

# SOCIAL DETERMINANTS OF HEALTH SECTORAL BRIEFING SERIES 5



**ENERGY: SHARED INTERESTS IN SUSTAINABLE  
DEVELOPMENT AND ENERGY SERVICES**



**World Health  
Organization**



# **SOCIAL DETERMINANTS OF HEALTH**

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## PREFACE

Public health is built on effective interventions in two broad domains: the biomedical domain that addresses diseases, and the social, economic and political domain that addresses the structural determinants of health. Effective health policy needs to address both domains. However, less rigorous and systematic attention has been paid to health issues in social, economic and political domains in recent decades.

Increasingly complex social, economic and political factors are affecting health and health policy-making. One area of complexity relates to health inequities. As emphasized by the WHO Commission on Social Determinants of Health (CSDH), the social gradient in health is driven by policies in other sectors. Hence, looking at population well-being from the perspective of health and health equity rather than disease demands a new approach to intersectoral collaboration and an imperative to participate earlier in policy processes. Some of the new responsibilities for public health include:

- understanding the political agendas and administrative imperatives of other sectors;
- creating regular platforms for dialogue and problem solving with other sectors;
- working with other arms of government to achieve their goals and, in so doing, advancing health and well-being<sup>1</sup>.

By providing information on other sectors' agendas and policy approaches, and their health impacts, and by illustrating areas for potential collaboration, the *Social Determinants of Health Sectoral Briefing Series* aims to encourage more systematic dialogue and problem solving, and more collaboration with other areas of government.

Examples of intersectoral action for health – current and historical – reveal that health practitioners are frequently perceived as ignoring other sectors' goals and challenges. This creates barriers to intersectoral work, limiting its sustainability and expansion. In order to avoid this perception, instead of starting from the goals of the health system (e.g. health, health equity, responsiveness, fairness in financial contributions), the *Social Determinants of Health Sectoral Briefing Series* focuses on the goals of other sectors. Rather than concentrating on traditional public health interventions (e.g. treatment, prevention, protection), the series use the goals of other sectors to orient its analyses and explore areas of mutual interest.

The target audience for the series is public health officers, who are not experts on determinants of health, but who have responsibilities for dealing with a broad range of development issues and partners. Each briefing will focus on a specific policy area, summarizing and synthesizing knowledge from key informants in health and other areas, as well as from the literature. They will present arguments, and highlight evidence of impacts and interventions, with special emphasis on health equity. They will make the case to health authorities for more proactive and systematic engagement with other sectors to ensure more responsive and cohesive governments that will meet broader societal aspirations for health, equity and human development.



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<sup>1</sup> WHO & Government of South Australia (2010). *Adelaide Statement on Health in All Policies*. Adelaide.

# THE ENERGY SECTOR: AN OVERVIEW

## Mutually reinforcing interests

Energy is a resource that connects economic growth, social equity and sustainable environment. Development is not possible without sustainable energy (UN, 2012). It plays a critical role in society, affecting the economy, international trade, national security, and the human and physical environment. Energy policy is a basic condition for economic and industrial development; it is equally critical for health. However, we are living in a world where millions of people still live without a reliable source of energy in spite of modern technology. Ensuring universal and sustainable access to modern energy sources for all is therefore another development imperative that plays a crucial role in effectively reducing poverty and providing health for all. If no improvements are made to provide access to energy services, the Millennium Development Goals (MDGs) will not be met (Modi et al., 2005).

Although the MDGs do not refer to energy, without access to energy, it is not possible to achieve them, whether reducing poverty, improving women and children's health, or providing education for all. Energy facilitates social and economic development, and improves living conditions. The link between energy services and poverty reduction was explicitly identified by the World Summit on Sustainable Development (WSSD) in the Johannesburg Plan of Implementation (Modi et al., 2005). The plan called for the improvement of access to energy services in order to facilitate the achievement of the MDGs, including the goal of halving the proportion of people in poverty by 2015. In 2011, recognizing the urgent need for sustainable access to energy, the United Nations Secretary-General launched an initiative on Sustainable Energy for All. In 2012, it further developed an Action Agenda for the Rio+20 Conference on Sustainable Development in order to achieve this initiative (UN, 2012). The initiative's three objectives are listed below.

1. Ensure universal access to modern energy services.
2. Double the global rate of improvement in energy efficiency.
3. Double the share of renewable energy in the global energy mix.

Access to energy allows people to have vital health determinants in the household such as heating and the means to prepare nutritious food. Energy provides the resources necessary to generate income from small-scale family businesses and other activities. At the community level, energy ensures access to clean water, and health and education services. It provides low-cost transport facilitating access to employment. Energy also enables people to access information and communication technologies. Without access to energy, children cannot study at night and are exposed to an elevated risk of fire from overturned kerosene lamps commonly used for lighting. Without access to energy, rural households have to collect wood, degrading forests and natural habitats, and further limiting their resources. Cooking on open fires or on inefficient stoves

results in increased levels of indoor air pollution – predominantly in poorer households – which kills around 2 million people each year. Energy policies also affect health indirectly, for example, when increasing the cost of health services and schooling and limiting other basic social services.

For the energy sector, the health of populations is also important because healthier populations can facilitate the rational use energy resources. Better population health is in itself an important outcome of the energy sector's goals to improve social development and people's quality of life. This energy briefing focuses on energy policies and their importance for households and for people's basic need for services.

## Scope and limitations

This briefing describes the energy sector – its public policy challenges, how the sectors tries to address these challenges, and areas for potential collaboration between health and energy.

The briefing has been structured to permit public health practitioners with limited time to obtain a well-rounded perspective of the topic by reading only sections 1 and 3. The three sections are:

1. **Energy sector overview.** This covers mutual interests that both sectors share, global trends in energy, and policy challenges from the perspective of the energy sector characterized as 'goals'. These goals are proposed as a result of a review of policy documents and from interviews with energy sector practitioners in order to consider different country contexts and realities.
2. **Goals 1 to 4.** The second part of the briefing analyses each goal, with a detailed description of policy approaches, health impacts, and areas for potential collaboration between sectors.
3. **Summary messages.** Presents key messages with respect to equity, the role for health, and examples of areas for collaboration.

## Global trends, projections and patterns in energy for households

**Energy for households.** Two indicators are mostly used to describe the links between access to energy and poverty. They are access to electricity and reliance on biomass fuels for cooking. Table 1 shows the most recent

information on the world's access to electricity (2009). As we can see, there are more than 1.3 billion people globally with no access to electricity (21% of the global population), most of whom live in rural areas (IEA,

2010). This is caused not only by a lack of energy supply but also by energy prices that are unaffordable for low-income groups (UN, 2012).

**Table 1. Electricity access in 2009 – regional aggregates**

Region	Population without electricity (million)	Electrification rate (%)	Urban electrification rate (%)	Rural electrification rate (%)
<b>Africa</b>	587	41.8	68.8	25.0
North Africa	2	99.0	99.6	98.4
Sub-Saharan Africa	585	30.5	59.9	14.2
<b>Developing Asia</b>	675	81.0	94.0	73.2
China & East Asia	182*	90.8	96.4	86.4
India and rest of South Asia	493**	68.5	89.5	59.9
Latin America	31	93.2	98.8	73.6
Middle East	21	89.0	98.5	71.8
<b>Developing countries</b>	1314	74.7	90.6	63.2
<b>World***</b>	1317	80.5	93.7	68.0

\* China: 8 million; \*\* India: 410 million; \*\*\* World data includes all OECD countries, and Europe and Eurasian countries.  
Source: IEA (2011a).

Households often have to rely on coal and biomass (e.g. wood, dung and charcoal) for energy. Table 2 shows the most recent information on the number of people in the world relying on traditional biomass fuels

for cooking (in 2010). As the table indicates, there are almost 2.6 billion people using biomass fuels for cooking and heating. This represents around 38% of the global population (IEA, 2012).

**Table 2. People relying on traditional use of biomass fuels for cooking in 2010 – regional aggregates**

Region	Population relying on traditional use of biomass (million)	Percentage of population relying on traditional use of biomass (%)	Percentage of urban population (%)	Percentage of rural population (%)
<b>Developing countries</b>	2588	48.9	18.7	72.3
Africa	698	68.0	44.0	83.0
North Africa	2.5	2.0	1.0	2.0
Sub-Saharan Africa	695.5	81.0	56.0	95.0
Developing Asia	1814	51.0	17.0	72.0
China & East Asia	716	36.0	12.0	56.0
India and rest of South Asia	1098	69.0	27.0	87.0
Latin America	65	14.0	5.0	50.0
Middle East	10	5.0	1.0	14.0
<b>World</b>	2588	37.8	12.5	63.7

Source: IEA (2012).

Overall, the regions most affected by a lack of access to energy sources are Africa and Asia. In sub-Saharan Africa, around 585 million people have no access to electricity, while almost 700 million people in the same region have to rely on traditional biomass energy for cooking. Asian countries have approximately 675 million people with no access to electricity, while more than 1.8 billion people use biomass for cooking, with pervasive impacts on health and the environment. In India, there are more than 400 million people who do not have access to electricity, while 855 million use biomass fuels. The People's Republic of China has almost achieved universal access to electricity, but 423 million people still depend on biomass fuels for cooking and heating (IEA, 2007). In the long term, analysts predict that if current trends are not scaled up, by 2030, the number of people without access to electricity will only decrease from the current 1.3 billion to around 1.2 billion people. Meanwhile, the number of people relying on biomass is projected to rise from almost 2.5 billion to 2.8 billion by 2030 (IEA, 2011a, 2012).

**Environmental challenges.** In recent decades, there has been an increasing awareness of the cumulative environmental impact that energy and other public policies are generating. Fossil fuel use is the main cause of climate change due to the release of greenhouse gas (GHG) emissions (McMichael et al., 2007). High fossil-fuel dependence is also associated with environmental degradation. Common gaseous pollutants (e.g. sulphur oxides, nitrogen oxides, carbon monoxides and dioxides) cause a number of effects such as smog, acid rain, ozone depletion and global warming. In 2010, total emissions were 30% higher than in 2000, and 46% higher when compared to 1990. Although emissions of sulphur oxides and nitrogen oxides have declined in most countries in Europe and North America, they have increased in developing countries (UNEP, 2007). New energy extraction and generation techniques are being implemented (including fracking and the use of biomass and geothermal energy production), however their impacts for health and the environment still remain mostly unknown.

