmental and health risks, due to inefficient or unsafe waste disposal practices, such as excess gas flaring, and due to risky waste storage practices, as tailings ponds for produced water.

3.9.1 *Contaminated Water*

In the service of fossil fuel extraction and processing, massive amounts of fresh water are mixed with chemical and other components. For example, hydraulic fracturing uses water mixed with sand and a potentially "proprietary" array of chemicals to break apart underground rock formations to release oil and gas[398]. Extracting oil and gas can also create "produced water" as existing ground water is pushed to the surface along with the target fossil fuel[399]. Produced water may contain hydrocarbons, salts, bacteria, heavy metals, radioactive materials, and fluids or chemicals used during the extraction process[399,400].

Some percentage of the water produced by hydraulic fracturing is re-used for further fracking, and some is treated and released into waterways, occasionally with concerning results for local drinking water[401]. Fracking wastewater that cannot be reused or treated is often injected deep underground or stored in surface ponds to evaporate.

Waste water resulting from oil sands processing that cannot be treated is similarly held in enormous tailings ponds. Wastewater spills and leaks are not infrequent, and there are ongoing concerns that stored water leakage may contaminate streams, lakes, aquifers and the surrounding environment[402]. These concerns are amplified because extraction companies have an unreliable history when it

AROUND THE WORLD

Coal Slurry Spill in Borneo, Indonesia (2021)[397]

In 2021, a coal-slurry spill in Indonesian Borneo's Malinau River, originating from PT Kayan Putra Utama Coal's waste facility, killed hundreds of fish and forced a shutdown of water lines to households. The company apologised for the incident and pledged to provide clean water to affected residents. Industry watchdogs and locals report that such incidents are frequent in North Kalimantan province, a major coal mining hub.

comes to reporting accidents. For example, it took nine months for Imperial Oil (a subsidiary of Exxon/Mobil) to inform the nearby municipality and First Nations groups that a leak at their facility contained tailings spillage, nine months during which people fished, hunted, and harvested food on potentially contaminated lands[403]. When it comes to fossil fuel waste water management, hoping for the best is an unacceptable public health strategy.

3.9.2 *Coal Ash*

Health studies conducted in central India have documented elevated rates of chronic conditions among communities living near coal mines and coal ash ponds. Reported health issues include hair loss, brittle hair, musculoskeletal pain, dry or discolored skin, cracked soles, and persistent cough. Increased incidences of kidney and gastrointestinal disorders have also been observed[404]. The U.S. Environmental Protection Agency (US EPA[405]), in its report, "Human and Ecological Risk Assessment for Coal Combustion Wastes," states that living next to a coal ash disposal site can increase the risk of cancer or other diseases, especially if people live near an unlined wet impoundment that contains coal ash commingled with other wastes. According to the report, people in those circumstances have as much as 1 in 50 chances of getting cancer from drinking water contaminated by arsenic, one of the most prevalent pollutants found in coal ash. Along with an increased risk of cancer from toxic heavy metal exposure, coal ash can affect human development, create lung and heart problems, cause stomach ailments, and contribute to premature mortality[406,407].

People living next to coal ash disposal sites can have as much as a 1 in 50 chances of getting cancer from drinking water contaminated by arsenic.

Breaches in fly ash ponds have been reported from many sites resulting in loss of lives and livestock, property damage, and contamination of vast tracts of agricultural and residential land rendering it unfit for habitation[408].

Coal ash from power plants is discharged into nearby rivers and lakes in Ennore, North Chennai.

Amirtharaj Stephen

Neha Dadsena
Public Health Expert,
Chhattisgarh, India

Neha Dadsena

I have been deeply engaged with communities suffering from industrial pollution, and the consequences are alarming. In areas near coal plants and mining operations, respiratory illnesses are rampant, with many families experiencing a rise in birth defects and skin infections. The air quality is visibly deteriorating, leading to frequent health issues. The pollution from fossil fuel activities profoundly impacts the health of local residents, particularly children and the elderly, who are increasingly affected by asthma, bronchitis, and other respiratory ailments. Additionally, water contamination from improper waste disposal is causing widespread gastrointestinal problems and skin diseases.

Immediate action is crucial. Stricter environmental regulations and rigorous compliance monitoring can dramatically reduce these health risks. Moreover, educating community members about environmental health and preventive measures is essential to mitigate the adverse effects. The health and well-being of these communities depend on our swift and decisive action.

3.9.3 *Gas Flaring*

Flaring is a waste management method where excess gas produced or released during oil and gas extraction or refining is burned off, often as a cost saving measure[409]. Designed as an emergency safety measure to manage unplanned over-pressurization, flaring has increasingly become a routine operation at extraction sites, sometimes as a cost-cutting measure, allowing facilities to avoid the expenses associated with capturing and processing these gases[409]. In addition to releasing CO_2 and methane, flaring can produce black carbon, NO_x, SO_2, VOCs including benzene and other pollutants, putting the health of surrounding and downwind communities at risk[410]. As with many oil and gas activities, flaring seems to impact birth outcomes – exposure to frequent nightly flaring may be associated with an increased odds of preterm birth[411]. Children exposed to benzene from exposure to daily flaring were found to have altered liver enzymes and blood cells[412]. Flaring also seems to negatively impact respiratory health. A study in North Dakota found that small increases in the amount of flared gas were associated with similar increases in hospital visits for respiratory concerns, and researchers in Nigeria found an association between flaring and respiratory illness in young children[413,414].

Flaring is also an environmental justice issue. Researchers note that hispanic communities in Texas, and economically disadvantaged communities and communities of color in North Dakota were more likely to be exposed to flaring than their white or wealthy counterparts[224,413].

Children exposed to benzene from exposure to daily gas flaring were found to have altered liver enzymes and blood cells.

Gas flaring has become a routine practice, releasing pollution into the air.

Ted Auch, FracTracker Alliance, 2018.

ON THE FRONTLINES

Ali's Story: BP's Gas Flaring in Iraq

Ali Hussein Juloud's life, though tragically short, is an example of resilience and a call to action for justice[415]. Born and raised in Rumaila, Iraq, at fifteen Ali was diagnosed with Acute Lymphoblastic Leukaemia (ALL), a childhood cancer that is associated with benzene exposure[416].

ALL and other cancers are common in Ali's community. One environmental scientist described cancer as being "like the flu" for local families[417]. Ali's illness was not a random misfortune, but rather a consequence of exposure to chemicals produced by the relentless gas flaring operations by British Petroleum (BP). These operations, conducted in unlawful proximity to his home, released carcinogenic pollutants into the air, poisoning the community and its children[418].

Despite his deteriorating health, Ali refused to be a silent victim. He became a determined advocate, documenting his daily struggles through video diaries. His courage caught the attention of the BBC, and his story was featured in the powerful documentary "Under Poisoned Skies[419]." The film revealed the grim reality of Rumaila, a region with the highest levels of gas flaring in the world, and showcased the health crisis caused by these operations.

Ali's fight was not just against his illness but against the powerful corporations responsible for the environmental disaster. His unwavering spirit led him to share his story at COP27 in Egypt, where he presented the documentary to a global audience. His testimony called on the world to confront the destructive impact of fossil fuels and the gross injustice faced by those living near extraction sites[420].

Ali's fight ended on April 21, 2023, when he succumbed to leukaemia[421]. His death was a profound loss to his family, community, and all who knew him. However, his legacy lives on. Ali's fight continues, carried forward by those inspired by his bravery and determination. His life serves as a powerful reminder of the urgent need to hold polluters accountable and to protect the health and well-being of vulnerable communities worldwide.

Ali Hussain Julood from Iraq was exposed to gas flaring and later died from leukemia.

Hussein Faleh, BBC

3.10 Decommissioning and Site Remediation

The final phase of the fossil fuel life cycle—decommissioning and site reclamation—presents significant risks and challenges[422]. This phase involves dismantling and removing fossil fuel infrastructure, as well as restoring the site to a condition that is safe for future use. If remediation and decommissioning efforts are not thorough, residual pollutants can remain in the soil and water years after an extraction site, production facility, power plant or gas/petrol station has been shut down. These pollutants can include heavy metals, hydrocarbons, VOCS including benzene, and other pollutants used or produced during fossil fuel life cycle[423–426]. In addition, the IEA estimates that abandoned oil and gas wells and coal mines produced about 8 metric tonnes of methane in 2024 alone[427]. Methane emissions from abandoned sites not only contribute to climate change, they put people living and working near these sites at an increased risk of methane exposure and gas explosions[428]. Individuals living near abandoned/ orphaned sites or improperly remediated fossil fuel sites can be at risk of long-term exposure to residual pollutants[429]. Exposure to certain toxic substances found around these sites, such as benzene and heavy metals, can increase the risk of developing cancer[276], cognitive impairments, and other neurological issues[430].

The IEA estimates that abandoned oil and gas wells and coal mines produced about 8 metric tonnes of methane in 2024 alone.

Decommissioning and remediating fossil fuel projects also incurs very high costs[431], compounded by a process often characterised by opacity and lack of accountability. Companies who have made considerable profits extracting fossil fuels often shirk their remediation responsibilities, leaving communities to face the health risks of their incomplete remediation efforts and unaddressed contamination[432].

Heavy machinery works around the clock at a coal ash–contaminated site in Korba, India.

Ishan Tankha and Clean Air Collective

HEALTH HARMS OF FOSSIL FUEL FROM EXPLORATION TO CLOSURE

GLOBAL CLIMATE & HEALTH ALLIANCE

At every stage of their lifecycle, fossil fuels cause severe health harms, **many of which are long-lasting and bioaccumulative**

Extraction

Mining, drilling, fracking:
Releases dust, methane, VOCs, heavy metals, radioactive materials

Refining & Processing

Oil refineries, gas processing plants, coal washing:
Volatile Organic Compound benzene, toluene, PAHs, SO_2, NO_2

Transport & Storage

Pipelines, shipping, trucking, storage tanks:
Leaches of VOCs, methane, and co-pollutants

Combustion

Power plants, vehicles, industry, home heating:
$PM_{2.5}$, Black Carbon, Ozone, NO_2, SO_2, PAHs, CO

Waste & Post-combustion

Coal ash ponds, tailings, contaminated water:
Leaks arsenic, mercury, lead, chromium, cadmium, and other toxic residues

#Cradle2Grave

Dr. Fithriyyah Iskandar
Bhayangkara Pontianak
Hospital, Indonesia

I am a Medical Doctor and environmental youth activist from Indonesia. I have been actively advocating for the right to a safe, clean, healthy, and sustainable environment at the regional and international levels. I am also a member of the UN Women 30 For 2030 Network and Youth Advisory Group at the London School of Hygiene and Tropical Medicine Centre for Climate Change and Planetary Health. I was a fellow in YSEALI Academic Fellowship Program 2021 in East-West Center, USA on Environmental Issues and am now a member of Regional Executive Body in ASEAN Youth Forum and represents them to the ASEAN Environmental Rights Working Group on behalf of the youth group representative. My aspiration is to create a healthy and just future for everyone.

Borneo is a land with many fossil fuel companies operating, mainly to harvest coal from the deep part of the island, particularly in the Eastern province. West Borneo has three power plants that largely depend on coal imports from East Borneo, home to the largest coal companies. One of these power plants, located in the Pontianak area, produces ash and

smoke that are visibly emitted daily as I and people pass by the road. Recently, there has been a move by some coal companies to establish operations in West Borneo, which has raised community concerns about the potential impact, despite the promise of job opportunities and welfare to the people[433,434].

The coal industry is widely known for its impact on the environment and human health, it causes deforestation and loss of natural wildlife habitats, destruction of the land, and produces pollutants such as Fly Ash and Bottom Ash (FABA) which contaminates soil and water around the area. In the context of human health, there are various effects resulting from the toxic substances, ozone, and heavy metals. Severe health impacts are caused by microscopic particles (PM2.5) that form from the emissions of sulfur, nitrogen oxides, and dust. These fine particles penetrate into the lungs and bloodstream, causing death and various health problems. In East Borneo, there are many cases where the community complained about the impact caused by the coal mine in the area, including environmental damage and a pungent odor, especially at night, which has been disturbing the local community[435].

One of the case studies provided by Greenpeace Indonesia is Tanjung Jati B, a 2640 MW coal-fired power plant in Jepara, Central Java, with four units that have been operational since 2006-2012. The emissions from the Jepara power plant are estimated to cause 1,020 premature deaths per year. This includes 450 deaths due to stroke, 400 deaths due to ischemic heart disease, 60 deaths due to lung cancer, 90 deaths due to chronic respiratory diseases, and 20 child deaths due to acute respiratory infections[436].