**Energy and development.** Recognizing the challenges related to energy and sustainable development, in 2012, governments adopted the Rio+20 Declaration. This Declaration calls on nations to adopt policies that ensure sources of energy for all future generations. Decision-makers need to follow three policy directions.

1. Expanding access to energy considering potential negative impacts on the environment to prevent or mitigate them.
2. Ensuring access for all to reliable sources of energy.
3. Exploring more opportunities to develop, and increasingly use, more efficient and renewable sources of energy.

**Increasing energy availability.** In 2010, it was estimated that to meet the goal of providing sustainable energy for all by 2030, annual investments of US\$ 48 billion would be needed (UN, 2011). The most

recent estimates indicate that in 2009, US\$ 9.1 billion was invested globally to improve access to electricity and sources of energy for cooking (UN, 2011). This means that to achieve the 2030 goal, five times the amount of investments will be needed.

## Energy goals: towards sustainable and universal access

Emerging best practice in energy policy is based on the assumption that access to energy for all is tied to its long-run sustainability, in line with international development agendas. This is because current energy sources are not predicted to last long enough to contribute to poverty reduction. The world's population of 7 billion is likely to increase to 9 billion by 2050. Given the high levels of inequality in the distribution of energy to households, a key challenge for energy policy is how to provide universal access to energy, while reducing the negative environmental impacts. Solutions discussed by energy 'think tanks' include developing models that rely less on energy consumption. In securing energy supplies policy-makers make strategic choices, in particular with respect to energy sources – oil, coal, gas, renewable or nuclear being among the main sources. Health impacts are important considerations, yet they are weighed against other strategic considerations that can include, for example, geopolitical, security or military factors. Taking into consideration these challenges, energy policies often focus on the goals in Table 3.

**Scope and limitations.** The bulk of the burden of disease and premature mortality arises from the social determinants of health (CSDH, 2008). The social determinants of health are the conditions in which people are born, grow, live, work and age and their structural determinants, such as the distribution of income and resources, discrimination, and political and governance structures, which create or reinforce inequalities in social position. Differences in social position shape living conditions and population health opportunities by limiting the ability of groups and individuals to take action to protect and promote their health, or by limiting the effectiveness of such actions and of health services. For this reason, public policies have profound effects on the health of populations and the social gradient in health. It is therefore important for the health sector to be aware of these effects and opportunities for action.

This briefing describes the energy sector – its public policy challenges, how the sector tries to address these challenges, and areas for potential collaboration between health and energy. While the briefing covers a range of challenges and interventions related to renewable and non-renewable forms of energy, it does not focus specifically on comparing the relative health impacts of different energy sources.

The scope of this briefing excludes nuclear energy. Its high health impact and relatively low risk makes it a difficult topic to cover. It was not possible to do this appropriately with the resource envelope available.



**Table 3. A set of policy goals commonly addressed in the energy sector**

	GOAL	DESCRIPTION
1	<b>Secure energy supply.</b> Secure, reliable energy supply is strategic for development and daily life.	Energy supplies should be reliable. Secure renewable energy that guarantees future supply.
2	<b>Universal energy access.</b> Everyone has access to energy without barriers.	Clean, modern and affordable energy to satisfy daily living conditions should be available to all groups in society.
3	<b>Energy efficiency and safety.</b> Energy is efficiently and safely produced, transported and used.	Energy policies should promote efficiency and safety, and reduce household waste.
4	<b>Energy and sustainable development.</b> Energy policies avoid adverse environmental impacts and contribute to sustainable development.	The energy sector should mitigate environmental damage. Adopt governance systems that ensure access for all.



# GOAL 1. SECURE, RELIABLE ENERGY SUPPLY IS STRATEGIC FOR DEVELOPMENT AND DAILY LIFE

ENERGY SUPPLIES SHOULD COME FROM RELIABLE, SECURE AND RENEWABLE SOURCES THAT GUARANTEE FUTURE SUPPLY

## Energy challenges and responses

Establishing reliable sources of energy supply is a key energy policy challenge in order for countries to achieve national strategic goals. Fossil fuels largely dominate the global energy supply. In 2009, more than 80% of the 12 150 mega tons of oil equivalent (Mtoe) of global energy supply came from oil, coal and natural gas (IEA, 2011b). Oil had a 33% share of this supply, followed by coal (27%) and gas (21%).

However, fossil fuel resources are not distributed uniformly across geographical countries or regions. Oil and gas resources are highly concentrated in the Middle East and the Russian Federation while coal resources are more evenly distributed across countries. Most low- and middle-income countries depend on imports. Europe and the Asian Pacific countries (including China, Japan and South Korea) are highly dependent on imports. Sub-Saharan Africa and developing countries in Asia have high import dependence and high share of oil as an energy source. However, constraints in production and transportation, and suppliers' strategic behaviour affect energy prices. Overall, rising prices affect macroeconomic conditions including balance of payments, inflation and gross domestic product (GDP). Price volatility and the rapid exploitation of resources raise concerns about future availability in countries. Thus, efforts to ensure cleaner, affordable and renewable energy supplies in the long term, are critical policy challenges for countries.

Generally, to promote reliable energy resources, countries adopt the following policies or combinations of policies to:

1. maximize access to energy resources and mitigate the risk of supply disruption through cooperation with other countries to maintain strategic reserves, or by diversifying import sources, hence reducing dependence on one supplier;
2. privilege access to energy to specific actors (e.g. specific industries as part of economic development plans);
3. ensure safe energy usage and disposal, and set pollution limits combined with measures to reduce exposure to pollutants;
4. promote energy efficiency and reduce consumption (analysed in more detail in Goal 3);
5. gain control of foreign production rights;
6. promote alternative domestic and renewable energy in import-dependent countries.

In many cases, focusing on renewable energy is seen as critical in ensuring availability and reducing dependence on other nations; in particular if the country is rich in natural renewable resources (e.g. water).

## Examples of health impacts and pathways

In accounting for the health impacts related to energy supply policies, we acknowledge the positive synergies between energy and development. Improving energy availability alleviates poverty, which in turn also influences health and its determinants. Yet, there can also be negative health impacts depending on the energy source. For reasons of space, we focus here on the health impacts of the largest sources of energy – oil, coal and renewable sources of energy – due to their relevance in the post-2015 sustainable development agenda; and, in the case of dams, due to their level of impact on populations, and policies that privilege access to energy to specific industries or sectors.

**Coal production and use.** Coal is a plentiful resource used to produce energy in the form of heat and electricity. Coal consumption is linked to pollution and carbon dioxide (CO<sub>2</sub>) emissions. Emissions of particulate matter are a key concern. Particulate matter (PM) is classified on the basis of the size of particles: PM 10 consists of particles of 10 micrometres, while PM 2.5 consists of particles of 2.5 micrometres or less. Coal combustion is the largest source of emissions of PM 2.5. PM can be inhaled and enter the lungs; it causes cardiovascular and respiratory diseases. WHO air quality guidelines for PM 10 are an annual average of 20 micrograms per cubic metre (µg/m<sup>3</sup>). In many cities in low- and middle-income countries, PM 10 exceeds this limit by up to five times (Lew, 2000). Coal combustion is also a source of sulphur dioxide, which can react with other components in the atmosphere to create particulate matter. Exposure to sulphur dioxide is linked to respiratory problems, such as bronchoconstriction and increased asthma symptoms. Coal is also tied to water contamination. For example, some studies have shown dangerous levels of arsenic in groundwater in coal-producing regions, which is linked to arsenicosis, skin cancers and tumours. Damage to nervous, digestive and cardiovascular systems are also documented (Yu, Sun & Zheng, 2007). A study published in 2008 found that increased water vapour and temperatures from higher levels of CO<sub>2</sub> exacerbated ozone levels more in already polluted areas. It was found that CO<sub>2</sub> could increase air pollution deaths in the USA by approximately 1000 (350–1800) annually, and cancers by 20–30 per 1000. An extrapolation by population found that globally there would be 21 600 more deaths caused by CO<sub>2</sub> pollution.

**Benefits and risks of renewables.** Renewable energy can put countries on the path to a cleaner environment, energy independence, and a stronger economy. Yet, it is important to consider that it can have negative impacts. Wind energy, for example, is a source of noise pollution. The infrasound frequencies can cause buildings to vibrate. This can, however, be avoided by good design and acoustic insulation

(Abbasi & Abbasi, 2010). Other hazards include accidents due to blade failures, particularly in highly populated areas. The negative effects of solar energy are linked to material requirements. For example, photovoltaic-based systems (PVs) require inputs that can be toxic and explosive (e.g. antifreeze agents, rust inhibitors, and leaked heavy metals) (Siddayao, 1993). Further adverse effects include the impact on land use due to the inadequate disposal of materials (e.g. fiberglass, glass, coolants, insulations, or cadmium and arsenic) (Abbasi & Abbasi, 2010). However, research is being carried out to develop more efficient solar technology. Quantum well solar cells are being developed as a way to increase solar cell efficiency (Ekins-Daukes, 2012). Progress has been made to develop organic photovoltaics (Kippelen & Brédas, 2009; Sun, 2012), while the PV industry has increasingly committed itself to recycling (Miles, Hynes & Forbes 2005).

**Health impacts of oil production.** Although oil and gas production contributes to employment growth, it can be linked to health problems. Health can be compromised by exposure to hazards through natural pathways such as polluted air, water or contaminated food. Examples include exposure to hydrogen sulphide, benzene, contaminated water and diesel dust, as well as ingestion of adversely affected livestock or wildlife (Neff et al., 2011). There are also risks associated with incidents such as well-site accidents, pipeline leaks and spills, and noise and light pollution (Zock et al., 2007). Production operations can also imply effects on the socioeconomic and demographic structure of communities, increasing pressure on health-care, social and community services, and municipal and regional infrastructure (Fraser Basin Council, 2012). There is evidence that exposure to oil during oil spillage clean-up work may result in respiratory symptoms that can last one to two years (Zock et al., 2007). Another issue that is increasingly raising concerns is hydraulic fracturing, its impact on water quality and potential to trigger gas releases (see Goal 4). An increase in road injuries in oil production sites and surrounding areas is also cited as a concern.