Therefore, having the fact that the coal industry still poses harm to people, animals, and humans, the worries of the West Borneo community to welcome the coal companies on their land is justifiable. Additionally, as the main home of tropical biodiversity, Borneo's natural habitats must be protected from industry, if it's not, then what we're going to achieve is only the loss of biodiversity and violations of human rights to a healthy environment.

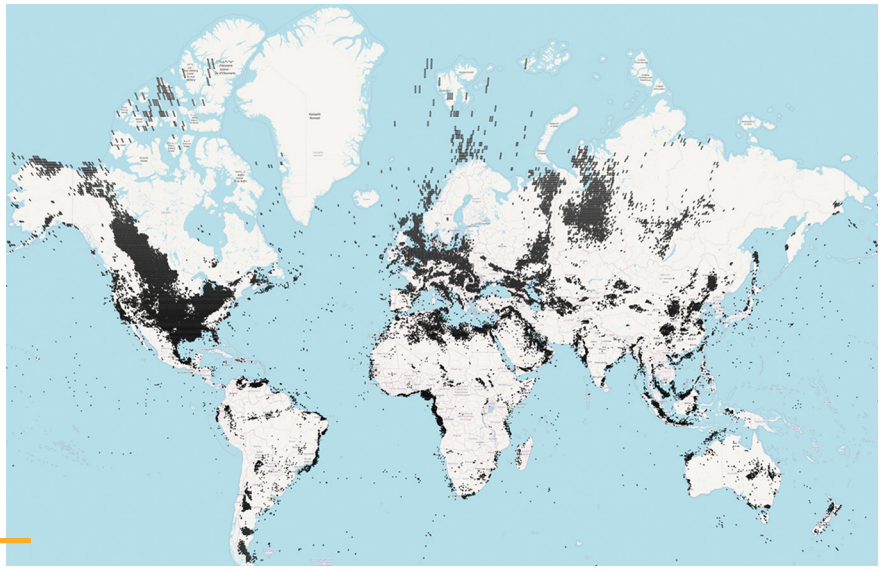
As Indonesia is progressing to achieve net zero emissions, serious and firm actions must be implemented. Transitioning to more green and sustainable solutions is needed to make a healthy environment that can lead to healthy people

Fossil Fuel Atlas

A project of Stockholm Environment Institute, Institute for Governance and SustainableDevelopment, and Global Energy Monitor

https://www.fossilfuelatlasportal.org/catalogue/#/map/582

Oil Wells
Global Coal Mines
Global Lease Blocks
Oil & Gas Extraction
Gas Pipelines
Oil Pipelines



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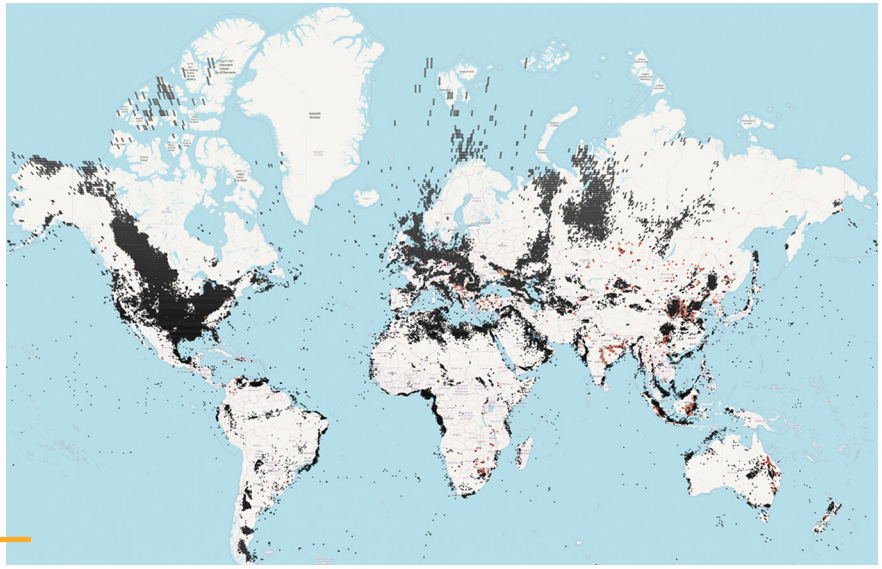

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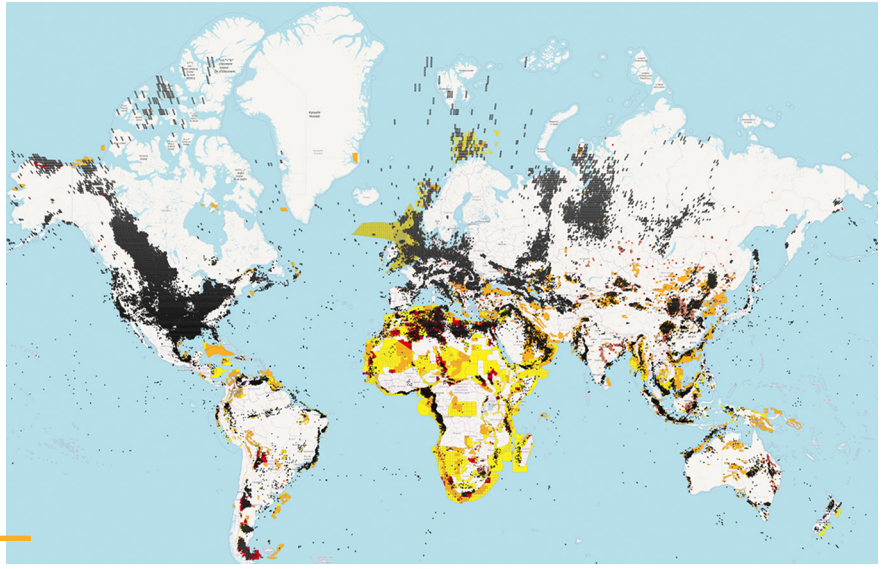

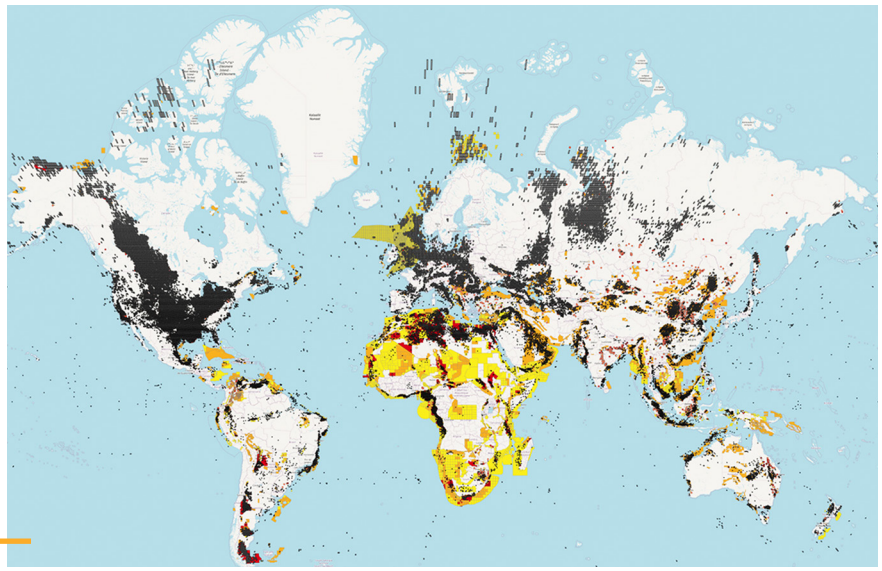

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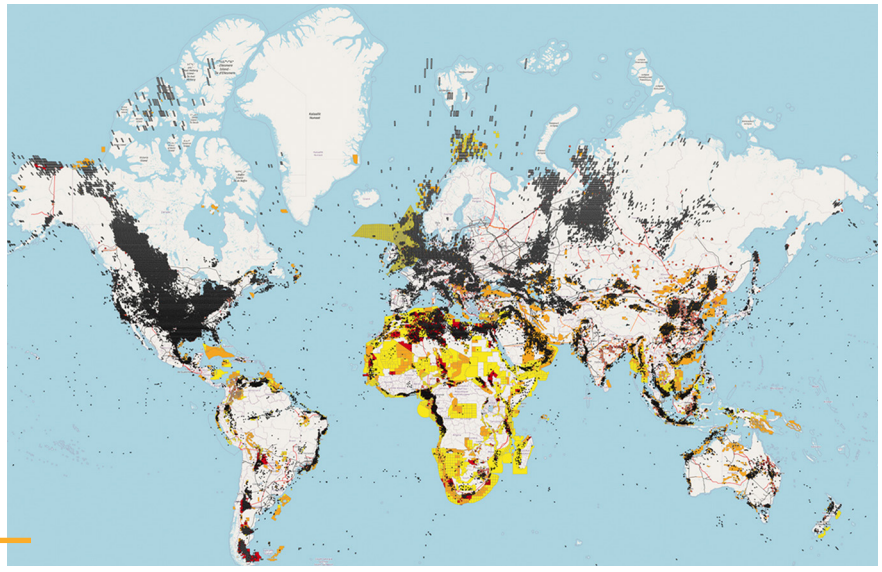

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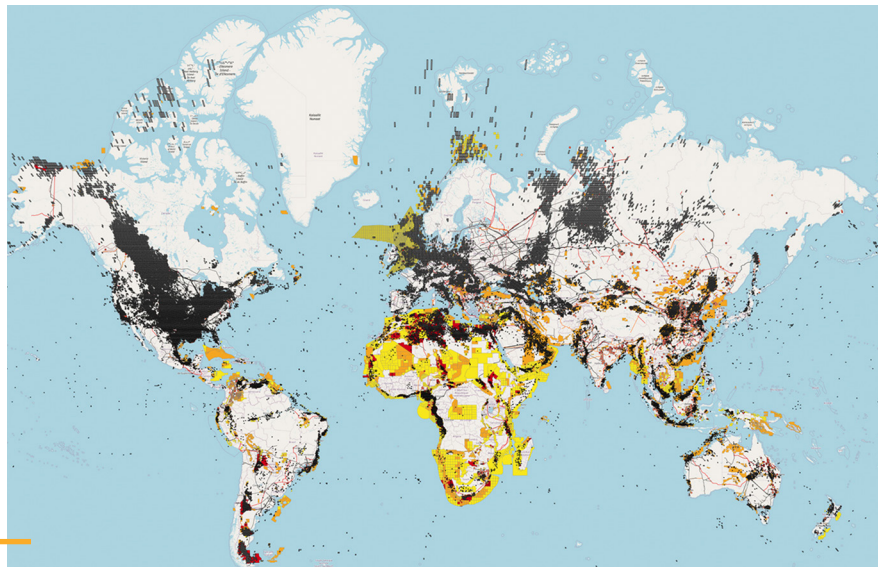

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Dr. Linda Rudoph
Steering Committee, Fossil Free For Health, US

We're all in this together. We must unite to fight for health, justice, and a livable future for our children and grandchildren.

I'm a public health physician who has lived in Oakland, California for decades. It's a vibrant, diverse city, but also one of deep inequality. Nowhere is this more evident than in West Oakland, a community burdened by some of the highest levels of air pollution in the region. Freight trucks, freeways, industry, and the operations of the Port of Oakland contribute to a toxic mix that has left generations suffering from asthma, heart disease, and other serious health conditions. Despite years of community organizing, harmful projects keep coming.

In 2012, a developer secured approval for a bulk commodity export terminal at the decommissioned Oakland Army Base—without mentioning coal. Shortly after, Kentucky-based Bowie Resource Partners sought to use the terminal to export Utah coal to Asia. The coal would be extracted from mines in Utah, transported by rail through communities in Nevada and California, stored at the Oakland terminal, then loaded onto ships bound for Asia. At every step—extraction, transport, storage, and combustion—people would be exposed to pollution with devastating health consequences.

When Oakland residents learned of the coal export plan, hundreds mobilized. I was part of a group that conducted a health impact assessment that found that coal transport would increase exposure to PM2.5, mercury, and lead—pollutants linked to respiratory diseases, neurological damage, and cardiovascular conditions.

In 2016, I traveled to the Philippines for a workshop on health impact assessments and energy policy. In Bataan province, I visited a small rural town where homes had been demolished to expand a coal-fired power plant. The air was thick with pollution. Coal dust settled on every surface—homes, food, even the vegetable gardens that sustained local families. Residents, especially children, suffered from severe asthma and other illnesses.

One of the local organizers, Gloria Capitan, was a grandmother who had seen the health impacts firsthand. She began speaking out, filing complaints, organizing petitions, and mobilizing her neighbors. Her advocacy forced the company to cover its exposed coal piles, reducing airborne pollution. But she paid the ultimate price—shortly after my visit, Gloria was murdered, one of many environmental defenders silenced for challenging corporate power.

Meanwhile, Bowie Resource Partners funneled tens of thousands of dollars to Utah legislators to pass a March 2016 bill allocating US$53 million for Oakland port expansion. At a climate and health conference in Salt Lake City the following month, I met organizers from Utah Physicians for a Healthy Environment, who, alongside community groups, condemned the use of public funds to support coal exports—citing the health risks of coal dust exposure and the industry's global climate harms.

In June 2016, Oakland's City Council unanimously banned coal handling at the port. Yet, the terminal's fate remains uncertain amid business failures, persistent opposition from local officials and activists, and ongoing legal battles. In 2018, the City revoked the developer's lease. But a Kentucky bankruptcy judge—2,000 miles away—recently allowed a hedge fund holding a sublease to proceed with a billion-dollar lawsuit against Oakland for blocking coal exports.

What have I learned from these different experiences? Across the world, fossil fuel expansion follows the same pattern: profit-driven projects extract resources from one region, transport them through another, and burn them elsewhere—leaving a trail of damage in their wake.

But we are not connected only by this chain of harms. We are also connected by resistance. In Utah, physicians fought against coal exports. In Oakland, community advocates organized and won policies to stop coal exports. In Bataan, Gloria Capitan's legacy lives on in those continuing to fight for clean air.

These struggles are not isolated—they are part of a global movement demanding health, justice, and an end to fossil fuel dependence. Breaking the fossil fuel supply chain isn't just an environmental necessity—it's a public health imperative. Our collective power lies in organizing, standing together, and refusing to accept that our communities are sacrifice zones. We must fight back, across borders and generations, to build a future that prioritizes people over polluters.

Fossil Fuel-Based Products:
Petrochemicals, Plastics and Agrochemicals

Petrochemicals

Some fossil fuels are converted into petrochemicals which are used for a vast array of products and purposes. Petrochemical workers were at an increased risk of developing oral and pharyngeal cancers[147]. Meta-analyses found that people living within 8km of a petrochemical industrial complex had an increased risk of developing leukemia[437,438]. Maternal proximity to petrochemical plants may be associated with miscarriage and stillbirth[69].

Plastics

As the world shifts towards renewable energy and reduces reliance on fossil fuels for electricity, plastic has become "Big Oil's Plan B". The industry is increasingly turning to plastic production[439] and other petrochemicals (such as fertilisers, pesticides, and industrial chemicals) as a means to sustain its profits.

The full lifecycle of plastics comprises the extraction of raw materials; the production of polymers, the manufacture of products, sales and distribution; use and maintenance; recycling, reuse, recovery or final disposal; and the persistence of plastics in the environment and in the human bodies. There is a common misconception that plastic pollution is merely a waste issue. In fact, plastics pollute throughout their entire life cycle.

Climate Impacts of Plastic Production

In 2019, the production of monomers and polymers —the building blocks of plastics—generated 2.24 gigatons of CO_2e, accounting for 5.3% of global greenhouse emissions[440]. The growth in plastic production is expected to accelerate, increasing by up to 4% annually, tripling by 2060, and reaching approximately 1 billion tons per year[441]. If this trend continues, plastic production could consume up to 25% to 31% of the remaining global carbon budget[440]. Plastics would thus surpass even the transport and energy sectors in terms of their share of global greenhouse emissions.

Health and Economic Impacts of Plastic-Associated Chemicals

At every stage of its lifecycle, plastic poses distinct risks to human health, from exposure to plastic particles themselves, and to plastics-associated toxic chemicals (e.g. toxic flame retardants, certain UV stabilisers, per- and polyfluoroalkyl substances (PFASs), phthalates, bisphenols, alkylphenols and alkylphenol ethoxylates, biocides, certain metals and metalloids, polycyclic aromatic hydrocarbons)[442].

Most people worldwide are exposed at multiple stages of the plastic lifecycle[443]. Recent studies have identified over 16,000 chemicals in plastics, with at least 4,200 of them known to be toxic[444]. Alarming evidence shows that plastic particles and their associated chemicals can be found throughout the human body, including in the brain, heart, lungs, and even in placenta and breast milk, leading to profound negative health impacts.

The economic costs of these health impacts are staggering. In 2015, the global health-related costs of plastic production exceeded US$250 billion[445]. In the U.S. alone, the health costs associated with plastic-related chemicals, such as PBDE, BPA, and DEHP, surpassed US$920 billion[445].

Rising global temperatures may exacerbate the toxicity of certain chemicals in plastics, increasing their harmful effects on the human body[445,446]. Higher temperatures can also reduce the ability of organisms to cope with these toxins, making them more vulnerable to their adverse effects[447]. Additionally, some chemicals in plastics can impair the body's ability to regulate temperature, further endangering individuals in a warming world[448].

The intersection of these issues highlights the urgent need to address plastic production as a key component of both climate and public health strategies.

Agricultural Chemicals

Fossil fuels are used in the production of chemical fertilisers and pesticides, together known as agrochemicals. Agrochemicals are an integral part of a monoculture-based industrial food system and are known to contribute to catastrophic biodiversity collapse and toxic pollution. Synthetic nitrogen fertiliser and most pesticides are fossil fuels in another form, driving fossil fuel expansion even as other sectors started to decarbonize.

Climate and Environmental Impacts of Agrochemicals

Making ammonia, the basis for synthetic nitrogen fertilisers, requires fossil gas or coal as feedstocks, as well as a large amount of energy to produce the high temperatures and pressures needed for the reaction process. Ammonia produces more greenhouse gases than the production of any other industrial chemical, including making steel or cement[449]. However, less than 40% of the emissions related to synthetic nitrogen fertilisers comes from the production stage. Around 60% comes for their use[450]. This is primarily because microbes in the soil break down nitrogen fertilisers to produce nitrous oxide (N_2O) – a climate "super pollutant" nearly 300 times as powerful as CO_2[5]. Globally, the synthetic nitrogen fertiliser supply chain represents 10.6%

of agricultural emissions and 2.1% of global GHG emissions - more than commercial aviation[450]. In Korea, a community near a fertilizer plant had an increased risk of all cancers including non-melanoma skin cancers and gastric cancers[451].

Beyond the climate impacts, synthetic nitrogen use in farming is behind a cascade of environmental impacts including soil acidification, inland and coastal water eutrophication (over-enrichment with nutrients, resulting, e.g., in algae growth), biodiversity loss, and impacts on regional air quality[452].

Health Impacts of Agrochemicals and Industrial Agriculture

Synthetic nitrogen fertilisers and chemical pesticides make the current industrial food system, which is based on a few crops and intensive grain-fed livestock, possible in the first place – with known adverse health outcomes[453]. The IEA projects petrochemicals will account for more than two-thirds of global oil demand growth through 2026, and could account for more than half (55%) of all petroleum usage by 2050[454]. 40% of petrochemicals are food-related plastics and fertilisers[455].

Moreover, overuse of synthetic fertilizers depletes the nutritional quality of crops, reducing essential micronutrients[456–460]. Some research has found pesticide exposure to be associated with adverse reproductive and developmental health effects across the life course for both males and females. In women, such exposures can disrupt multiple stages of reproductive function, while in men, they have been linked to reduced fertility and sterility[461].

This convergence of interests between fossil fuel companies and agrochemical producers is reflected in deep interlinkages between the industries themselves. While the role of oil and gas companies in the growing plastics crisis is well-documented, links between the fossil fuel and agrochemical industries have received far less attention.

Drawing on the fossil fuel playbook, agrochemical companies argue that they can eliminate the climate impacts of chemical fertiliser production through widespread deployment of carbon capture and storage (CCS), a technology with a long history of overpromising and under-delivering[462,463]. By positioning this so-called “blue” ammonia as a clean fuel for speculative use for maritime shipping or as hydrogen carrier as well as a clean fertiliser[449], both industries, fossils and agrochemicals, are manoeuvring to exploit not only the marketing potential of claimed sustainable fuels and fertilisers, but also significant government subsidies for infrastructure investments in the name of climate mitigation[463].

After Hurricane Katrina in Louisiana, oil spills from nearby refineries added to the damage caused by wind and floods.

Denny Larson, 2005

04 Multiplied Risk: Fossil Fuel and the Climate Crisis

Fossil fuels are the primary source of greenhouse gas emissions, which are driving the climate crisis. This crisis presents a growing number of risks to human health[464]. In many cases, the health harms caused by fossil fuels and the climate impacts they generate are not separate—they interact and reinforce one another, creating a compounding threat.

4.1 Amplified Health Risks

Fossil fuel-driven climate change amplifies health risks, creating a compounding crisis. Warmer temperatures worsen air pollution, increasing ground-level ozone and PM2.5, which contribute to respiratory and cardiovascular diseases. Wildfire smoke and fossil fuel emissions can combine, pushing air pollution to hazardous levels. Extreme heat interferes with one's ability to work, causes heat exhaustion and heat stroke and exacerbates many chronic diseases.

The combined effects of wildfire smoke and extreme heat are particularly dangerous. A recent study from British Columbia found that mortality during these overlapping events was more than seven times higher than under normal conditions[465].

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At the same time, climate change is shifting disease patterns—such as the spread of vector-borne diseases like malaria and dengue—place additional strain on health systems. Disruptions from storms, floods, and extreme weather events can damage hospitals, reduce access to care, and displace vulnerable populations, compounding public health emergencies.

4.2 Cascading Risks Prompted by Fossil Fuel Infrastructure

Fossil fuel infrastructure—refineries, pipelines, power plants, and storage depots—is increasingly at risk from the climate crisis it helps drive. Located disproportionately in coastal and low-lying areas, these facilities are exposed to intensifying weather extremes, including hurricanes, cyclones, heatwaves, and sea level rise[414]. When compromised, these facilities can release toxic chemicals, causing environmental contamination, health risks and community displacement[467,468]. The disruption of healthcare services during extreme weather events may mean that people facing toxic exposures cannot access care. Economic impacts include costly repairs, environmental clean up and energy price volatility[469]. Fossil fuel companies rarely bear the full cost of cleanup, repair, and remediation following climate-related disasters, shifting the burden to taxpayers, local communities, and governments.

4.2.1 *Cascading Risk: Hurricanes, Cyclones and Typhoons*

Storm-related damage of fossil fuel infrastructure has led to major health and environmental crises. On the U.S. Gulf Coast Hurricane Katrina in 2005 damaged refineries and chemical plants, causing oil spills and toxic emissions linked to respiratory illness, gastrointestinal infections, and skin conditions[470,471]. Hurricane Rita soon followed, releasing over 600 hazardous substances, exacerbating respiratory and skin conditions, and increasing the risk of waterborne illnesses[472]. Estimates calculate that the amount of oil spilled was about 10.8 million gallons – similar to the amount spilled by the 1989 Exxon Valdez disaster into the Prince William Sound in Alaska[473].

4.2.2 *Cascading Risk: Heat*

Heat extremes can overheat power plants, reduce refinery efficiency, and weaken pipelines, increasing public health risks connected with equipment failures, leaks, explosions. For example, the Middle East is home to some of the world's largest oil and gas reserves, with major fossil fuel infrastructure concentrated in countries including Saudi Arabia, Kuwait, the United Arab Emirates, and Iraq[476].

Across the region, fossil fuel infrastructure is increasingly threatened by rising temperatures, water scarcity, and sandstorms – conditions that are intensifying with climate change[481]. In Saudi Arabia, refineries in coastal cities like Jubail and Yanbu face heightened risks of equipment failure, oil spills, and fires due to reduced cooling efficiency in high temperatures[478]. In southern Iraq, particularly around Basra, extreme heat, frequent power outages, and inadequate infrastructure has led to unsafe refinery shutdowns, toxic chemical releases, and worsened public health outcomes, including heat-related illnesses and respiratory conditions[479,480].

THE PHILIPPINES: TYPHOONS X OIL DEPOTS AND COAL-FIRED POWER PLANTS

In the Philippines, which is hit by an average of 20 typhoons annually, much of the fossil fuel infrastructure, such as the oil depots in Batangas and coal-fired power plants in Luzon, are at constant risk. Typhoon Haiyan in 2013, one of the strongest storms ever recorded, caused massive damage to a power barge in Estancia town, spilling hundreds of thousands of litres of oil onto the shoreline, making the area unsafe for human habitation[474]. The health impacts on the affected populations were severe, with outbreaks of leptospirosis, increased respiratory problems due to polluted air, and long-term psychological trauma from the disaster[475].