**Population displacement and ecological disruption from dams.** Dams contribute to economic growth through delivery of water, electricity and flood control, yet they negatively impact on some population groups – in particular rural people (WCD, 2000). Since the construction of large dams began in the 1930s, around 40 to 80 million people

worldwide have been displaced. Dams often destroy agriculture and fishery systems, resulting in food shortages and malnutrition in densely populated areas in countries such as India, Malaysia, Thailand and Viet Nam (WCD, 2000). Dams can change the biological characteristics of water, impacting on the availability of natural drinking water resources (Chai et al., 2009). Sixty per cent of all rivers in the world have been affected by dam diversions (WCD, 2000). Dams can also damage ecological integrity; at least 20% of the world's fresh water fish have become extinct, threatened or endangered in recent years due to industrial effluents, raw sewage and heavy boat traffic related to dam expansion (WCD, 2000; Stone, 2008) (Box 1).

Finally, vector-borne diseases are also associated with reservoir development. For example, Rift Valley Fever spread along the Blue Nile in the Sudan due to the impoundment of irrigation systems in Aswan and Kariba (WCD, 2000). Schistosomiasis has been found to be moving along upstream waters created by dams. Around 779 million people are at risk of infection; most of them living in irrigation areas within or close to large reservoirs (Zeng et al., 2011). Schistosomiasis causes neurological damage, pulmonary disease, stunting and anaemia in children (McManus et al., 2010). In China, this condition is a major public health concern, on a par with HIV/AIDS, and its increase has been linked to the expansion of dams in the country (McManus et al., 2010; Zeng et al., 2011).

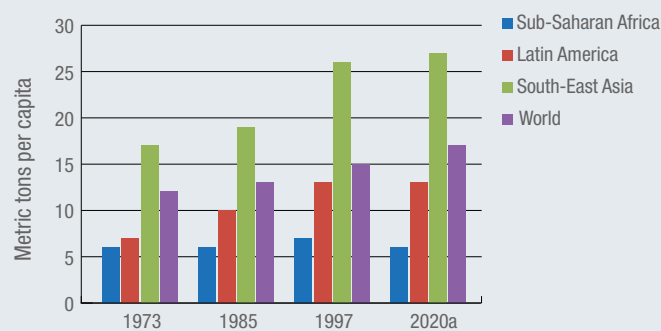
**Strategic policies for industrial development and impacts on households.** Energy is central to industrial diversification. Generally, industries have larger consumption needs than households. However, there is often a trade-off when privileging access for industrial purposes and households can suffer the negative effects of energy distribution policies (UNDP, 2011). This can affect people's well-being and key social determinants of health. For example, Africa is the most undersupplied region in the world when it comes to electricity, and the expansion of the electricity grid is constrained by a lack of funds and limited capacity to invest in public infrastructure. It is estimated that more than 80% of the population is off the power grid (McDonald, 2008). However, despite the limited development of the grid, some countries opt to direct vast supplies of energy to specific sectors to support industrial development (such as mining and other key industries), which can exacerbate the negative impacts on the overall population (Box 1).

## BOX 1. SOCIAL DETERMINANTS AND EQUITY FOCUS

Fish is a critical source of protein for many poorer communities. In Africa, it provides 21% of people's protein consumption (WCD, 2000). While rivers supply around 6% of the fish protein consumed by humans globally, it is often the only source of protein and nutrition for many inland communities in Africa (WCD, 2000). Figure 1 depicts global per capita fish production and its gradual increase in all regions except for Africa, where it has remained stagnant (FAO, 2012).

The reduction in consumption of fish protein has, in part, been attributed to the negative impact that dam development has had on ecosystems (e.g. changing riverine habitats and forcing migration away from fishing areas). The dams not only affect the livelihoods of the people using the rivers to make a living, but it also limit their access to their most important source of protein and nutrition.

Figure 1. Stagnant fish production in sub-Saharan Africa, 1973-2020.



a, projected.  
Source: FAO (2012).

## What can both sectors do together?

Given the importance of energy as a determinant of health and well-being, the health sector can explore opportunities for collaboration with the energy sector by determining in which energy-related activities there is potential to achieve mutual gains or mitigate harm. The energy production has several implications for climate change, national security, private sector participation, development, and poverty reduction, among others. For reasons of space this section focuses on air pollution and national development, and how these impact on health.

### Air pollution

**Contribute scientific analyses to the adoption of pollution limits.** In most high-income countries, regulations on air quality standards and pollutants produced by, for example, power generation or transport, are common policy measures. A recent study showed that low- and middle-income countries have few examples of such regulations (Hunt, 2011). The health sector can support the energy sector to set caps on specific pollutants through appropriate scientific analyses and conduct impact studies to assess compliance. In these cases, the differential impacts of pollution on different social groups could be considered.

**Support identification of pollution sources.** Health practitioners can support assessments of pollution sources. Although the transport and power generation sectors are often targeted, other sources of pollution may be underestimated. For example, an analysis in Mongolia identified additional pollution sources as cooking stoves in small businesses, commercial kiosks, heat only boilers in residential areas not connected to power generation plants, informal construction industries, hospital waste burning sites, dust, garbage and livestock.

**Integrate interventions that reduce exposure to outdoor pollutants.** The health sector could support authorities to consider the impact of air pollution on health when making decisions on land use, and the possibility of adopting minimum distances between sources of pollution and homes, as well as between schools and workplaces (Giles et al.,

2011). An example of this could be locating residences, schools and hospitals away from roads highly polluted due to vehicle traffic. The health sector could work with authorities to set exchange air and building standards to prevent infiltration of pollutants indoors.

### National development

**Support actions to ensure healthy oil production operations.** In order to support oil producers to address and improve public health, authorities could examine key issues, for example, pollution levels, impacts on water sources, or food crops, and related health outcomes. The health sector could evaluate the efficacy, effectiveness, efficiency and equity of interventions adopted by oil producers so that they could adapt their current operations in line with previously approved environmental impact assessment and mitigation measures. It could also scrutinize proposed solutions and their unintended consequences, and develop interventions to address them (Neff et al., 2011). The health sector could also raise public health issues in policy debates including climate change, transportation and food policies, which are directly related to oil production and availability, and can impact on health. In this context the health sector could also explore avenues to promote intersectoral coalitions.

**Contribute to the adoption of off-grid sources.** Based on the requirements of communities and/or public and social services, a wide range of technologies is available for power supply. The choice of technology depends on many factors, such as the type of sources available, distance to a grid, reliability and quality of grid supply, and energy costs, among others. A community close to a transmission line would often find a grid connection to be the easiest solution. In cases where a grid is not available, off-grid solutions can be explored. A cost-effective solution is solar lanterns for lighting in households and public services including health posts. Other sources could include renewable energy, such as solar, wind, hydro and biogas, that could be combined with cleaner fossil fuel technologies to improve supply. Recently, several renewable energy-based technologies have declined in price. However, when adopting a specific type of energy, it is essential to explore the

potential impact on households and communities, as well as training needs and maintenance of the new technologies and devices. This is another opportunity where the health sector could contribute by undertaking impact analyses.

**Support impact evaluations of new sources of energy.** As fossil fuels are limited, renewable energy is being promoted on the development agenda. In the decision-making processes for selecting sources of energy, policy-makers frequently request cost-benefit analyses. Here again, it is important that comprehensive assessments are made of the potential health impacts of each energy source. The health sector has an opportunity to contribute to this undertaking by providing evidence on exposures to pollutants, their determinants and pathways.

**Contribute to the reduction of environmental and health impacts.** The Clean Development Mechanism (CDM) defined in the Kyoto Protocol allows countries with emission-reduction commitments to implement projects to earn certified emission reduction (CER) credits. For example, a CDM project can be an electrification using solar panels, the installation of energy-efficient boilers, or a Small Hydropower Project (SHP) (Purohit, 2008). India has more than 300 Small Hydropower Projects that provide 0.01 – 30 megawatts (MW) of electricity that

are developed under the CDM (Purohit, 2008). They provide emission-free power with little environmental impact, thereby improving the rural population's access to energy. In this case, the health sector can cooperate with the energy sector to adopt health impact assessments or integrate indicators into the projects to monitor health impacts.

**Support the formulation and implementation of resettlement plans in energy projects to mitigate health impacts.** Some institutions (e.g. World Bank) have guidelines for the resettlement of populations displaced by energy projects, such as dams or power transmission lines. Dams often require the resettlement of people living in construction areas. In such cases, the adverse impact of displacement can be mitigated by resettlement action plans to assess health impacts. Additionally, the United Nations Office of the High Commissioner on Human Rights (OHCHR) has rules that countries should respect (OHCHR, 2008). Such guidelines recommend financial compensation for loss of key health determinants, such as housing, health and social services, education, transport, and for temporary accommodation. Health professionals can participate in the formulation of action plans in order to lessen the negative health impacts and suggest mitigation measures.

### For more information

The International Energy Agency (IEA) works to ensure reliable, affordable and clean energy. IEA has four main focus areas – energy security, economic development, environmental awareness and global engagement: <http://www.iea.org/topics/energysecurity/>

The European Small Hydropower Association promotes hydropower at European Union level: <http://www.esha.be/about/about-esh.html>

The United Nations Office of the High Commissioner on Human Rights (OHCHR) oversees programmes to protect human rights and international rights agreements: <http://www.ohchr.org/EN/Pages/WelcomePage.aspx>

Sustainable Energy For All is an initiative launched by the United Nations Secretary-General and guided by his High Level Group that brings all key actors to the table to make sustainable energy for all a reality by 2030: <http://www.sustainableenergyforall.org>

The Guardian newspaper provides an interactive map giving an overview of exposure to air pollution mapped by city: <http://www.guardian.co.uk/news/datablog/interactive/2013/jan/16/exposure-air-pollution-mapped-by-city>

# GOAL 2. EVERYONE HAS ACCESS TO ENERGY WITHOUT BARRIERS

CLEAN, MODERN AND AFFORDABLE ENERGY TO SATISFY DAILY LIVING CONDITIONS SHOULD BE AVAILABLE TO ALL GROUPS IN SOCIETY

## Energy challenges and responses

Globally, 1.3 billion people did not have access to electricity in 2009, while 2.6 billion people could not access clean cooking energy relying instead on rudimentary biomass and coal stoves (IEA, 2011a). Although significant progress in the level of electrification has been recorded in a number of countries (including Brazil, China, the Philippines, South Africa, Thailand and Viet Nam, among others), the problem of access to electricity persists in many countries in Asia and in sub-Saharan Africa. The level of success has been even lower in giving people access to clean, renewable cooking energy, where limited investments have been made.