MEDITERRANEAN: EXTREME HEAT PROMPTS CASCADING HEALTH RISKS

In 2023, extreme heat across the Mediterranean forced Spanish and Italian refineries to cut output by up to 10% due to cooling system failures, exposing the sector's lack of preparedness for escalating temperatures. Drought conditions further strained water supplies needed for cooling, with some refineries tapping underground reserves shared with drinking water systems. Despite isolated upgrades, most operators lacked adaptation plans, leaving infrastructure vulnerable. By 2024, El Niño-driven heat compounded risks, tightening fuel supplies in Europe – already impacted by heat-related disruptions at refineries in the U.S. Gulf Coast – underscoring the cascading health and energy security risks of fossil fuel dependence.

After heavy rains, a coal fly ash pond breach in Raigarh, central India, contaminated agricultural land, endangering farmers and their crops.

Manshi Asher

4.2.3 *Cascading Risk: Sea Level Rise and Coastal Flooding*

The vulnerability of global oil refining infrastructure to sea level rise and coastal flooding has been identified as a critical risk, particularly as climate change exacerbates these hazards[481]. Approximately 32% of refineries worldwide are located in low-elevation coastal zones, exposing over 35% of global refining capacity to annual flood risks. These risks are projected to intensify under warming scenarios, with disruptions anticipated in refining hubs. The highly interconnected nature of global petroleum distribution networks means that localized disruptions could propagate widely, resulting in significant impacts on global energy supply chains. Economies with high dependence on energy imports or concentrated refining infrastructure are expected to face amplified economic repercussions. These disruptions could further lead to cascading public health and social consequences, as energy price volatility, reduced availability of essential services, and heightened community vulnerabilities are likely to emerge.

A study[482] assessing the risks of sea level rise and extreme precipitation found that flooding could trigger toxic chemical releases from hazardous facilities in California, disproportionately affecting low-income communities of color. Using regression models and probabilistic projections of sea level rise, the study estimates that 423 facilities will be at risk of flooding by 2100 under a high-emissions scenario. Social vulnerability factors—including poverty, renter status, racial demographics, linguistic isolation, and low voter turnout—were significantly associated with a higher likelihood of living near at-risk sites.

A woman is standing in front of her house which is under water due to tidal flood in Mousuni Island, Sundarbans

Supratim Bhattacharjee, iStock

Dr. Crystal Cavalier-Keck
Citizen of Occaneechi
Band of The Saponi Nation,
Co-Director: 7 Directions of Service

I am a citizen of the Occaneechi Band of the Saponi Nation. I have been on the frontlines of the fight against methane gas expansion in the southeast for almost a decade. Beginning with the Mountain Valley Pipeline (MVP), we have amplified the voices for marginalized communities facing fossil fuel expansion and environmental destruction. We were instrumental in stopping the MVP Southgate from crossing Occaneechi Saponi territory in Alamance County. We are currently fighting the Southeast Supply Enhancement Project (SSEP) methane gas expansion project.

The marginalization of Indigenous women's voices is central to the continued destruction of our planet. When women's voices are silenced, the planet and all its inhabitants suffer. The fossil fuel and extractive industries rely on this silencing to perpetuate their destruction. In our communities we have seen increased rates of childhood health problems, respiratory issues, and cancer. The continuation of imperial colonial practices on the land has a devastating impact on the mental health of those communities that have experienced this for hundreds of years. Generational trauma is a real issue, and its effects can be seen in our Indigenous communities in the form of alcohol and substance abuse.

The fossil fuel and extractive industries and the politicians funded by them must accept the impacts that these industries have on the planet. Their descendants will also suffer from this continued destruction.

Anabela Lemos
2024 Right Livelihood Award Winner,
Director of Justiça Ambiental
Mozambique

In Mozambique, for decades the fossil fuel developments have directly and indirectly harmed human health and well-being. In inland Tete province, transnational corporations mining coal have blatantly disregarded human health. Some companies have been operating open pit mines alongside communities, without relocating affected peoples, forcing them to live in the midst of coal dust clouds for years. Coal dust settles thick in peoples' lungs, their homes, their clothes, and their lives. Meanwhile, gas developments in the northern Cabo Delgado province have taken land from farmers, and robbed fisherfolk of their access to the sea. The gas industry has contributed to an ongoing violent conflict that has claimed the lives of nearly 6,000 people, with reports of disappearances, rape, murder, and torture. Almost a million children, women and men were internally displaced. All this has also led to a crisis of nutrition and survival. The malnutrition among children today will affect their development and future health. For the survivors, these traumas will persist for decades to come.

Women from an oil-impacted community in Nigeria take part in a local hearing.

HOMEF

05 Societal Harms of the Fossil Fuel Industry: Fossil Fuel and the Climate Crisis

5.1 The Social Fallout of Fossil Fuel Projects at the Community Level

While new fossil fuel projects are often promoted to proposed host communities and government leaders as a source of jobs and economic benefits, evidence emerging over the past decade instead shows a picture of significant social disruption and economic volatility.

Fossil fuel projects often displace local communities, resulting in significant social disruption and economic hardship[483]. This displacement creates loss of livelihood as well as conflicts[484], as the displaced populations compete for limited resources in their new locations. The economic disruption caused by the influx of fossil fuel

industry workers, heavy workload among the industry workers, and hazardous working conditions often leads to increased alcohol and drug abuse among both local residents and transient workers[485,486]. According to a World Bank report, while income for male workers who are employed through the fossil fuel project may increase, this increased income frequently fails to benefit women and children, being spent instead on alcohol, cigarettes, and other similar consumables[487]. In addition the social isolation, distress, and high-stress work environment experienced by fossil fuel industry workers fosters increased substance abuse[488]. The stress of displacement and economic uncertainty can exacerbate domestic conflicts, leading to an increase in violence within households. It also adversely impacts the mental health[489] and is associated with increased cases of depression and suicides[490]. A study of 20 major industries in the US from the Centers for Disease Control and Prevention found the suicide rate was nearly double among workers in mining, quarry work, and oil and gas extraction as compared to the rate across all industries[491].

The economic instability brought on by displacement and the influx of transient workers is closely linked to higher rates of domestic and sexual violence and higher crime rates[445,446]. Studies from Pennsylvania and Texas found elevated rates of chlamydia and gonorrhea in counties with unconventional oil and gas activities, and during years where more gas drilling was occurring, respectively, suggesting that fossil fuel activities may increase risky sexual behaviour[494,495].

The presence of large work camps, often referred to as “man camps,” established for fossil fuel projects can further aggravate social disruptions in the communities[496]. These camps, often situated near Indigenous and rural communities, are associated with increased rates of sexual violence and exploitation, posing safety risks to local women and girls[497]. Moreover, displaced and economically vulnerable populations become more susceptible to exploitation and human trafficking, including sexual exploitation, including “a rise in forced prostitution, the trafficking of women (particularly young women), acceleration of sexually transmitted disease, and local prevalence of alcohol and narcotics,” according to the World Bank[487]. Women and children are thereby made more vulnerable to poverty, domestic violence, and the breakdown of healthy family structures. These dynamics heighten the vulnerability of women and children—leading to greater poverty, family breakdowns, antisocial behaviors, and a rising burden on female caregivers as the health of household members deteriorates. In Papua New Guinea, new oil wealth changed marriage patterns, leaving many local women unmarried as men sought marriage partners from outside the community. This in turn increased pressure on women to provide for the local community[487].

Women working in mining are also vulnerable to violence. IndustriALL convened a global network meeting for women in mining in 2021. The workshop found that, “The abuse of women working in the mines is driven by a toxic masculinity culture. Gender-based violence, both physical and verbal, is prevalent. Women face sexism and sexual harassment on a daily basis; 40% of women mine workers surveyed in Canada had experienced unacceptable behavior like sexist remarks or unappropriated touching; women miners have been raped and killed in South African mines. Although some mining companies have developed policies, little action is taken to protect women workers, with some companies turning a blind eye to the reported cases”[498]. Limited legal protections, and the absence of women leadership roles in mining projects, contribute to limited recourse for women facing workplace violence in these contexts[498,499].

The combination of economic hardship, social disruption, and the presence of transient workers creates an environment where exploitation, crime and human trafficking can thrive. This situation exacerbates the already difficult conditions faced by displaced communities, leading to further social and economic instability and profound physical and mental health consequences.

The combination of economic hardship, social disruption, and the presence of transient workers creates an environment where exploitation, crime and human trafficking can thrive.

5.2 Resource Competition, Economic Disruptions and Economic Inequity

The nature of fossil fuel extraction and processing often results in boom-and-bust cycles in the local economy where periods of rapid economic growth are followed by sharp declines[500]. When fossil fuel resources are first discovered and developed, local economies may experience a surge in employment opportunities, increased investment, and improved infrastructure. However, these benefits are often short-lived. Once the resources are depleted or when market conditions change, the industry contracts, leading to widespread job losses and economic instability[501,502].

The volatility of fossil fuel markets exacerbates this cycle[503]. Fluctuating oil, gas, and coal prices can lead to sudden layoffs and reduced investment, leaving communities that are now dependent on these industries vulnerable. This instability can hinder long-term economic planning and development, making it difficult for affected regions to diversify their economies and recover from downturns[504].

Economic inequality is another significant issue associated with the fossil fuel industry[505]. The profits from fossil fuel extraction and processing are typically concentrated among a small group of stakeholders, including company executives, investors, and sometimes national governments. By contrast, local communities that host these industries frequently bear the brunt of environmental degradation, health problems, and social disruption caused by fossil fuel activities, with little compensation and investment in return[506,507].

Beyond economic hardship, fossil fuel infrastructure devastates local livelihoods by polluting air, water, and soil, disproportionately impacting fisheries and agriculture-dependent communities[508]. Oil refineries, coal mines, fracking sites, and pipelines release toxic pollutants that harm human health and degrade rivers and farmlands[509]. Fossil fuel extraction consumes and contaminates water supplies, exposing crops and livestock to heavy metals and chemicals, reducing yields, and threatening food security[510]. For communities reliant on farming and livestock, this pollution means lost income, dwindling resources, and greater economic vulnerability, deepening the cycle of inequity.

Beyond economic hardship, fossil fuel infrastructure devastates local livelihoods by polluting air, water, and soil, disproportionately impacting fisheries and agriculture-dependent communities.

The disparity in economic benefits can lead to social tensions and a sense of injustice among local populations. While a few individuals or entities accrue significant wealth, much of the population may experience declining living standards, higher energy costs[511], reduced access to clean air and water, and compromised health outcomes. This economic inequality can also hinder efforts to transition to more sustainable and equitable economic models, as those benefiting from the status quo may resist changes that threaten their financial interests.

ENERGY EQUITY DOES NOT REQUIRE FOSSIL FUEL DEPENDENCE

The argument that the Global South must follow the fossil-fuelled development trajectory of wealthier nations disregards 21st-century realities. Today, we possess the knowledge, technology, and resources to build energy systems that are clean, equitable, and resilient, without replicating the environmental and health harms of the past. Communities in the Global South already bear a disproportionate burden of fossil fuel-related harms. Air pollution has the highest mortality in low- and middle-income countries. Climate-related disasters, driven by fossil fuel use, have inflicted over US$525 billion in economic losses across the Global South over the past two decades, exacerbating poverty and undermining development[512].

The notion of a trade-off between energy access and fossil fuel use is a false dichotomy. Decentralised renewable technologies - particularly solar and wind - now offer the fastest, most cost-effective pathway to universal energy access. Solar prices have declined by 89% in the past decade, and off-grid and mini-grid solutions are already reaching underserved communities without the need for expensive fossil fuel infrastructure. Countries such as Kenya demonstrate that renewable energy can power development, with more than 90% of its electricity sourced from renewables.

Conversely, continued investment in fossil fuel infrastructure locks countries into volatile global markets and diverts public resources into subsidies, often at the expense of health, education, and climate resilience. Wealthier nations, having profited from fossil fuel expansion, have a responsibility to support a just energy transition in the Global South – through financing, technology transfer, and capacity building – not by promoting outdated, polluting models in the name of equity.

In Mpumalanga, South Africa, residents demand their right to breathe clean air.