While Goal 1 refers to the broader strategic issue of securing energy at the national level, access to energy in this section refers to energy security at the level of the household or social services targeting households. The general population's lack of access to energy limits the potential for human development and this is a major policy challenge. Research identifies two types of poverty related to this goal: fuel poverty and energy poverty. Fuel poverty refers to people's inability to access energy to ensure a comfortable temperature at home. The most accepted criteria of fuel poverty is when more than 10% of household income is spent to maintain a satisfactory indoor heating level, defined by WHO as a minimum of 18 degrees centigrade (Liddell & Morris, 2010; WHO-EURO, 2007). Clearly, fuel poverty has the greatest impact on low-income groups that live in thermally inefficient housing and lack the financial resources to pay for heating (Marmot Review Team, 2011).

Energy poverty is a broader concept that looks at the impact of lack of access to energy at family, community and societal levels that often perpetuate poverty. For the purpose of this paper we consider energy poverty as the lack of access to energy sources essential to ensure a minimum of basic services and goods, and to secure adequate income (Jannuzzi & Goldemberg, 2012). At the household level, lack of access to energy often forces the poor to rely on non-renewable solid fuels in the form of coal, dung, wood and crop residue. Consequently, excessive exposure to smoke from incomplete combustion of solid fuels imposes heavy social costs. The impact on health is described below. School systems, transportation, the operation of irrigation systems, and social and health services are also affected.

Policy interventions to address these challenges include:

1. promote electrification through grid extension where possible and rely on off-grid, decentralized systems where it is difficult to extend the grid;

2. provide clean and renewable energies ('off-grid measures') combining the supply of petroleum-based fuels (kerosene, LPG) with the promotion of biogas or new technologies (e.g. efficient cooking stoves) (Bhattacharyya, 2012);
3. provide different pricing levels for grid electricity and subsidies for fuel-efficient stoves for low-income households or communities.

Due to market failures, interventions very often rely on governments as the poor have low capacity to regularly pay for modern fuels (as opposed to traditional non-monetary transactions for solid fuels collection). In addition, the private sector shows little interest in loss-making investments, which perpetuates the limited access. Access to renewables is currently an expensive option for the poor.

Given the gender dimension of energy poverty, many interventions pay attention to women and girls. There are projects that encourage girls to use solar lanterns for studying after dark. Others investigate gel fuel options to replace highly flammable liquid ones, or support the distribution of new technologies like solar or efficient cookers, or promote access to public distribution systems such as gas (Balmer, 2007). Other alternatives include mandates to place wood plantations within 1 km of rural habitations. Related measures improve community development by providing renewable energy such as solar photovoltaics managed by members of the community (e.g. women) who become knowledgeable on the specifics of solar technologies, and issues related to the assembly and maintenance of solar batteries.

## Examples of health impacts and pathways

**Energy poverty, and morbidity and mortality.** Every day, millions of women and children spend long hours gathering wood for cooking and heating (UN-Energy, 2005). These two groups are most vulnerable to energy poverty because they are often responsible for collecting and using solid fuels, which reduces their economic and educational opportunities. Energy poverty also limits the availability of transport services reducing access to work and better incomes. Lack of energy decreases land productivity because of the absence of irrigation systems. It also impacts on health facilities and can limit medical attention after dark. Lack of adequate energy in health facilities is a barrier to the provision of health services in many countries. Examples include lack of: (a) lighting for childbirth and delivery; (b) refrigeration for blood and vaccines; (c) power for sterilization equipment and basic medical devices; and (d) power for emergency response at night. Also, the need for high technology interventions to fight noncommunicable

diseases leads to additional energy requirements (for example, electricity for imaging equipment for cancer detection) (Clark, 2011). Without energy, many interventions cannot be undertaken, and this contributes to preventing the attainment of universal health coverage.

**Fuel poverty and morbidity and mortality.** Research has found that between 1988 and 1997, the inability to afford adequate heating levels and thermally inefficient housing were linked to excessive mortality rates in winter, accounting for 28% in Portugal, 21% in Ireland, and 19% in England (Healy, 2003). In the United Kingdom, fuel poverty is linked to co-morbidities like cardiovascular disease (40%) and respiratory conditions (33%) during winter, with the elderly and children most affected (Liddell & Morris 2010; Marmot Review Team, 2011).

**Solid fuels, indoor air pollution and morbidity.** Use of biomass fuels for cooking increases indoor air pollution (IAP) (IEA, 2010; WHO, 2006). IAP causes 5% of the global burden of disease, and has direct health impacts through the inhalation of carbon monoxide, nitrogen oxide, benzene, butadiene, formaldehyde, and polyaromatic hydrocarbons. IAP is a major cause of child mortality due to respiratory infections (WHO, 2006). Dependence on rudimentary biomass and coal stoves increases exposure to smoke, which is linked to nearly a half of pneumonia deaths in children under five years and a third of deaths

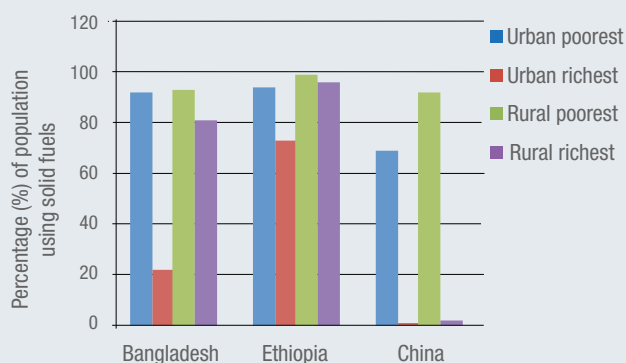
from chronic obstructive pulmonary disease. Furthermore, IAP causes a fifth of all deaths due to ischaemic heart disease (WHO, 2009a). Similarly, solid fuel use causes pulmonary airflow restriction in women over 30. There is also evidence of links with tuberculosis and lung cancer (IEA, 2010). As the number of people relying on biomass is projected to rise to 2.8 billion by 2030, IAP from inefficient stoves can be expected to cause over 1.5 million premature deaths annually due to respiratory and cardiovascular diseases (over 4000 per day). There will also be negative impacts on neonatal health (IEA, 2010; Holdren & Smith, 2000). This is significant, as collective death rates from IAP are more than the national burden of malaria, tobacco, AIDS, heart disease or cancer (IEA, 2010) (Box 2).

**The least developed countries and sub-Saharan Africa suffer most severely.** Globally, one third of deaths from pneumonia and lung cancer are attributable to solid fuel use, but in sub-Saharan Africa, this share increases to one half (UNDP & WHO, 2009). A broader measure, disability adjusted life years (DALYs), which captures the premature death and the years lived with a disease, reveals even more concentrated effects of solid fuel use in these regions. Globally, out of 40 million DALYs attributable to solid fuel use, 44% occur in sub-Saharan Africa (UNDP & WHO, 2009).

### BOX 2. SOCIAL DETERMINANTS AND EQUITY FOCUS

The poorest rural and urban households in low-income countries are most affected by energy poverty. The persistent lack of modern fuel sources for cooking and electricity in low-income households contributes to increased mortality and pollution, and hinders progress towards halving the number of people in poverty by 2015. Reducing the availability gap between low-income and high-income populations is necessary to reduce child mortality, improve maternal health and mitigate pressure on the environment. However, great disparities can be seen between and within countries. Figure 2 shows the percentage of poor versus rich populations using traditional solid fuels in 2003 in three countries (WHO, 2006).

Figure 2. Energy poverty and use of solid fuels in selected countries



Source: Adapted from WHO (2006).

### What can both sectors do together?

**Contribute to design and implementation to reduce household indoor air pollution.** The health sector can contribute to the design, implementation and evaluation of programmes to promote the use of advanced biomass stoves, and fuels such as biogas, ethanol and liquefied petroleum gas. This can reduce the risk of IAP. Using surveys, health data and its technical capacities, the health sector can support initiatives to develop and expand the use of cleaner cooking stoves and fuels by demonstrating the health impacts of traditional stoves and anticipate health gains created by innovative programmes. Some

countries have initiatives to develop cleaner cooking stoves and deploy them in households. In India, for example, a national initiative will reach 160 million households that rely on improved biomass and coal cooking stoves. The aim is to reduce combustion pollutants that affect health and increase greenhouse gas emissions. The health sector can contribute to setting standards for materials and guidelines for manufacturers of new cooking stoves (Venkataraman, 2010). In the deployment to communities of improved cooking stoves, health practitioners can partner with local actors to disseminate information on how to install, manage and maintain them, and provide households and communities with information on the health impacts of IAP. Health

practitioners can also partner with housing authorities to introduce new design features for homes in order to improve ventilation.

#### **Support grid differential pricing initiatives to address energy poverty.**

There are no specific programmes or interventions addressing energy poverty. In general, electric grid extension or expansion is the preferred option when addressing energy poverty with measures to provide special electricity tariffs for poor households. In other cases, policy-makers set cross subsidization mechanisms by charging higher tariffs to specific consumers like industries (Bhattacharyya, 2012). Other options include off-grid electrification through two modes of operation: 1) local-grid systems that rely on diesel generators or hydropower, although reliance on diesel imposes a cost burden on oil importing countries; and 2) stand-alone energy generators including solar photovoltaic systems in local grids or in battery charging systems in rural areas (IFC, 2012). In all these cases, the health sector can contribute by assessing the benefits and potential negative impacts of such policies. By working jointly with other sectors and actors, it can also assist health practitioners to better plan for the expansion of social and health services to wider geographical areas (Jain, 2010).

#### **Support or advocate measures to address energy poverty for women.**

The supply of clean, safe fuels to low-income households for cooking or heating is often inadequately addressed and is an implementation challenge for the energy sector. Local health authorities can support or advocate for regulatory measures given their wide-ranging impact on health determinants. In cooperation with other actors, the health sector can also support the creation of databases for effective policy-making. For example, by documenting the gender dimensions of energy poverty or promoting the adoption of gender disaggregated data on energy consumption patterns and impacts. Furthermore, it can advocate for energy policies that directly address gender issues in order to understand intra-household differences, and recognize the relationship between energy, income and gender (Jain, 2010).

**Work with nongovernmental organizations (NGOs) and communities to improve social participation.** The energy sector needs to improve household awareness and interest in newer cooking and lighting technologies. The health sector can partner with NGOs and organizations, which can play an important role in creating this awareness. This may involve, for example, joint planning of the introduction of new technologies to ensure their widest possible dissemination. The health sector can

also be involved in carrying out demonstrations of new devices. The promotion of efficient cooking stoves requires lifestyle changes and different cooking skills, which also have implications for nutrition. The use of solar energy panels, for example, requires that householders know about different cooking times. In addition, local health workers and community organizations can carry out campaigns addressing the need for lifestyle changes to improve energy safety (Jain, 2010).