Daylin Paul
Center for Environmental Rights

5.3 Forced Displacement, Human Right Abuses, and Increase in Land Conflicts

The increase in land conflicts and the forced displacement of Indigenous people and fence line communities due to fossil fuel industry activities have profound and far-reaching impacts on the affected communities[513,514]. One significant consequence is the loss of livelihoods. Many Indigenous and fence line communities depend on their traditional land for farming, hunting, and fishing to sustain themselves. When communities are forcibly removed from their lands, their ability to carry out these practices is disrupted, leading to food insecurity and malnutrition[515]. The loss of access to natural resources essential for subsistence can force communities into economic instability and poverty.

Forced displacement can lead to severe mental health issues and being removed from ancestral lands has been found to cause psychological stress, anxiety and other negative mental health impacts for Indigenous people[199]. The profound sense of loss and disconnection from cultural roots often results in higher rates of depression, anxiety, and suicide[516]. This distress is compounded by solastalgia[517], a term describing the emotional and existential grief experienced when one's home environment is degraded or lost—a growing concern in the context of climate change and environmental destruction. Forced removal not only strips away community members' physical homes but can also erode a sense of identity and belonging, compounding the psychological distress. In addition, Indigenous communities often have a rich cultural heritage and traditional knowledge that are closely tied to the land. When forced to leave ancestral territories, the community loses access to sacred sites, cultural practices, and at times traditional knowledge that have been passed down through generations. This loss of cultural heritage diminishes the communities' identity and disrupts the transmission of cultural values and practices to future generations[518,519].

Displacement and land conflicts often lead to violence and human rights abuses[520]. Fossil fuel companies and government forces defending them have frequently clashed with local communities over land rights, at times resulting in violent confrontations. Companies have funded private security, collaborated with state police[521], and used legal retaliation to suppress protests, often leading to surveillance, harassment, and deadly violence against activists[522,523]. There have been numerous instances of forced evictions, beatings, and even killings of activists and community leaders who oppose fossil fuel projects[524,525]. Over the past decade alone, a shocking 1,910 people have been murdered according to well-documented reports for speaking out against fossil fuel projects[526]. The power imbalance between well-funded companies and vulnerable communities exacerbates these conflicts and human rights violations[527–530].

Over the past decade alone, a shocking 1,910 people have been murdered for speaking out against fossil fuel projects.

As with other marginalized groups, for Indigenous peoples legal and economic marginalization frequently compounds the challenges and harms of the situation. Many Indigenous groups lack the legal resources and economic power to defend their land rights effectively. This lack of legal protection and economic leverage opens the door to exploitation and even greater marginalization. The inability to secure and protect their land rights can perpetuate a cycle of poverty and disenfranchisement, making it difficult for communities to achieve sustainable development and economic self-sufficiency.

Seth Harris
Citizen of New River Catawba Nation,
Program Director - 7 Directions of Service

My name is Seth Harris, and I am a citizen of the New River Catawba Nation. I hold a Bachelor of Science in Geography with a minor in Geology, and I spent 24 years working as a county planner for local government. After years of volunteering for environmental justice groups, I joined the staff of 7 Directions of Service in 2022, and I also serve on the administrative council for my Nation.

I became deeply involved in the movement to stop the Atlantic Coast Pipeline in eastern North Carolina. I volunteered with a primarily Lumbee group to ensure that the Indigenous voice was present in discussions about the pipeline that was directly impacting our communities. Through the dedication of grassroots activists, we successfully stopped the Atlantic Coast Pipeline. That victory strengthened my resolve, and I became part of the fight against the Mountain Valley Pipeline and MVP Southgate. I've lobbied state and federal elected officials, urging them to halt fossil fuel expansion and protect our lands and people.

One of the challenges we face in North Carolina is the division among Indigenous communities. Large industries exploit this division to advance their agendas, particularly the expansion of fossil fuel projects. These industries thrive on our disunity, and it's become one of my goals to educate our communities about their rights and the manipulative tactics these corporations use.

The impacts on our communities are devastating. We've seen alarming increases in childhood health problems, respiratory issues, and cancer. The continuation of imperial colonial practices on our lands has deeply affected the mental health of our people, compounding the generational trauma we've endured for hundreds of years. This trauma manifests in our communities through substance abuse and alcohol dependency, creating cycles of pain and struggle.

The effects of fossil fuel extraction on our communities cannot be ignored. These projects don't just harm the environment; they harm our people, our health, and our future. Indigenous sovereignty must be respected, and it's vital that Indigenous community leaders—not just tribal governments—are included in these discussions. Our voices matter, and we must be at the table when decisions are made about our lands and our lives.

5.4 Corruption, Undue Influence, and Disruption to Ethical Governance

Beyond the localized harms inflicted on communities, fossil fuel companies, both private and state-owned, engage in systemic practices that undermine governance, justice, and climate policy. While this section focuses on publicly traded companies, national oil entities from countries such as the UAE, Saudi Arabia, and Azerbaijan also maintain troubling records of corruption, repression, and unethical influence in international negotiations. Operating with limited transparency and deeply intertwined with authoritarian regimes, these state-backed firms wield disproportionate influence on global energy policy while suppressing dissent.

Bribery is a recurrent issue. A review of UK cases from 2008–2012 found the oil and gas sector responsible for nearly one-fifth of all bribery prosecutions, primarily for foreign payments and kickbacks[531]. In 2021, a Paris court fined Total €500,000 for bribing an Iranian official between 1997 and 2004[532]. Such misconduct facilitates operations with minimal oversight[533].

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The industry also invests heavily in lobbying and public relations to shape policy. In the U.S., fossil fuel companies have systematically misled the public through greenwashing, astroturfing, funding climate denialism, and exaggerating scientific uncertainty[534–537]. These efforts have fueled one of the highest global rates of climate denialism[538,539], even as polls show broad public support for a clean energy transition[540]. Despite this, the industry continues to obstruct climate action through extensive lobbying[537]. For instance, in 2023, a gas-linked dark money group succeeded in labeling gas as "green energy" in Ohio[541], and in 2018, fossil fuel money helped defeat major climate initiatives in Washington and Colorado[542]. From 2008 to 2018, trade associations tied to the industry spent $2billion, 27 times more than climate advocacy groups, lobbying against climate policies[543].

Conflicts of interest are widespread. In 2023, over 1,500 U.S. lobbyists were found to represent fossil fuel firms while also lobbying for liberal cities, universities, and environmental groups[548,549]. Examples include State Farm, which halted new insurance policies in California due to climate risks while employing lobbyists for fossil fuel firms[544], and Baltimore, which sued ExxonMobil for climate damages while sharing a lobbyist with the company[545]. Syracuse University, despite divesting from fossil fuels, retained a lobbyist with oil and gas clients[546].

Fossil fuel influence has also permeated international climate negotiations. At COP meetings, industry actors have promoted language favoring continued fossil fuel use via terms like "unabated" combustion and proposed technologies such as Carbon Capture and Storage (CCS)—which to date have not delivered (see Carbon Capture and Storage, p.29). At COP26, there were 503 fossil fuel lobbyists; that number rose to 636 at COP27 and surged to 2,456 at COP28[547,548].

FOSSIL FUELS AND CLIMATE NEGOTIATIONS

Fossil fuels were formally named in a UNFCCC decision for the first time at COP26[554], which called for phasing down unabated coal and eliminating inefficient subsidies. However, this language was weakened from initial drafts. At COP28, the decision advanced to call for a "transition away from fossil fuels" and ending "inefficient fossil fuel subsidies...as soon as possible"[256]. Yet, vague definitions and lack of time-bound commitments continue to hinder alignment with the 1.5°C goal.

Over the past three decades, climate negotiations have narrowly focused on reducing emissions, particularly CO_2. This CO_2 emissions-centric lens ignores broader harms tied to fossil fuel production, including ecological destruction, health risks, and social injustice. Technologies like CCS cannot address these impacts. Addressing the climate crisis requires confronting the full extent of fossil fuel harm.

The entrance to UNFCCC COP 29

Matthew TenBruggencate

Industry corruption and collusion with governments also enable subsidies, deregulation, and enforcement failures[555]. Tactics include rigged bidding for public land[556,557], tax breaks that distort energy markets[558], and weakening of environmental and labor protections[559,560]. These efforts erode regulatory frameworks and legal protections, while practices like selling old assets to shell firms that then declare bankruptcy help companies evade cleanup responsibilities[549,550].

Public perception is shaped through PR campaigns, which promote fossil fuels as essential to economic stability while downplaying harms[551,552]. In low- and middle-income countries—and even some wealthier states—weak enforcement enables environmental degradation and labor exploitation. Underfunded public institutions cannot counter powerful polluters, whose practices often include deforestation, land grabbing, and toxic waste disposal. In Nigeria's Niger Delta, Shell and others have caused extensive environmental and health damage through oil spills and neglect[553,554].

Labor rights violations are also endemic. In countries with weak protections, fossil fuel workers face unsafe conditions, long hours, low pay, and in some cases, child or forced labor[555–558]. These patterns underscore the broader exploitative nature of the fossil fuel economy and its obstruction of ethical governance.

Dr. Katriona (Kate) Wylie
General Practitioner, North Eastern Health Centre, Tea Tree Gully, South Australia
Executive Director of Doctors for the Environment Australia

As a general practitioner in suburban Adelaide I have seen many patients who have had their health impacted by fossil fuels. Patients impacted by heat and heatwaves, patients impacted by fire and smoke, by air pollution, by increased frequency and severity of asthma and hayfever; so many impacts of fossil fuel induced climate change.

But the thing that I see most frequently is the mental health impacts brought about by people's awareness of the climate health emergency and the successive failures of our governments to protect our health from the hazards of fossil fuels. Grandparents and parents worried about their children and what kind of world they are being left in, young people scared about their future and disillusioned by the ongoing expansion of coal and gas exports in Australia and our continued dependence on fossil fuels.

The case I find most personally troubling is that of a young woman requesting a referral for permanent contraception. This young woman was twenty-eight at the time and was wanting to see a gynaecologist for a tubal ligation. When I asked her why, and especially in light of her age and our expectation as doctors that at thirty she might change her mind, she said that she didn't want to bring a child into this world because of climate change. This intelligent, inquisitive young woman looked to the future and saw no hope for future generations and did not want the heartbreak of seeing her future child experiencing the horrors of our warming world. She understood that the climate health emergency means water insecurity, civil unrest and displacement, generally a harder world and she had made the call, that it would be unethical to bring a baby into such an inhospitable planet. As a parent my child is a fundamental motivation for my advocacy for climate action, but I understood her position and that it came from her profound grief for the tragedy of climate change. I will not share here what her final outcome was, but needless to say we have had many a conversation about the ethics of the fossil fuel industry as they continue to pedal their dangerous product and what that means for personal and planetary health. To think that we have created a world where people are choosing childlessness, when having a child is considered by many as the very essence of our humanity, is a profoundly upsetting thing.

My call is to the executives of the fossil fuel industry to use their capacity and power to phase out fossil fuels to protect the health of our planet, so that human civilization can flourish, where young adults do not have to face impossible choices and where children can live long and healthy lives on a safe planet.

Desmond DSa
Co-Founder of South Durban Community Environmental Alliance (SDCEA)

Shweta Narayan
Global Climate and Health Alliance

Durban rich coastal zone and one of South Africa's National Treasures eg.unique flora and fauna,wetlands,dune grasslands, estuary, and a wonderful display of marine life .Our wonderful spaces are been degraded by the largest industrial polluting centre specifically in South Durban which has impacted negatively on the quality of the living environment for all residents South Africa's growth and economic framework put profits before people.

Our families have had to breathe toxic pollution for generations; many have died from cancer, asthma and Leukemia and other related sickness. We have since COVID 19 experienced the shutdown of the 2x refineries and chemical industry. We have seen clear skies and no smells in our area as the two refineries remain close. The Malaysian owned Petronas refinery exploded on the 4th December 2020 and the biggest crude oil refinery in South Africa Shell & BP closed on the 12th April 2022 after the rain bomb that affected Durban and over 500 people lost their lives including women and children. This refinery was completely flooded out and has since not reopened. Shell has pulled out of South Africa which we are quite happy as residents as we breathe fresh air. We expect that Shell and Petronas management in the Hague or London or in Malaysia will be held accountable for the damage of their facilities on the peoples and communities of South Durban health .

We call on the governments of the world to start the Just Transition by phasing out toxic industries and hazardous landfill sites. Not in our backyard and not in anyone else's backyard.

Family fun near windmills showcases global innovation in renewable energy.

iStock

06 A Just and Health-Focused Energy Transition

Major international bodies, including the WHO, agree that phasing out fossil fuels is essential to limiting global warming to levels compatible with human health. The IEA's Net Zero Report underscores the urgency, stating that "the path to net-zero emissions is narrow" and demands "immediate and massive deployment of all available clean and efficient energy technologies." It further affirms that achieving net zero requires "a huge decline in the use of coal, oil and gas" and that no new fossil fuel infrastructure is needed beyond projects underway as of 2021. However, the transition to clean energy is not solely a technological endeavor – it must be shaped by policy frameworks that ensure it is fair, inclusive, and health-promoting. Without such safeguards, existing inequalities may be deepened[559].

The IPCC's Sixth Assessment Report[5] highlights that equity, climate justice, social justice, inclusion, and just transition principles are essential for ambitious climate mitigation and resilient development. A just transition entails respect and dignity for vulnerable groups, the creation of decent work, social protection, employment rights, equitable access to energy, and inclusive stakeholder dialogue.

Recognizing this, Parties at COP27 launched the Just Transition Work Programme under the UNFCCC – a multilateral framework to define and implement just transition policies. This was further operationalized at COP28, where governments committed to holding regular dialogues, formally embedding just transition within international climate governance[560,561]. This represents a critical opportunity: to design transitions that not only reduce emissions but also protect health, uphold dignity, and promote equity. A just energy transition must extend beyond labor market protections to include health safeguards, social protection, and restorative measures for all communities affected by both fossil fuel extraction and the transition itself.

6.1 Transitions Across Sectors

There are key sectors that account for the majority of all fossil fuel use (see table). Bringing a healthy, just transition lens to phasing out fossil fuels from these sectors is necessary to ensure a healthy and equitable transition for populations around the world.

Challenges	Solutions
Electricity	
• Over 60% of global electricity still comes from fossil fuels, driving air pollution and climate change[562].	• Phase out fossil fuel based electricity through the investment in clean, renewable energy systems that improve public health.
• 685 million people lack electricity access, particularly in rural and low income regions, undermining health and development[563,564].	• Expand decentralized renewable energy systems (e.g., solar microgrids) to underserved areas, leapfrogging the need for fossil fuel infrastructure and supporting energy sovereignty.
• Reliance on biomass for energy leads to over 3 million deaths annually due to household air pollution, disproportionately affecting women and children[565].	Replace biomass with clean cooking and heating solutions, such as electric and solar-powered systems, prioritising marginalized and frontline communities.
• Poor electricity access degrades healthcare delivery[565,566].	• Prioritize electrification of health facilities using reliable, off-grid renewables with storage.
• Transition risks from renewable energy, including negative health impacts from poorly managed hydropower and critical mineral extraction[567–569].	• Regulate and manage renewable energy supply chains to protect community health and ecosystems.

Challenges

Solutions

Industry

- Steel and cement production rely heavily on coal, contributing significantly to GHG emissions and air pollution, with the steel industry alone responsible for ~7% of global emissions [570].
- Accelerate adoption of cleaner production methods such as hydrogen-based steelmaking (e.g., HYBRIT) and electric arc furnaces powered by renewables, while supporting affected communities to avoid job losses and economic marginalization.
- Fossil fuel combustion in industrial processes generates hazardous air pollution, increasing risks of respiratory and cardiovascular diseases in nearby communities, often low-income or marginalized.
- Implement stronger pollution controls and environmental regulations to reduce toxic emissions. Prioritize health protections for frontline communities and include them in environmental decision-making.
- Plastics are produced from oil, gas liquids (NGLs) and coal, and can generate toxic pollutants in the production process.
- Prioritize systemic reduction in plastic production, invest in reuse systems, and avoid false solutions like bioplastics. Support a strong, binding global plastics treaty that includes provisions on health, chemical safety, human rights, and corporate accountability. Ensure affected communities have a voice in negotiations.

Transport

- Road transport, aviation, and shipping drive air pollution, disproportionately affecting communities near roads, ports, and airports [571,572].
- Accelerate shift to zero-emission vehicles, with strong emissions regulations and targeted protections for overexposed communities.
- Electric vehicles reduce tailpipe emissions but do not address inequality or non-exhaust pollution (e.g., tyre & brake wear). Analysis shows that almost 2,000 times more particle pollution is produced by tyre wear than is pumped out of the exhausts of modern cars, polluting air, water and soil with a wide range of toxic organic compounds, including known carcinogens [573].
- Invest in active and public transport, including safer non-vehicle options like separated bike lanes and improved walking and biking infrastructure, to reduce overall car dependence and address equity, physical inactivity, and air pollution [574–576].
- Low-income and marginalized communities lack access to safe, affordable, and reliable transport.
- Design inclusive transport systems that prioritize underserved areas and integrate health equity into planning.
- Fossil fuel transport policies are often costlier to public health systems.
- Implement low-emission zones and reinvest health savings, as seen in London's Ultra Low Emissions Zone which is estimated to save the National Health Service 5 billion GBP over three decades through air quality improvements alone [577,578].

Challenges

Solutions

Food and Agriculture

- Food systems account for 15% of fossil fuel use annually—more than the emissions of the EU and Russia combined[579].
- Fossil fuel use in food systems alone would overshoot the 1.5°C budget by 2037, even if 2030 pledges are met[579].
- Most agrochemicals (fertilizers and pesticides) are derived from fossil fuels[580].

- Shift to agroecological and regenerative farming to reduce fossil dependence, restore ecosystems, and improve nutritional quality.
- Align agricultural policies with climate goals, prioritizing sustainable, low-carbon food systems.
- Support fossil-free alternatives and reduce chemical inputs to improve soil health and reduce exposure risks.

Buildings and Residences

- 2.1 billion people lack access to clean cooking fuels and technologies[581]. Household air pollution causes over 3 million deaths annually from stroke, ischaemic heart disease, chronic obstructive pulmonary disease (COPD) and lung cancer[566].
- Poor insulation and inefficient buildings increase energy poverty and vulnerability to extreme heat.
- Household fossil fuel use undermines decarbonization and harms community health.

- Prioritise electric stoves and heat pumps powered by renewables. Subsidise efficient biofuels stoves, local biogas, and electrical appliances for those living in poverty.
- Retrofit homes for energy efficiency and passive cooling. Incentivize adoption of electric heating and cooling systems.
- Integrate clean household energy into national fossil fuel phase-out and public health strategies.

Health Sector

- The health sector is responsible for nearly 5% of global GHG emissions[582].

- At COP26, and in the years since, 85 national governments have committed to resilient and/or low-carbon sustainable health systems (of which 37 have set net zero target dates), and over 60 health care institutions representing the interests of over 14,000 hospitals and health centres have joined the UNFCCC Climate Champions Race to Zero health care cohort[583–585]. In their 2024 Communiqué G7 leaders reaffirmed “the objectives of the COP28 Declaration on Climate and Health to transform health systems to be climate-resilient, equitable, low-carbon, and sustainable”[586].

There are two specific areas in which just transition considerations are emerging that require awareness and consideration: The question of clean cooking, for households currently dependent on burning coal or biomass (see 3.8 Residential Heating and Cooking, p.43); and the extraction of critical minerals needed for renewable energy (see Critical Energy Transition Minerals, p.82). Both of these issues are important in their own right, and also illustrate some dimensions of applying a healthy and just transition approach.

PRINCIPLES OF JUST AND HEALTH-FOCUSED TRANSITION

The following principles can guide fossil fuel transition in the above sectors. These principles are adapted from Principles of just and health energy transitions, developed by Health Care Without Harm[587].

1. Reduce Emissions: The Most Urgent Imperative

The most urgent health intervention is to rapidly phase out fossil fuels to limit warming and prevent climate-related health crises, including heatwaves, malnutrition, vector-borne diseases, and air pollution-related deaths. Every fraction of a degree matters.

2. Provide finance commensurate with historical responsibility

High-income countries, accountable for 92% of global historical emissions[588], have a responsibility under international law to lead fossil fuel phase-out and finance equitable transitions in lower-income countries – supporting clean, renewable energy, healthcare, and sustainable livelihoods.

3. Protect and promote public health

Health must guide all decisions to avoid transitions that create new harms (e.g., unsafe mining for clean, renewable energy tech). Maximize health gains via clean air, active mobility, safe jobs, and healthy environments. Integrating Health in All Policies (HiAP) approaches and conducting health impact assessments (HIAs) to systematically evaluate the health implications of energy, transport, and industrial projects is key.

4. Develop safe, productive, and sustainable livelihoods

Transitioning away from fossil fuels must ensure safe, sustainable employment for workers – particularly in fossil fuel, transport, agriculture, and chemical industries. Retraining, income support, and social protection are essential for long-term health and dignity[501,589].

5. Maintain and improve equitable access to essential services

Access to clean, renewable energy, transport, healthcare, education, and housing are key health determinants. Transition policies must expand access to these services, especially for communities made vulnerable by fossil fuel dependency or exclusion.

6. Ensure participation and autonomy of people and communities

Communities most affected by fossil fuel harms, or by the transition, must shape decisions. Indigenous knowledge, community ownership (e.g., of renewables), and participatory governance is essential for context-specific, effective, and equitable health outcomes.

7. Require remediation by polluters

From 1988 onwards, over half of the global industrial greenhouse gases (GHGs) can be traced back to just 25 corporate and state-owned producers. As per the Polluter Pays Principle, enshrined in the Rio Declaration and international law and instruments, “the polluter should, in principle, bear the cost of pollution” (UN, 1992). Reparation and remediation should fund land restoration, health care, and clean, renewable energy infrastructure in affected communities, reducing intergenerational health harms.

6.2 The Economic Case for a Just and Health-Focused Energy Transition

Fossil fuels impose vast and undercounted economic burdens, largely through their health and environmental externalities. In 2022, the International Monetary Fund estimated global fossil fuel subsidies at US$7 trillion – of which US$5.7 trillion represented indirect costs, including healthcare expenditures, productivity losses, and climate-related damages. These costs are disproportionately borne by governments, communities, and households, diverting public resources away from essential services such as healthcare and education[590].

Air pollution alone, primarily driven by fossil fuel combustion, cost the global economy US$2.9 trillion in 2018 – equivalent to 3.3% of global GDP – through premature mortality, lost labour, and diminished quality of life[591,592]. In the U.S., fossil fuel-related air pollution and climate impacts account for over US$820 billion annually[14]. Specific sources such as oil and gas flaring contribute US$7.4 billion in health damages[410], while the U.S. oil and gas sector caused an estimated 7,500 premature deaths and US$77 billion in health costs in 2016 – triple the climate costs of methane emissions alone[223].

Air pollution alone, primarily driven by fossil fuel combustion, cost the global economy US$2.9 trillion in 2018 – equivalent to 3.3% of global GDP – through premature mortality, lost labour, and diminished quality of life.

Globally, heat exposure – worsened by climate change – resulted in the loss of 490 billion labour hours in 2022, translating into US$863 billion in productivity losses[582]. The monetized value of heat-related mortality surpassed US$240 billion, or 6.7% of global GDP[593]. In high-income countries, air pollution accounts for 3.5% of total health expenditure, rising to 7.4% in rapidly industrialising nations such as Sri Lanka[594].

The cumulative effect is stark: every US$1 of fossil fuel subsidy in G20 countries generates an estimated US$6 in health-related costs[595]. By contrast, the economic case for renewables is compelling. Redirecting fossil fuel subsidies – US$1.3 trillion in 2022 – toward clean, renewable energy and health systems would yield powerful returns[596]. Removing these subsidies and pricing pollution could avert 1.6 million deaths annually, raise US$4.4 trillion in revenue, and reduce global CO_2 emissions by 43% by 2030, within the limits needed to avoid catastrophic warming[597].