#### **Track trends in IAP and set standards and strategies to protect health.**

Health authorities can support energy policy-makers to track national trends on indoor air pollution by, for example, implementing household energy databases disaggregating information according to key stratifiers, such as the location of households or household income. For this, the WHO global database on household energy can serve as an example to national authorities. National data collection can also provide the health sector with an opportunity to collaborate with the energy sector and other actors to prepare national air quality guidelines as well as guidelines for IAP related to domestic fuel combustion, by proposing standards and strategies to protect health.

#### **Monitor health and other basic services facilities' access to energy.**

The global campaign to attain universal access to energy by 2030, as articulated in the United Nations Secretary-General's Sustainable Energy for All (SE4All) initiative, aims to track access to energy for households, productive uses and community applications. Health facilities are among those community institutions where access to adequate, reliable and sustainable energy needs attention (UN, 2011). It is envisaged that countries that opt-in to the SE4All initiative will implement a system of monitoring access to energy, as proposed in the Global Tracking Framework. In some sub-Saharan African countries, up to 50 per cent of health facilities have no electricity. Access to electricity is critical for emergency care, childbirth and other essential health procedures. The health sector can help countries monitor health facilities' access to energy by implementing mechanisms to assess health service availability and readiness, which could include energy components. It can support other sectors by providing basic social services (e.g. education) to implement similar interventions so as to ensure equitable access to energy. To implement this work, countries could apply the methods and criteria adopted in the WHO global database of energy access in health facilities that will soon be published. This could be an important tool in addressing an important barrier to universal access to health services.



## For more information

The World Energy Outlook (WEO) highlights how energy access plays a critical role in socio-economic development: <http://www.iea.org/topics/energypoverty/>

WHO describes poverty and its association with health determinants: <http://www.who.int/topics/poverty/en/>

Links between household energy, the MDGs and Indoor Air Pollution: <http://www.who.int/indoorair/mdg/energymdg/en/>

UNIDO is the specialized agency of the United Nations that promotes industrial development for poverty reduction, inclusive globalization and environmental sustainability: <http://www.unido.org/>

UNDP's 'Energizing Poverty Reduction' examines to what extent energy-poverty dynamics are reflected in current policies and plans set forth in national poverty reduction strategies: [http://www.undp.org/content/undp/en/home/librarypage/environment-energy/sustainable\\_energy/energizing\\_povertyreductionareviewoftheenergy-povertynexusinprsp.html](http://www.undp.org/content/undp/en/home/librarypage/environment-energy/sustainable_energy/energizing_povertyreductionareviewoftheenergy-povertynexusinprsp.html)

The Sustainable Energy for All joint World Bank and IEA report charts the course to achieve universal energy access, double the use of renewable energy and improve energy efficiency: <http://www.worldbank.org/en/topic/energy/publication/Global-Tracking-Framework-Report>



# GOAL 3. ENERGY IS EFFICIENTLY AND SAFELY PRODUCED, TRANSPORTED AND USED

ENERGY POLICIES SHOULD PROMOTE EFFICIENCY AND SAFETY, REDUCING WASTE BY HOUSEHOLDS

## Energy challenges and responses

The production, transformation, transportation and use of energy involve processes where a part of energy is lost through inefficiency. For example, only 35% of oil found in a reservoir can be effectively extracted. Similarly, transformation of primary energies such as coal, oil and gas into secondary energies such as electricity results in significant losses. The efficiency of fossil fuel conversion to electricity (particularly from coal) is close to 33% – implying that two thirds of energy input is wasted. For example, an incandescent lamp is 10% efficient (one tenth of energy input is converted to light). On average a petrol-driven car is 20–30% efficient. Clearly, it is easy to appreciate the cumulative effect of inefficiency in the supply chain.

In terms of primary energy intensity (i.e. energy required per unit of GDP at purchasing power parity), European countries perform best and have the lowest intensity in the world. High-income countries in Asia, the Pacific and Latin America come close to the European level – with about 10% higher intensity. North America and low-income countries in Asia come next with 30% higher energy intensity than Europe, while China has 40% higher energy intensity. Middle East countries on average use from two to three times more energy per unit of GDP than Europe (WEC, 2008). The 1990s saw significant efficiency improvements but, since then, there has been a visible decline in progress.

Energy efficiency has implications for the poor. Globally, it is estimated that in 2010, low-income households spent US\$ 37 billion on dirty and inefficient lighting alone (UN-Energy, 2005). To meet their needs, 90% of poor people spend most of their earnings on paraffin or kerosene lamps, candles and disposable batteries (IFC, 2012). Health can be improved indirectly because greater energy efficiency allows more people to benefit from energy and engage in the economy. Direct benefits arise from reduced emissions, exposure and environmental degradation (see Goal 4). Also, lower demand for energy reduces imports, which can release funds for other investments.

Initiatives to improve efficiency include implementation of standards and enforcement, which is challenging for low-income countries. A common concern in these countries is the lack of safety standards for gasoline products (Peck et al., 2008). Another area for standardization is in information and labelling where information dissemination on energy technologies, efficiency measures and incentives, aim to create awareness of energy efficiency. For example, the European Union labelling of electrical appliances indicates in simple terms their

level of energy efficiency. Other interventions include standards for appliances, buildings, transport vehicles and lighting. Financial and fiscal mechanisms include grants and subsidies, tax relief, favourable depreciation rates and loans.

## Examples of health impacts and pathways

**Higher risks associated with a combination of poor housing and disadvantaged populations' use of riskier fuels.** The low cost of flammable inefficient energy appliances like kerosene and paraffin lamps, particularly in low- and middle-income countries, encourages their use among the poor (Barillo et al., 1998). They damage people's health and property largely due to faulty design or improper use (Peck et al., 2008). Even worse, globally, around 10% of all unintentional fire-related deaths are associated with inefficient stoves and lamps using kerosene and liquid petroleum gas (Peck et al., 2008). Fire-related burns are the eleventh leading cause of death among children between the ages of one and nine, while infants have the highest death rates and are most vulnerable (WHO & UNICEF, 2008). Rates increase between ages 15 and 19, due to increased exposure, experimentation and risky behaviours. The severity of burns is coupled with the lack of access to water and first aid services (Peck et al., 2008; WHO & UNICEF, 2008). Most burns-related mortality occurs in Africa, the Eastern Mediterranean and South-East Asia (WHO & UNICEF, 2008). In South Africa, shack fire burns are the second most common reason for hospitalization in Cape Town. Added to this, cramped settlements and dwellings made of highly combustible materials contribute to the rapid spread of fires (Peck et al., 2008).

**Poor quality vehicles with inefficient engines and high emissions on roads and in communities.** Diesel consists of crude oil and hydrocarbon additives. It has been associated with lung cancer and a higher risk of bladder cancer (IARC, 2012). Large populations are exposed to diesel fumes every day given off by motor vehicle, train or ship engine exhausts, electricity generators or ambient air (IARC, 2012). Also, many local electricity grid systems rely on diesel generators. Diesel exhaust produces particulate matter (PM 10 or lower), which is linked to a higher risk of lung cancer comparable to second-hand smoke inhalation. One of the characteristics of diesel exhaust is the release of PM 10 (or lower) at a markedly greater rate than gasoline, at an equivalent fuel to energy ratio. Technologies to reduce emissions from diesel engines and strict regulations to limit diesel emissions are being implemented in many high-income countries. Indeed, Europe and North America have tight emission standards for diesel engines. However, in many

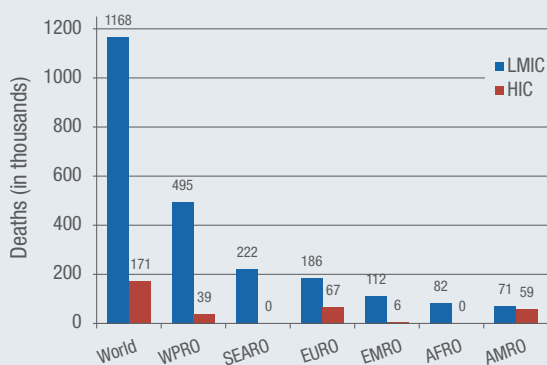
countries, the replacement of vehicles without improved technologies to limit emissions will take longer. Diesel usage in many regions is not regulated and new technologies are simply not available. This is linked to the fact that many African cities, for example, have PM 10 levels that are double the recommended *WHO Annual Air Quality Guideline* of 20ug/m<sup>3</sup>.

**Low-carbon technologies and exposure to toxic substances.** Household energy efficiency can be increased with the use of compact fluorescent light bulbs (CFLs), which are four to five times more efficient than incandescent bulbs, while lasting much longer. However, it is important to consider that there are risks associated with CFLs. For example, small amounts of mercury and other chemicals are sealed inside the glass tubing. When a CFL breaks, some of the mercury is released as vapour and may be a health risk. It is important, therefore, to consider measures that balance the benefits of CFL with the negative effects.

### BOX 3. SOCIAL DETERMINANTS AND EQUITY FOCUS

Approximately 1 339 000 people died from urban outdoor air pollution in 2008; 1 168 000 of whom live in low-to-middle-income countries (LMICs) (WHO, 2008). Figure 3 shows deaths by WHO region for high-income countries (HICs) versus LMICs. Mortality in LMICs was almost seven times higher than in HICs.

**Figure 3.** Deaths attributable to urban outdoor air pollution by country income level, 2008



WHO regional offices: AFRO: Regional Office for Africa; AMRO: Regional Office for the Americas; EMRO: Regional Office for the Eastern Mediterranean; EURO: Regional Office for Europe; SEARO: Regional Office for South-East Asia; WPRO: Regional Office for the Western Pacific  
Source: WHO (2008).

## What can both sectors do together?

**Contribute to energy efficiency and carbon reduction initiatives.** Although the energy sector generally takes the lead in interventions to promote energy efficiency, the health sector can provide information on how the use of inefficient and unsafe home appliances and fuels impacts on people's health. Also, it can help by undertaking health

impact assessments (HIAs) of energy efficiency interventions to measure their benefits and mitigate anticipated negative impacts. In addition, some current housing initiatives could provide an opportunity for collaboration. For example, the health sector could support initiatives for new homes that produce zero net carbon emissions (UK Department of Communities and Local Government, 2010). These strategies impose specific caps on emissions with which all new homes would gradually comply. The health sector can also support local initiatives to develop compact urban housing, which delivers energy-efficient transport, electricity, water and sewage (see Sectoral Briefing 1. Housing).