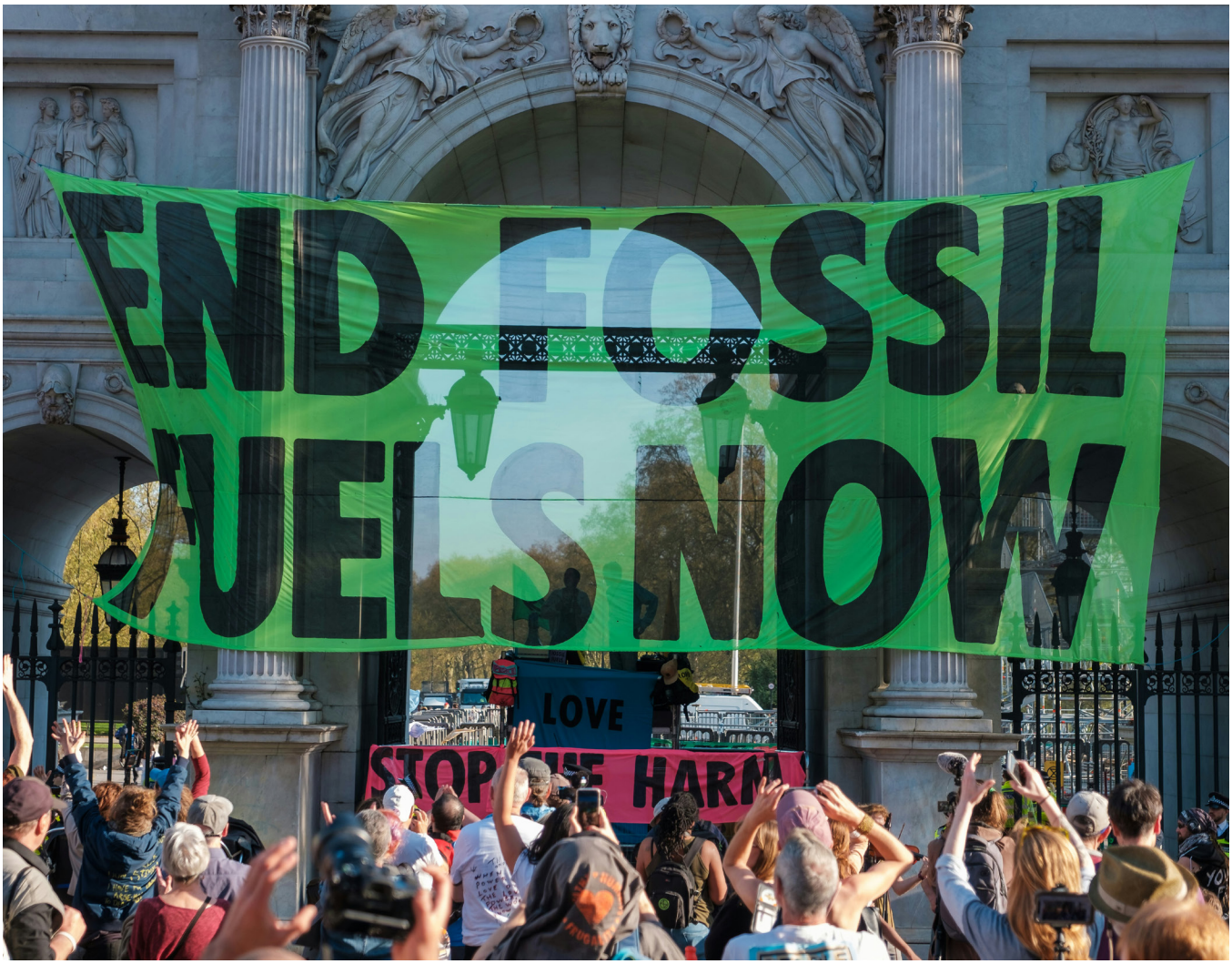
Health benefits alone can offset or exceed the cost of climate action. The UNFCCC estimated that meeting Paris climate targets would generate up to US$564 billion in health and productivity gains in European countries[598]. Research has found that in China and India, the health co-benefits from improved air quality due to climate mitigation policies could fully compensate for the costs of implementing these policies in most scenarios[599].

Air quality improvements in the U.S. since 1970 have returned US$30 for every US$1 invested[600]. A clean, renewable energy transition aligned with 1.5°C could prevent trillions in health losses, including US$3.9 trillion from air pollution in major cities by 2050[601].

ADDRESSING CRITICAL ENERGY TRANSITION MINERALS FOR A JUST GLOBAL TRANSITION – THE UN SECRETARY-GENERAL'S PANEL ON CRITICAL ENERGY TRANSITION MINERALS [602]

The shift to renewable energy is driving soaring demand for critical minerals like lithium, cobalt, and rare earths, expected to triple by 2030. While vital for technologies such as batteries and solar panels, their extraction could repeat the same pattern as historical models - causing human rights abuses, environmental harm, and economic inequities in resource-rich countries. To ensure a just transition, the UN Secretary-General's Panel proposes seven guiding principles: human rights protection, environmental sustainability, economic diversification, transparent trade, inclusive governance, international cooperation, and a circular economy. Key actions include traceability systems, global cooperation, and capacity building to enable equitable, sustainable mineral supply chains.

Campaigners advocating for the end of fossil fuels, London.



Ehimetalor Akhere Unuabona
Unsplash

Children from a coastal village near a power plant in Gujarat, India.

Joe Athialy / Rewa Images

07 Policy Recommendations

The response to climate change provides an unparalleled opportunity to improve health and redress health inequities, as many climate solutions deliver immediate and significant health benefits. A just phase-out of fossil fuels is critical to achieving these goals. More broadly, there is a fundamental need to address global injustices that underpin both the climate and health crises, ensuring that future energy systems are equitable and provide fair access to resources. There is a clear need to carefully assess the health benefits and trade-offs of climate action, including how the phase-out of fossil fuels is implemented, to ensure a just and equitable transition that prioritizes public health. To this end, we offer eight policy recommendations.

1. Halt New Fossil Fuel Exploration and Development

To effectively address the climate crisis, halting new fossil fuel exploration and development is essential. Expanding extraction directly undermines global climate targets, including the 1.5°C goal of the Paris Agreement. The IEA stated in 2021 that no new coal, oil, or gas fields should be approved to stay on track for net-zero by 2050[603]. Research in Nature reinforces this, estimating that 60% of oil and gas and 90% of coal reserves must remain unextracted to limit warming to 1.5°C[604]. Yet, new fossil fuel projects continue to be approved, threatening climate goals and risking irreversible damage.

New fossil fuel infrastructure also carries major economic risks. Carbon Tracker estimates up to US$1 trillion in assets could be stranded by shifting regulations and the transition to renewables[605]. These projects often harm marginalized communities through pollution, health impacts, and displacement.

Approving new fossil fuel and petrochemical projects is incompatible with climate commitments. Countries such as Denmark, Colombia, and Costa Rica have formed the Beyond Oil and Gas Alliance (BOGA) to end new exploration and phase out existing production[606]. Initiatives like the Fossil Fuel Non-Proliferation Treaty[607] seek a global agreement to end new exploration, phase out production, and ensure a just transition. The Treaty has gained support from at least 15 countries—including Colombia[608] —as well as cities like Los Angeles, Sydney, and Barcelona. The WHO has endorsed the Treaty's goals, alongside thousands of health professionals and organizations worldwide[609]. A new initiative aims to establish a World Commission on Fossil Fuel Phase Out to identify barriers and build consensus for a global transition[610].

Despite growing momentum, contradictions persist. In 2018, New Zealand banned new offshore oil and gas permits[611], aligning policy with climate goals, but reversed the ban in 2024[612]. France banned new oil and gas exploration and pledged to phase out production by 2040[613], yet French company TotalEnergies continues expanding fossil fuel operations abroad, especially in Africa—highlighting the gap between domestic policy and corporate action.

Halting new fossil fuel development must be paired with time-bound commitments to phase out existing extraction. A just transition requires deadlines, support for fossil fuel-dependent economies, job creation in clean energy, and strong social protections. The IEA's Net Zero Roadmap calls for phasing out coal by 2030 in advanced economies and by 2040 globally, with steep declines in oil and gas use thereafter[559]. However, voluntary pledges have proven insufficient as production expands[614]. Legally binding targets, backed by regulatory and financial frameworks, are essential to align with climate science and protect health, communities, and economies.

Halting new fossil fuel development must be paired with time-bound commitments to phase out existing extraction.

CASE STUDY

Accelerating Global Action on Coal: The Powering Past Coal Alliance (PPCA)

The Powering Past Coal Alliance (PPCA) is the world's leading coalition of governments and businesses working to accelerate global coal phase out. PPCA members commit to take concrete action as a national or subnational government, utility, business, or industry institution by not building new coal power assets and achieving the phase out of unabated coal-fired power on timelines aligned with the Paris Agreement.

Since its launch, more than 180 governments, organizations, and businesses have joined the Alliance, and through their policies and investments, committed to advancing the coal-to-clean transition in a just manner and safeguarding public health. Many members have even accelerated coal phase out commitments with support from the Alliance, despite global energy security concerns, as the growing economic and social benefits of the transition stack up in favour of clean, renewable energy alternatives[615].

The growing body of coal transition research and evidence continues to tell the same story. For example, an early phase out of all coal plants around the world could help avoid over 14.5 million premature deaths from air pollution over the next three decades while for every US$1 invested in coal phase out and renewables replacement globally can bring US$3 in social and economic benefit[616,617]. Significant financial and technical challenges exist, particularly in Asia, where new coal plants are being built and adverse health impacts from coal-fired electricity generation are most acute, but scalable solutions to accelerate the coal-to-clean transition in a just and economically sound way are being piloted today[618].

By committing to No New Coal and coal power phase out with the PPCA, countries and businesses send clear signals to industry, communities and investors helping to unlock finance and ensure an orderly transition to cleaner, healthier energy systems.

Children collecting coal ash from power plant waste in India.

Amirtharaj Stephen

2. End Fossil Fuel Subsidies and Redirect Savings to Health

Direct fossil fuel subsidies, estimated at US$1.3 trillion globally in 2022[597], encourage the use of harmful energy sources that contribute to climate change and threaten public health. These subsidies, including financial support, tax breaks, and incentives, reduce the cost of fossil fuels, thereby promoting their continued use over cleaner alternatives.

Redirecting these subsidies to health-protecting investments and climate mitigation measures can yield both immediate and long-term benefits. Investments in renewable energy, such as solar and wind infrastructure, can reduce greenhouse gas emissions and improve air quality and health. Strengthening public health infrastructure, especially in vulnerable regions, would enhance the capacity to respond to climate-induced health crises. Additionally, funding climate-resilient infrastructure, like flood defences and drought-resistant crops, can protect communities from adverse climate impacts. Moreover, pollution mitigation efforts, such as electric public transport and waste management systems, could significantly decrease disease burdens related to environmental pollutants. Eliminating fossil fuel subsidies and reallocating funds to these areas offers a powerful strategy for fostering a healthier future.

Redirecting these subsidies to health-protecting investments and climate mitigation measures can yield both immediate and long-term benefits.

3. Clean Up Existing Fossil Fuel Production

While a full transition away from fossil fuels is essential to meet long-term climate goals, immediate action is also necessary to reduce the most harmful impacts of ongoing fossil fuel production. This includes prioritizing cleanup of facilities near communities and rapidly cutting methane emissions—through halting venting and flaring and fixing leaks—to reduce both short-term climate impacts and public health risks. These measures, however, must not be used to justify continued fossil fuel development. Mitigation efforts should occur alongside a clear phase-out strategy and support for a just transition for affected workers and communities.

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The oil and gas sector is a major source of methane, a potent greenhouse gas that also contributes to ground-level ozone and carries toxic co-pollutants throughout the production cycle. The IEA estimates that existing, cost-effective technologies could reduce methane emissions by 75% by 2030[619]. In the U.S., the EPA has proposed regulations aiming for an 87% reduction from 2005 levels by 2030[620]. Stronger regulations on flaring and venting are essential, as oil-related flaring alone emitted over 400 million metric tons of CO_2 equivalent in 2020[621].

The Global Methane Pledge (GMP), launched at COP26 by the EU and the U.S., now includes 159 participants as of January 2025[622]. Signatories commit to voluntary action to help reduce global methane emissions by at least 30% from 2020 levels by 2030. Achieving this target requires national or subnational policies that enforce these commitments, including mandatory leak detection and repair using satellite and drone technology, and economic incentives like methane fees to drive investment in cleaner infrastructure.

Beyond methane, fossil fuel operations release numerous toxic chemicals and co-pollutants, posing serious and ongoing health risks to frontline communities. To effectively curb these harms, governments must implement stringent regulations and enforcement measures, including:

- **Stronger emission standards for refineries and processing facilities –** Governments should adopt and enforce stricter air and water pollution limits, including the phase-out of hazardous emissions from oil and gas operations, similar to the EU Industrial Emissions Directive[623].
- **Mandatory real-time air and water quality monitoring –** Operators should be required to install continuous emissions monitoring systems (CEMS) at all fossil fuel facilities, with publicly accessible data to ensure transparency and accountability.
- **Stricter limits on flaring, venting, and hazardous waste disposal –** Policies must mandate the elimination of routine flaring and venting, with strong penalties for non-compliance, and require safe disposal of hazardous byproducts, preventing contamination of drinking water sources and farmland.
- **Stronger environmental enforcement and community-led oversight –** Governments should increase penalties for pollution violations, strengthen independent regulatory agencies, and fund community monitoring initiatives that empower local residents to track pollution and file legal complaints against violators.
- **Cumulative impact assessments –** Permitting processes should require comprehensive health and environmental impact assessments that consider the cumulative pollution burden in affected areas before approving new fossil fuel infrastructure.
- **Targeted pollution reduction programs for frontline communities –** Governments must allocate funding for pollution remediation, such as soil and water cleanup projects, in communities suffering from decades of fossil fuel-related contamination.

These policies must be implemented without delay, ensuring that fossil fuel companies clean up existing production while a just transition away from fossil fuels progresses.

4. Internalize the Health Costs of Fossil Fuels through the "Polluter Pays" Principle

The "Polluter Pays" principle ensures that those responsible for pollution bear the costs of its environmental and health impacts (see Principles of Just and Health-Based Transition, p.80). Despite well-documented harms from fossil fuel combustion—including respiratory illness, cardiovascular disease, and premature death—these health costs are typically externalized, falling on public health systems and communities. Internalizing these costs would shift the financial burden to polluters and create incentives to reduce emissions.

The "Polluter Pays" principle ensures that those responsible for pollution bear the costs of its environmental and health impacts.

In the U.S., the Clean Air Act allows for fines based on the public health damage caused by pollution[624]. Expanding this approach to cover broader health costs would encourage fossil fuel companies to invest in cleaner technologies and transition to renewables.

Legal frameworks are also essential. In 2021, Friends of the Earth Netherlands won a lawsuit against Shell, with a Dutch court ordering the company to reduce CO_2 emissions by 45% by 2030 in line with the Paris Agreement[637]. Although Shell's appeal succeeded in 2024[625], the ruling affirmed that corporations have a legal duty to cut emissions—setting a key precedent for future climate litigation.

National laws requiring companies to pay for pollution-related health damages can further reinforce this principle. Sweden's carbon tax is a proven example, reducing emissions while sustaining economic growth by internalizing environmental and health costs[626]. In India, the National Green Tribunal ruled in Samir Mehta vs. Union of India that companies responsible for a sunken, polluting coal- and oil-laden vessel must reimburse the government for cleanup and remediation[627,628].

5. Initiate Community-Led Health Research and Action for Fossil Fuel-Affected Areas

Initiate and support community-partnered research to assess the full spectrum of health harms caused by fossil fuel activities and climate change on highly impacted communities. This research should be co-designed and co-led with affected communities, combining Western scientific approaches with Traditional and Indigenous Knowledge systems to reflect a more holistic understanding of health — including mental, physical, spiritual, and cultural dimensions.

Such studies should not only document the lived realities of harm — including pollution exposure, climate-driven displacement, loss of cultural practices, and psychological distress — but also build community ownership and leadership in shaping the research agenda. Importantly, this work must not stop at data collection: the results must directly inform concrete action, including targeted health interventions, policy reforms, environmental remediation, and investments in community resilience. Governments, funders, and public health institutions have a responsibility to ensure that the findings of these studies lead to justice-driven outcomes and real change for the communities affected.

6. Counter and Curb Fossil Fuel Industry Influence, Advertising and Disinformation

Fossil fuel advertising and sponsorships play a significant role in sustaining oil, gas, and coal consumption by shaping public perception and downplaying environmental and health harms. Like the tobacco industry, fossil fuel companies market their products as essential to modern life while concealing their destructive impacts. They misleadingly promote liquefied natural gas (LNG) as a "bridge" fuel despite its substantial greenhouse gas emissions and continued role in driving climate change and pollution[629].

This disinformation undermines climate action, public health, and environmental justice. Banning fossil fuel ads, including digital and social media, and investing in counter-marketing can help dismantle greenwashing and reduce the normalization of fossil fuels. Such bans have been implemented in cities like Amsterdam, which prohibited fossil fuel advertising in public spaces in 2021[630]. Medical professionals in Canada[631] and Australia[632] have also called for comprehensive ad bans.

Ad bans support climate and health goals by limiting corporate influence over policy and public discourse, while shifting attention and investment toward clean energy. These efforts align with the Paris Agreement and promote a cultural transition to sustainable energy. Notable examples include the Hague's municipal ban[633], France's national prohibition on petrol and diesel ads in 2021[634,635], and UK rulings against misleading advertisements by ExxonMobil[636] and Shell[637]. Banning fossil fuel advertising is a critical step toward ensuring accurate public information and advancing a just transition.

Ad bans support climate and health goals by limiting corporate influence over policy and public discourse, while shifting attention and investment toward clean energy.

At the same time, it is essential to restrict fossil fuel companies and petro-states from influencing international negotiations, including the UN plastics treaty and climate COPs. Their lobbying power has repeatedly delayed progress and weakened outcomes in favor of continued fossil fuel production. Safeguards must be put in place to ensure transparency, prevent conflicts of interest, and protect the integrity of global agreements focused on public health, environmental protection, and climate justice.

CASE STUDY

The impact of Canada's New Anti-Greenwashing Law on Oil Majors and their "Astroturf" groups

In June 2024, Canadian oil majors and their affiliated astroturf groups responded dramatically to the enactment of new amendments included in Bill C-59 designed to crack down on greenwashing in Canada's Competition Act, requiring all corporations to substantiate their environmental claims with evidence based on "adequate and proper" products tests or "adequate and proper substantiation in accordance with internationally recognized methodology" for claims regarding businesses. The law reverses the burden of proof on green claims. Whereas before the Competition Bureau had to prove the claims were false, the onus is now on companies to show they can back them up with proof.

In response to these new truth in advertising provisions, the Pathways Alliance, a consortium of the six largest oil sands companies in Canada, removed all content from its website and social media channels. Known for promoting carbon capture and storage (CCS) as a "net-zero" solution, this digital blackout suggests a deeper concern over the new regulations. Similarly, industry-backed groups like CanadaAction have begun blocking Twitter followers en masse, and pro-gas websites like BCLNGHelps.ca have disappeared entirely. Even the Alberta government shut down the controversial Alberta Energy "War Room" in response to the threat of federal fines[638].

The new provisions represent a significant victory against corporate greenwashing, driven by relentless advocacy from groups like the Canadian Association of Physicians for the Environment (CAPE), Ecojustice, Équiterre, the Centre québécois du droit de l'environnement (CQDE), and a formal complaint by Greenpeace Canada against the Pathways Alliance's ad campaign. These efforts have brought misleading environmental claims into the spotlight, challenging the oil industry's portrayal of CCS as a "silver bullet" for climate change.

Predictably, the oil industry and its allies are pushing back, arguing that the new regulations create "policy uncertainty," suppress free speech, and harm Canadian businesses. They continue to lobby to weaken the guidance currently under consultation on how the law is to be applied. Despite this opposition, Bill C-59 aims to ensure that all businesses are held to the same standard of evidence and transparency, representing a crucial step toward genuine corporate accountability. By dismantling the façade of false solutions and promoting a more honest discussion about environmental responsibility, this legislation sets a new precedent for corporate practices and could inspire similar efforts worldwide.

The Canadian flag with the top of Ottawa's Parliament building.

Dennis Ludlow, iStock

7. End Fossil Fuel Finance: Align Global Institutions with Climate Goals

Global financial institutions, such as the World Bank, multilateral development banks, and international investment banks, continue to invest billions in fossil fuel projects, which undermines climate goals and delays the transition to renewable energy. Stopping these investments is critical for achieving a sustainable, low-carbon future. Despite their commitments to the Paris Agreement, institutions like the World Bank still fund fossil fuel projects, with US$12 billion invested from 2016 to 2020 alone[639]. Halting these investments is essential to align their financial practices with climate targets. Redirecting funds from fossil fuels to renewable energy is vital for achieving net-zero emissions by 2050, as the IEA calls for clean, renewable energy investments to triple to US$4.5 trillion annually by 2030[640].

Despite their commitments to the Paris Agreement, institutions like the World Bank still fund fossil fuel projects, with US$12 billion invested from 2016 to 2020 alone.

Fossil fuel investments often cause significant harm to low-income communities, contributing to environmental damage, displacement, and human rights abuses[641,642]. Ending such investments would reduce these harms and help protect vulnerable populations. Continued funding for fossil fuels also poses financial risks, with potential stranded assets reaching up to US$1 trillion[643]. The European Investment Bank (EIB) has already phased out fossil fuel funding, signaling that this move is both environmentally and financially prudent. When global financial institutions stop funding fossil fuels, it sets a powerful precedent that encourages private investors to shift toward sustainable finance[644].

However, there remains an urgent need for more change. For example, despite its pledges, the World Bank continues to directly and indirectly[645] fund fossil fuel projects, highlighting the need for a comprehensive divestment policy. Similarly, several major international banks, including Citigroup and HSBC, have committed to net-zero emissions by 2050 but undermine these goals by continuing to invest in fossil fuel projects. Reports indicate that JPMorgan Chase, for instance, has financed US$317 billion in fossil fuels since the Paris Agreement[646]. While some progress has been made—such as through the Glasgow Statement and commitments by a number of countries to end international public financing for fossil fuels—the implementation has been uneven, with notable gaps and backtracking[647–649].

Ending fossil fuel investments by global financial institutions is crucial for meeting international climate targets, accelerating the global clean, renewable energy transition, reducing financial and environmental risks, and protecting vulnerable communities. Immediate and decisive action is required to align these institutions' financial flows with a climate-resilient future and to inspire the entire financial sector to follow suit.

8. Lead by Example in the Health Sector

To help propel the rapid phase out of fossil fuels and mitigate their detrimental health impacts, the health community should leverage its significant social and economic influence to drive meaningful change. Health organisations and systems can commit to ambitious decarbonization targets, aiming for net-zero carbon emissions by 2040 or sooner, through reducing energy use, investing in renewable energy sources, and improving energy efficiency. They can also implement green healthcare practices, such as waste reduction, sustainable procurement, and the adoption of low-carbon medical technologies.

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A strong focus on divestment can send a powerful message; health organizations, including hospitals, clinics, and professional associations, can publicly commit to divesting from fossil fuel assets and redirecting investments toward renewable energy and sustainable technologies. The impact of health organizations' divestment can be compounded by advocating for financial institutions to divest from fossil fuels and reinvest in health-promoting industries. Additionally, health organizations can adopt sustainable procurement policies, setting high standards for vendors and suppliers that prioritize environmental, social, and governance (ESG) criteria and support local, sustainable businesses to minimize carbon footprints. By taking these steps, the health community has the potential to play a pivotal role in accelerating the transition to a healthier, fossil-free future, reducing greenhouse gas emissions, and enhancing public health outcomes while reinforcing its leadership and credibility. Immediate integration of these strategies into operational plans and advocacy efforts could catalyze the structural change needed for a healthy future.

pixelfusion3d, iStock

FG Trade Latin, iStock

08 Conclusion

The devastating impacts of fossil fuel dependence on the environment and human health are undeniable. While formal research highlights the immense scale of this crisis, personal testimonies reveal a far deeper and more pervasive toll on communities. Yet, amidst this urgent reality lies a transformative opportunity: the transition to a sustainable, equitable future is not only achievable but imperative.

This transition must be grounded in the principles of justice and inclusion, ensuring respect for human dignity, the creation of sustainable and decent jobs, robust social protections, equitable energy access, and the meaningful participation of all rights holders. It is a call to action to reimagine a world where the well-being of both people and the planet takes precedence over short-term profits.

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As a medical professional, I have witnessed firsthand the devastating health impacts of fossil fuel pollution—rising respiratory diseases, cardiovascular conditions, and the disproportionate burden on vulnerable communities. This report makes it undeniably clear: fossil fuels are not just an environmental crisis; they are a public health emergency. But this is also a moment of profound opportunity. A just transition to clean, renewable energy is more than an environmental necessity—it is a prescription for healthier lives, cleaner air, and a more equitable future. By moving beyond fossil fuels, we can achieve intergenerational justice for our future children who are owed a healthy planet.

The science is clear. Now is the time for bold action. We as scientists and health practitioners must summon the courage to embrace change, to advocate for policies that prioritise health, and to invest in a future where clean air and clean water are fundamental rights, not privileges.

The cost of inaction is measured in lives. This transition is not just possible—it is imperative. The time for a healthier, just world is now.

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With 200+ organisational members, from every region and reaching over 125 countries, the Alliance co-chairs the WHO-Civil Society Working Group on Climate & Health and collaborates with organisations and agencies around the world to ensure that people's health is protected in the climate change era, in national, regional, and international decision-making. We are committed to tackling the climate crisis to preserve a healthy home for humanity.

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