**Promote partnerships in low-carbon energy transitions.** Research shows that CFLs can help reduce the burden of disease and health infrastructure shortages (IEA, 2010), and that the use of CFLs has been successful in many low-income countries. The health sector can get involved by contributing information and estimates on their health benefits and can support energy and environmental actors in preparing technical guidance or advocacy materials to provide simple, user-friendly directions to prevent and reduce people's exposure to mercury pollution.

**Support initiatives to implement energy efficient public transport and cycle/pedestrian routes.** Working with local authorities, and transport and energy policy-makers, the health sector can support initiatives aimed at introducing public transport systems that use clean fuels and reduce emissions, while promoting public transport commuting and the use of non-motorized transport (e.g. bicycle lanes). By undertaking health impact assessments that anticipate the benefits that these investments can bring, stakeholders can identify co-benefits to improve both health and energy efficiency. Urban investments in public transport also support safer travel and physical activity (see Sectoral Briefing 3. Transport).

**Work together in eco-labelling programmes.** Labelling programmes can transform markets and promote efficient product development and use (Banerjee & Solomon, 2003). Labelling often requires government involvement, product categorization, design processes, partnerships and legislative mandates (Banerjee & Solomon, 2003). This is attributed to the fact that government support is critical for labelling credibility and long-term viability. By participating and highlighting the potential health benefits of the labelling programme, the health sector can contribute to the achievement of efficiency, while promoting the use of healthier appliances that can reduce IAP, burns and fires in homes caused by the use of unsafe fuels. It is important to note that raising awareness, information sharing and promotional programmes do not necessarily mean that health risks will be reduced. In many countries, where the hazards of unsafe fuels are well known, low-income groups rely on these low-cost fuels. Therefore, in addition to the above measures, it is important to increase access to modern fuels, and to innovative heating and cooking technologies among the poor.

**The public health sector: leading by example.** The health sector can take a leading role in design projects, such as new hospital construction incorporating energy efficiency features, which can foster goodwill and intersectoral collaboration. In 2004, the Scottish Government launched a Central Energy Efficiency Fund (CEEF) to assist public sector organizations lead the way in energy efficiency. The health sector committed itself to investing £4 million in a revolving loan fund

ring-fenced for energy efficiency projects. The financial savings are re-invested in further energy efficiency measures, and any profit is used to improve frontline services. The programme aims to facilitate the reduction of local National Health Services' energy consumption while increasing funding for health-system operations. These types of public programmes can also raise the profile of the issue of energy efficiency and stimulate behaviour change across organizations and society.

## For more information

The Global Health Observatory provides extensive data on mortality and burden of disease from outdoor air pollution: [http://www.who.int/gho/phe/outdoor\\_air\\_pollution/burden/en/index.html](http://www.who.int/gho/phe/outdoor_air_pollution/burden/en/index.html)

The Global Ecolabelling Network is an association of third-party environmental performance recognition, certification and labelling organizations: <http://www.globalecolabelling.net>

The Global Alliance for Clean Cookstoves is a public-private partnership which seeks to mobilize high-level national and donor commitments toward the goal of universal adoption of clean cookstoves and fuels: <http://www.cleancookstoves.org/the-alliance/>

The International Energy Agency works to ensure reliable, clean energy: <http://www.iea.org/topics/energyefficiency/>

The International Agency for Research on Cancer (IARC) is a WHO agency that follows UN governing rules to provide publications, education, training, news and research on human carcinogens: <http://www.iarc.fr/>

The Central Energy Efficiency Fund (CEEF) is a Scottish Government initiative to deliver efficient energy and small-scale renewable energy alternatives to the public: [http://www.energy-efficiency.org/ceef/CCC\\_FirstPage.jsp](http://www.energy-efficiency.org/ceef/CCC_FirstPage.jsp)

## GOAL 4. ENERGY POLICIES AVOID ADVERSE ENVIRONMENTAL IMPACTS AND CONTRIBUTE TO SUSTAINABLE DEVELOPMENT

THE ENERGY SECTOR SHOULD MITIGATE ENVIRONMENTAL DAMAGE, ENSURING GOVERNANCE OF SYSTEMS THAT ARE ACCESSIBLE AND SUSTAINABLE TO ALL

### Energy challenges and responses

Climate change is a phenomenon where natural and human factors alter weather patterns over time (Haines et al., 2006). The main origin of climate change is the release of greenhouse gas emissions caused by the burning of fossil fuels (McMichael et al., 2007). Activities in the energy system (production, conversion and utilization) lead to several environmental impacts. Common gaseous pollutants such as sulphur oxides, nitrogen oxides, carbon monoxides and dioxides, and PM 10 cause a number of effects such as smog, acid rain, ozone depletion and global warming. Some of these effects are local in nature (i.e. smog) while others can have regional (i.e. acid deposition) or global effects (i.e. global warming). This reiterates the importance of recognizing the need for international sustainable energy in line with the framework developed in Rio de Janeiro (Rio+20) under the guiding principles of the Kyoto Protocol.

International policies with targets for environmental impacts include regulatory and incentive-based mechanisms. The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) describes regulatory measures and standards for industrialized countries to reduce GHG emissions and cooperate with other parties to enhance the effectiveness of their interventions. Other measures include product, technology and efficiency standards to promote more renewable forms of energy. Incentive-based mechanisms focus on emission charges, trading and fuel taxes, and market-based instruments of “cap and trade”. These mechanisms have been successfully implemented in the USA to control pollution from stationary sources that contribute to acid rain mostly composed of sulphur oxides and nitrogen oxides. In Europe, they are used as instruments for carbon emissions reduction.

In 2010, total emissions were 30% higher than in 2000, and 46% higher than in 1990. Although emissions of sulphur oxides and nitrogen oxides have declined in most countries in Europe and North America, they have increased in developing countries (UNEP, 2007). This has had an impact on human health, crop growth, forests and fisheries, and global warming.

Energy extraction has also had an impact on ground and surface water quality. The costs of the damage are difficult to measure due to gaps

in information and difficulties in putting a monetary value on damages. In the production of electricity, there is a consensus that coal tends to impose significantly higher environmental costs, followed by oil, while gas-based electricity generation imposes the least amount of environmental impacts.

In addition, new energy extraction and generation techniques implemented in recent years have uncertain impacts for health and the environment. New techniques include fracking, biomass and geothermal energy.

**Fracking.** Advances in oil and gas extraction technology now allow drilling from unconventional and previously inaccessible sources (Passoff, 2012). Fracking involves injecting a mixture of water, sand and chemicals under high pressure into deep wells, to crack shale rocks and allow the gas or oil trapped there to flow to the surface (Hoogakker, 2010). The discovery of this energy source has led to a surge in natural gas operations in the USA and other countries (Kerr, 2010; Dyni, 2010). Meanwhile, deposits of shale oil occur around the world, including major deposits in Brazil, China, Estonia, Germany, the Russian Federation and the USA (Dyani, 2010).

**Biomass.** Biomass is biological material derived from living, or recently living organisms that is used to generate energy. Biomass is carbon based. The carbon used to construct biomass is absorbed from the atmosphere as carbon dioxide by plant life, using energy from the sun. Plants may be eaten by animals and thus be converted into animal biomass, but plants perform the primary absorption. Fossil fuels such as coal, oil and gas are also derived from biological material that absorbed CO<sub>2</sub> from the atmosphere many millions of years ago. As fuels, they offer high energy density, but making use of that energy involves burning the fuel and returning carbon sequestered millions of years ago back into CO<sub>2</sub>, and contributing to increased emissions. Biomass takes carbon out of the atmosphere while it is growing, and returns it as it is burned. This maintains a closed carbon cycle with no net increase in atmospheric CO<sub>2</sub> levels (Abbasi & Abbasi, 2010). The carbon neutral nature of biomass energy has renewed interest in the use of biofuels, such as methanol, ethanol, biodiesel, among others, as substitutes for

petrol and diesel (Hill et al., 2006). However, at present, biofuels cannot replace petroleum without affecting food supplies. Also, it has been estimated that if all corn and soybean production were dedicated to biofuels in the USA, they would only meet 12% of gasoline demand and 6% of diesel demand (Hill et al., 2006).

**Geothermal.** This source of energy is being promoted as cost effective, reliable, sustainable and environmentally friendly. It has been found that CO<sub>2</sub> emission levels are reduced by at least 50% when compared to fossil fuels. If the electricity that drives a geothermal heat pump is produced from a renewable energy source, emission savings can be as high as 100% (Fridleifsson, 2010). The use of geothermal energy has historically been limited to areas near tectonic plate boundaries, but this has changed and areas have been expanded due to technological advances, especially for applications such as modular power generation, home heating, and other applications that can use heat directly (Glassley, 2010). There are three types of geothermal resources: hydrothermal, dry hot rock and geopressures (Abbasi & Abbasi, 2010). A disadvantage of geothermal energy for the sector is that sites can stop producing steam. Additionally, costs and environmental effects increase if large-scale geothermal energy extraction is carried out as it can trigger small earthquakes associated with the hydraulic fracturing of dry rock to create artificial ground wells.

## Some health impacts and pathways

It is expected that climate change will increase mortality and morbidity via biodiversity degradation, pollution, malnutrition from food and water insecurity, and increased infectious and noncommunicable diseases resulting from natural disasters, vector-borne disease migration, among other causes (Kundzewicz et al., 2008; WHO, 2011). Natural disasters and deforestation destroy potable water sources, compounding the effects of climate change (Kundzewicz et al., 2008). Rising sea levels due to higher temperatures will cause flooding and increase the incidence of drowning and injury, and cause large-scale displacement (Haines et al., 2006).

**Climate change, food insecurity and extreme weather events.** Around 88% of the climate change toll will affect children under the age of five (Wilkinson et al., 2007). Key pathways include lack of sanitation, food insecurity and water-borne diseases (WHO, 2011; Confalonieri et al., 2007). By 2020, the burden of diarrhoea related to natural disasters is projected to increase by up to 5% in low-income countries, while high-income countries will be relatively unaffected (Haines et al., 2006). Extreme weather impacts negatively on food production, creating shortages and increasing costs (FAO, 2011). Furthermore, severe dust storms from regions such as Africa to the Caribbean increase air and water pollution, which can lead to serious health consequences (Confalonieri et al., 2007; WHO, 2011). Climate change is projected to increase the frequency and intensity of heat waves and the number of hot days during summer months, raising morbidity and mortality rates, and will particularly affect groups such as the elderly. Heat waves are likely to transcend health concerns and have an impact on the fabric of society. If climate change continues at current rates, the frequency and duration of natural disasters such as droughts may increase as much as six fold, and CO<sub>2</sub> emissions will increase acid rain concentrations,

damaging buildings, forests and cropland (Confalonieri et al., 2007; WHO, 2011). More than 30 countries (2.2 billion people) have reduced malnutrition by 25%; yet 600 million people are still affected due to food insecurity and volatile food pricing related to the effects of climate change (FAO, 2011).

**Deforestation, water insecurity and health.** Arable land is finite, and only 22% of the earth's surface is suitable for agriculture (Weill et al., no date). Some 2 billion people depend on forests and croplands, 90% of whom live in low-income countries. Demand for food, fuel and raw materials is growing rapidly, yet in the last 20 years, cropland expansion has contracted, while the use of available land has increased, leading to land degradation and deforestation (UNEP, 2007). Deforestation lowers the capacity of an ecosystem to provide natural resources; in conjunction with climate change, it poses a threat to biodiversity, economic growth and health (UNEP, 2007). Deforestation can cause flooding and contribute to detrimental silting of rivers (Chaudhuri, 2003). The expansion of farming in Western Bahia, Brazil, has contributed to land degradation caused by soil erosion, nutrient depletion, water salinity and disruption of biological cycles (UNEP, 2007; Batistella & Valladares, 2009). Shifting rainfall patterns, melting ice caps and increased evapotranspiration affects the supply of clean water, which destabilizes environmental and social systems (WHO, 2011). Taking global population growth into account, the amount of people living with water shortages is projected to reach 3 billion by 2050; a twofold rise from 1990 (WHO, 2011). Furthermore, rising sea levels and subsequent salination of coastal freshwater can disrupt water treatment services, drainage and sewage disposal. Also, exposure to contaminated water is linked to around 90% of diarrhoeal infections in low- and middle-income countries (WHO, 2011).

**Health impacts of fracking.** Many of the chemicals used in fracking include known and suspected carcinogens. At least 75% are said to negatively affect the skin, eyes and other sensory organs, along with the respiratory and gastrointestinal systems (Colborn et al., 2011). Furthermore, each fracking event uses millions of gallons of water. Shale gas development also produces wastewater, which enters groundwater reservoirs and contaminates it with toxic elements (Passoff, 2012). Research on fracking wastewater has found toxicity levels above allowable thresholds, as well as radioactive materials picked up underground; materials that have been shown to cause liver, bone and breast cancers (Passoff, 2012). Moreover, inhalation health hazards were identified for workers exposed to crystalline silica at hydraulic fracturing sites.

**Health impacts of biofuels.** Despite the environmental benefits provided by biofuels, a substantial biomass energy policy could increase nitrogen emissions (Hill et al., 2006). Moreover, a commitment to increase the production of biofuels requires large water and land resources. For example, in some regions of Arizona in the USA, in order to produce biofuels, groundwater is pumped 10 times faster than the natural recharge potential of the aquifers (Pimentel et al., 2004). Production can also contribute to water pollution as more pesticides and fertilizers are needed for intensive cultivation (Chari & Abbasi, 2005). The removal of biomass also increases soil and

water degradation and flooding, which affects wildlife and natural areas (Abbasi & Abbasi, 2010). The massive production of biofuels could impact on food security reducing land for crops (Abbasi & Khan, 2000), thus contributing to rising food prices (Abbasi & Abbasi, 2010). There are studies showing that the thermal conversion of biomass into utilizable biofuels contributes to air pollution, emissions of dioxin, toxic irritants, the generation of solid wastes and occupational hazards due to workers' prolonged exposure to toxic and corrosive chemicals (Abbasi & Abbasi, 2010).

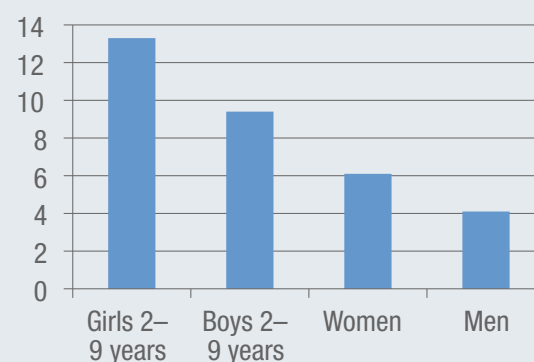
**Health impacts of geothermal energy.** The likely health effects of geothermal energy can be a consequence of surface disturbances, noise, thermal pollution and chemicals release. Another concern is land subsidence (land movement) following the withdrawal of hot water or steam from an underground field as well as air pollution due to pollutants present in the steam released in the geothermal energy process. Also, geothermal energy production often requires very large quantities of water, which can impact on domestic water availability. Negative environmental effects are, however, much lower than for fossil fuel sources (Abbasi & Abbasi, 2010).

### BOX 4. SOCIAL DETERMINANTS AND EQUITY FOCUS

In low-income countries, children are often the worst affected by disasters that can be related to climate change. In 1993, a severe flash flood devastated the district of Sarlahi in the southern plains of Nepal. After an unprecedented 24-hour rainfall, a protective barrage on the Bagmati river was washed away during the night, sending a wall of water more than 20 feet high crashing through communities and killing more than 1600 people. Two months later, a follow-up survey assessed the impact of the flood. This survey was unusual in that an existing prospective research database was available to verify residency prior to the flood.

As part of a large community-based nutrition programme, longitudinal data existed on children between the ages of two and nine and on their parents from 20 000 households, about 60% of the households in the study area. A difference between boys and girls' fatalities was found mostly among children under five (Figure 4). This possibly reflects the gender discriminatory practices that are known to exist in this poor area – when hard choices must be made in the allocation of resources, boys are more often the beneficiaries. This could be a reflection of the rescue attempts as much as of the distribution of food or medical attention.

**Figure 4.** Deaths from flash floods (per 1000 people) for Sarlahi district, Nepal



Source: WHO (2009b) adapted from Bartlett (2008).

### What can both sectors do together?

Explore co-benefits by incorporating energy strategies into housing design to reduce greenhouse gas emissions. Many GHG mitigation policies that shift fossil fuel use are accompanied by hidden benefits, so called 'co-benefits' that can improve population health. These are opportunities for the health sector to help reduce GHG emissions. For example, the health sector can partner with energy, environmental and housing authorities to incorporate sustainability principles into housing design and introduce standards for reducing housing emissions. In Scotland, the Sustainable Housing Design Guide for Scotland explains how to introduce features into social housing design that produce limited emissions. This guide provides information on installing combined heat and power systems using gas instead of petrol. The hot water used in the household is pumped around other buildings in the community to heat radiators, and thereby supports the heating system. This has contributed to a 50% reduction in emissions,

and an important reduction in the associated health risks created by emissions.

**Contribute to initiatives to reduce the impact of heat waves.** Heat waves put a strain on power, water and transport infrastructure, can be linked to social disturbance, and can negatively impact on the retail industries and tourism. This is an area where the health and other sectors can collaborate. Effective adaptation measures need to be implemented to prepare for these events and avoid or reduce people's exposure. Ways of reducing exposure include measures to change individuals' behaviour, but also structural measures related to housing, urban planning and transport policies (WHO-EURO, 2007).

**Heat waves affect people living in cities the most.** Several factors explain this including the mass of buildings, traffic patterns, urban and transport

infrastructure, lack of green areas and building standards. Appropriate and climate friendly urban planning, however, may help to reduce the magnitude of the urban heat island. The health sector can work with the urban planning and transport authorities on measures to: increase green spaces by planting trees in streets (trees provide shade and improve air quality); increase ventilation and air flow between buildings (which also improves air quality); increase the number of courtyards and other open spaces; increase the proportion of heat reflected from surfaces (e.g. painting roofs white); and decrease anthropogenic heat production (e.g. natural space cooling). These interventions could be combined with measures to reduce air pollution and increase active transport (e.g. walking and cycling), all of which have potential health and transport co-benefits, such as greenhouse gas mitigation (WHO-EURO, 2007).

**Contribute to initiatives that address water scarcity.** Most climate models indicate that high temperatures will create conditions for warmer and dryer weather in the Caribbean. This is affecting water availability, which is generating negative impacts in a variety of sectors. Barbados is already classified as a water scarce country. Working with the departments of finance and education as well as the Barbados Water Authority and the Town and Country Planning Department, the health department is helping to increase human and financial resources so that climate change risks can be incorporated into the activities of participating sectors. The focus is on the preparation of guidelines and legislation for water storage. This means that any new storage facility development plan will take climate change and the related social impacts into consideration. This initiative will improve the capacity to reuse wastewater for non-potable purposes or to recharge aquifers. However, human and technological capacity needs to be improved in this area. Partners can also improve public information and communication on climate change and its health impacts in Barbados. This includes those in the health and other sectors as well as the general public. Linked to this, information to the general public on how certain diseases, particularly dengue, are related to the environment and climate change needs to be strengthened.

**Livestock products, emissions and human health.** Although meat products are a source of essential nutrients for human health, livestock contributes to four fifths of agricultural-related GHG emissions. Evidence shows that livestock products are an important source of saturated fats linked to the risk of cardiovascular disease. The energy, environment and health sectors can adopt policies and programmes to reduce emissions from excessive livestock production, which in turn will ultimately reduce consumption, and the risk of cardiovascular disease among the population. For example, recognizing that livestock is a large contributing factor to climate change, in 1990, the United Kingdom Committee on Climate Change recommended reducing emissions by 80% by 2050. However, livestock production cuts would impact on the food industry and the private sector. This is an opportunity for the health, energy, food, agricultural, and financial sectors to work together to explore ways of lessening these health effects.

**Integrate health in measures, policies and strategies for climate change mitigation and adaptation.** Tackling climate change is a complex challenge for several government sectors. Increasingly, they are adopting mechanisms and national frameworks to establish a coordinated

and integrated response. The health sector can find opportunities to contribute to the formulation of strategies by assessing the risks, and contributing to multisectoral adaptation. It can also seek opportunities to share best practices, undertake joint research and development, and monitor the costs, benefits and effectiveness of interventions. It can contribute to the work of other sectors by helping to improve warning systems and establishing monitoring and surveillance mechanisms to share information among different sectors.

**Contribute to the prevention of the negative impacts of shale oil and gas extraction.** The energy sector has encountered two main problems related to shale oil and gas extraction: 1) the costs of the extraction process and the resulting products are high compared to traditional oil and gas extraction (Dyni, 2010); and 2) public protests due to the economic, social, environmental and public health impacts of the intensive industrial activities involved, including well construction, waste management, and gas transport and processing (Rusco, 2012). The health sector could implement systems to anticipate or measure the impact of these operations. Research shows that the shaling technique is challenging existing regulatory regimes that tend to focus on traditional oil and gas drilling and extraction. This is an opportunity for the health sector to get involved in public policy processes and provide evidence of the potential health impacts, which can be included in proposed regulatory frameworks. In response to concerns related to shaling techniques, some countries are considering banning hydraulic fracturing, while others are developing local and regional zoning limitations. In all these processes, the health sector can contribute with evidence on the potential health impact of the proposed measures.

**Contribute to determine, prevent or reduce the negative impacts of fracking.** The health sector can support in the formulation of preparedness and mitigation plans for potential small earthquakes and other risks associated with hydraulic fracturing used for the construction of geothermal plants using dry rock. It can also implement studies to determine the likelihood of adverse effects on humans of surface disturbance caused by fluid withdrawal, noise, thermal pollution, release of chemicals, and land movement following the withdrawal of hot water or steam from an underground field.

**Contribute to determine, prevent or reduce the negative impact of biomass.** Given the fact that biofuels production can impact on food supplies, the health sector can contribute by determining the impact of biofuels production on food supplies and its potential health consequences. This would include exploring potential policy measures to address health impacts such as subsidies, the expansion of health services and other social protection mechanisms. Moreover, the health sector could explore avenues to develop low-input biomass, thereby reducing dependence on food-based biofuels (Hill et al., 2006). It can also help the energy and agricultural sectors to adopt criteria to define agriculturally marginal land for production of biomass (Abbasi & Abbasi, 2010). Additionally, it can seek to contribute to research and development initiatives that aim to develop more efficient and environmentally friendly biofuel production processes (Gomez, Steele-King & Mason, 2008; Kotchoni & Gachomo, 2008; Patil, Tran & Giselrod, 2008; Keshwani & Cheng, 2009). In the specific case of projects being



implemented to produce biomass, the health sector can support impact assessments of households, their water resources and land availability, water and land pollution due to pesticides and fertilizers, soil and water

degradation, flooding, the emission of agents such as dioxins and toxic irritants, as well as assessments of occupational hazards.

### For more information

The Kyoto Protocol is an international environmental treaty that sets obligations for developed countries to reduce GHG emissions: <http://www.kyotoprotocol.com/>; [http://unfccc.int/kyoto\\_protocol/items/2830.php](http://unfccc.int/kyoto_protocol/items/2830.php)

The United Nations Environment Program advocates for collaboration and information transparency in relation to the environment. Their mission is “to provide leadership and encourage partnership in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations”: <http://www.unep.org/>

The United Nations Conference on Sustainable Development (Rio+20) took place in June 2012 as an opportunity for countries to define ways to achieve more equitable socio-economic growth while ensuring protection of the environment now and in the future: <http://www.uncsd2012.org/about.html>

The United Kingdom’s Committee on Climate Change (CCC) is an independent organization that advises other sectors and the Government in setting emission targets under the Climate Change Act: <http://www.theccc.org.uk>

# SUMMARY MESSAGES

## **Access to energy for all is a powerful means to achieve development goals and can have co-benefits for health equity**

- Securing a continuous energy supply is critical in guaranteeing social and economic development. The gradual sourcing of cleaner energy supplies can result in major reductions in negative health impacts for poorer populations.
- Investments in renewable energy are often made within a country, thereby creating local jobs and improving local economies. These positive impacts on the economy should also consider the health impacts. Health can also support the energy sector in defining the negative impacts on health of certain renewable resources and help to design strategies to mitigate them.
- Fuel and energy poverty is a problem in many countries, even in the developed world, perpetuating social and health inequities. In particular, the health of women and children suffers because it is generally their task to oversee fuel collection. Certain measures by the energy sector could help to remove the barriers to accessing energy, and the health sector can be instrumental here too. These could contribute to women's empowerment – a key determinant of health equity.
- Efficient energy use and energy-efficient appliances are strongly linked to the reduction in the different levels of exposure of poorer households to indoor air pollution and particularly of children to burns. In addition, they provide savings for the energy sector. Improved efficiency can be initiated through government regulation and supported by the provision of incentives for the population.
- Environmental degradation and climate change are the adverse consequences of high fossil-fuel dependence. Given that the negative health impacts of environmental degradation are concentrated in poor and vulnerable households, it is critical for the health sector, in collaboration with the energy and environment sectors, to help reduce the negative environmental impacts of energy.

## **New role for health in working with energy: cross-cutting functions**

The health equity imperative and the intersectoral actions described in this document provide specific examples of a new role for public health, which was outlined in the Adelaide Statement on Health in All Policies (WHO & Government of South Australia, 2010) and in the Rio Political Declaration on Social Determinants of Health. Governments can expect to reap better returns from health and energy policies if they improve intersectoral collaboration. This may involve ensuring more systematic engagement opportunities or the development of collaborative working arrangements where they do not yet exist. The health sector can act with regard to the following.

- Monitor trends and outcomes for populations using disaggregated data to identify the impact of energy policies on equity and health, and using this information to lend support to the energy sector's efforts to improve energy sustainability, and reduce energy and fuel poverty.
- Engage in relevant surveillance and monitoring, including examining energy trends, and issues like energy poverty, fuel poverty, energy efficiency, and their differential impacts on nutrition, housing, access to transport and related health determinants, and their ultimate impact on public health, across different population groups.
- Evaluate the efficacy, effectiveness, efficiency and equity of public health interventions, and their ability to adapt to energy trends and specifically to energy and fuel poverty.
- Support the energy sector in needs-based assessments for disadvantaged populations and specific groups with regard to their energy needs and anticipate the implications for lifestyle changes, food use and other health determinants.
- Support the energy sector in the design of mitigation measures taken in the case of population displacement and ecological disruptions.
- Scrutinize proposed solutions for potential unintended consequences, communicate these to all concerned and the public, and develop interventions to address them.
- Conduct research including on how to develop and refine responses to energy threats, improve adaptation, and identify the costs and benefits of different approaches.
- Study and model public health policies, programmes, delivery systems and the impact of policy decisions on health outputs associated with energy.
- Develop evidence-based guidelines, standards and recommendations on energy-related risk factors and safe-use practices, and disseminate guidance in a spirit of shared responsibility to both health and energy actors.

- Amplify the public health voice in energy policy debates, including climate change policy, transportation policy, local planning policy, trade policy, food and agricultural policies, housing policies and aid policy. Highlight the potential public health ramifications of inaction.
- Strengthen coalitions of professionals working in public health, environment, nutrition, chronic disease epidemiology, social and behavioural sciences, and other professionals to collaborate on policy development and advocacy.
- Improve the dissemination of information on the linkages between sustainable energy systems and health equity to key energy and health stakeholders. This could encourage the inclusion of sustainable energy practices in health policies and vice versa.
- Confront the public health impacts by convening bodies to grapple with equity concerns in energy policies and programmes.
- Ensure a competent public health workforce, including providing training in energy policy and other functions needed to address new realities.
- Mobilize regional and international partnerships including energy policy bodies to identify and address public health concerns.

## There are many entry points for health stakeholders to work with energy stakeholders

Table 4 shows several practical examples of how the health sector can collaborate with the energy sector to support them in achieving their goals, while improving health and health equity.

**Table 4. Summary of areas for intersectoral collaboration between health and energy sectors**

ENERGY SECTOR ISSUE	AREAS OF COLLABORATION
<b>Secure energy supply</b>	<ul style="list-style-type: none"> <li>• Establishing a reliable supply of energy is key to achieving national goals such as MDGs. Reliance on fossil fuels can be problematic due to price fluctuation, dependency and potential negative impacts on health.</li> <li>• The health sector can support energy stakeholders in promoting access to clean energy by implementing impact evaluations of new sources of energy on health. It can support the definition and adoption of outdoor pollution limits, collaborate in interventions to reduce exposure to pollutants, and support resettlement plans in energy projects to mitigate health impacts.</li> </ul>
<b>Universal energy access</b>	<ul style="list-style-type: none"> <li>• Globally, 1.3 billion people do not have access to electricity, while 2.7 billion cannot access clean cooking energies. This problem is concentrated in the poorest regions of the world, which limits development and endangers population health.</li> <li>• Interventions include electrification via grid extension and off-grid, decentralized systems when grids cannot be extended, efficient technologies, and differential pricing and subsidies for low-income households. Given the gender dimension of energy poverty, interventions should pay particular attention to women and girls through the adoption of regulations and through cooperation with civil society.</li> </ul>
<b>Energy efficiency and safety</b>	<ul style="list-style-type: none"> <li>• Improved efficiency decreases energy use, reduces energy demand, helping to reduce emissions and lowering health exposures. It frees funds for other investments.</li> <li>• The health sector can contribute through health impact assessments of energy efficiency interventions. Anticipating the benefits of these interventions can provide incentives to energy and health stakeholders to collaborate. The health sector can also lead by example adopting processes and programmes to improve energy efficiency in its operations.</li> </ul>
<b>Energy and sustainable development</b>	<ul style="list-style-type: none"> <li>• Fossil-fuel dependence is linked to increased environmental degradation, impacting human health through pollution, and crop, forest and fishery degradation, and global warming and noise pollution, among others. Some new energy production processes (e.g. fracking) have unknown health impacts that need further assessment.</li> <li>• The health sector can contribute to the design of sustainable energy production and use with impact assessments that quantify potential harms from energy sources. It can explore co-benefits with sectors like the environment and help governments to establish policy options, as well as strategies, safeguards and regulatory oversight. Examples include health strategies for housing design to reduce GHG emissions, initiatives for the reduction of emissions from livestock activities, and strategies for climate change mitigation and adaptation, among others.</li> </ul>

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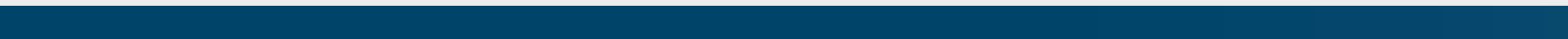




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