



energy
& health
making the link

LONDON
HEALTH COMMISSION

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introduction

This booklet provides an introduction to the links between energy and health. These links are very diverse, ranging from the crucial role energy plays in sustaining our society and culture to the illnesses associated with air pollution from power stations and transport.

There are opportunities for health improvement through energy-related decisions in all sectors. Energy consumption is often treated as a marginal issue, yet any decision about energy can have health impacts at local, national and international levels.

This booklet seeks to promote a wider awareness of these health impacts and the opportunities everyone has to make a difference. It aims to help health professionals to appreciate the relevance of energy policy to public health while also encouraging the many different professionals involved in energy-related decisions to think through the health consequences of those decisions.

energy & health making the link

The booklet is based on a review of the current literature†, undertaken to inform a health impact assessment of the Mayor of London's Draft Energy Strategy.¹ This was not a systematic review but a rapid review designed to draw together the disparate bodies of evidence that relate to the links between energy and health.

This review and the health impact assessment report are available on the London Health Commission website at www.londonhealth.gov.uk.

†Anderson, W. Energy and Health: Rapid Review of the Evidence. London Health Commission, London, 2003.

Policy links

In February 2003, the government published its White Paper Our energy future – creating a low carbon economy.² This sets out a long term energy strategy for the UK. Central to this strategy is the acceptance of the recommendation of the Royal Commission on Environmental Pollution that the UK should aim to reduce its carbon dioxide emissions by about 60% by the year 2050.³ The other aims of the strategy are to maintain the reliability of energy supplies, to promote competitive energy markets in the UK and beyond in order to increase the rate of sustainable economic growth, and to ensure that every home is adequately and affordably heated.

All energy policy decisions have health impacts, either directly or indirectly. The move towards a low carbon future will have many positive health benefits and it is vital that public health professionals support this transition at local as well as national levels. More generally, public health scrutiny and input is needed across all energy-related policy and decision-making in order to make explicit the health impacts which may otherwise be easily ignored.

The main policy area where the links between energy and health are well established is fuel poverty. The government's fuel poverty strategy has the aim of bringing all vulnerable groups out of fuel poverty by 2010.⁴ The Energy White Paper has extended this goal to all citizens by 2016-18. However, even in this key policy area, failure to think through all the possible health consequences of interventions can lead to adverse impacts.

There are many other areas of local energy-related policy where health impacts should be considered, such as housing, transport and regeneration projects. Decision-makers for whom health has not been a traditional priority need to consider the range of ways in which they can improve health through energy-related decisions. Health Improvement and Modernisation Plans in the NHS and Community Plans in local government provide excellent opportunities for systematically considering the effects of such decisions.

Links between energy and health

People do not want sticky barrels of black goo, or raw kilowatt-hours. What they're after is hot showers, cold beer, light, comfort and mobility.⁵

To make sense of the diverse ways in which energy is linked to health, it helps to draw a distinction between energy and energy services. Although much of energy policy is focused on the former, it is the latter that we really care about: heat, light, power and mobility. Crucially, energy services can be improved without increasing energy supply. Installing loft insulation, for example, will increase domestic warmth and may even reduce energy consumption.

Energy services typically play a positive role in promoting health whereas the generation of energy tends to have negative health impacts. Consequently, there are often health trade-offs

involved in energy consumption. For example, we currently use fossil fuels to keep warm in winter, but burning these fuels increases air pollution. Similarly, an ambulance driven to a casualty department will leave a trail of noxious exhaust fumes behind it.

It is crucial that any account of the links between energy and health acknowledges these trade-offs. The goal of a healthy energy policy should be to maximise the benefits of energy services while minimising the negative impacts of energy generation.



This summary of the links between energy and health addresses three distinct areas:

- the importance of energy services in sustaining health,
- the hidden health impacts of energy consumption,
- the economic and social impacts of energy policy and their effects on health.

The importance of energy services in sustaining health

The security of energy supply

As of December 1992, no fuel oil had been received in Armenia for 3 months, and the fuel supply for the power system was adequate for only 8 days. The shortage of fuel also prevents distribution of commodities and cooking. Power blackouts of 12 hours or more per day throughout the country have reduced the availability of running water and, by compromising sanitation, increased the risk of certain diseases (e.g. hepatitis A, enterovirus, giardiasis, and shigellosis). These conditions also may result in adverse health effects related to nutritional deficiencies, cold exposure, inadequate vaccination levels, and inadequate drinking water supplies.⁶

It is easy to take energy for granted. It is hard to imagine the consequences of a prolonged loss of energy, although this example from Armenia gives a

flavour of how quickly public health deteriorates as infrastructure grinds to a halt.

Security of supply has always been the most important objective of national energy policy and is a central challenge for the transition to a low carbon economy. Without a secure supply of energy, health is put at risk. A more diverse fuel mix and more local, distributed generation should help to improve energy security.

Affordable domestic energy services and 'fuel poverty'

At the level of the individual or household, there are many people who do not have a secure supply of energy because they cannot afford it. Those who forego essential energy services, particularly heating in the winter, face heightened risks of illness and mortality. Consequently, fuel poverty is a major public health concern.

Fuel poverty is defined as the inability to obtain adequate energy services for 10% of income.⁷ As the key issue is access to energy services, the focus on fuel is rather misleading and the term 'affordable warmth' is more accurate. In practice, people who lack affordable warmth are likely to gain it through energy efficiency measures rather than through better access to fuel.

Cold homes are dangerous places, especially for vulnerable people. Every year in the UK, many more deaths occur in winter than in summer. For

every ten deaths that occur at the lowest rate in summer, fourteen occur at the highest rate in winter.⁸ Although a similar seasonal pattern is seen in other European countries, the magnitude of the increase in the winter death rate in the UK is comparatively large.^{9,10} Although there are other seasonal factors which affect health, such as lower levels of vitamin C in the winter diet,¹¹ cold is manifestly the principal problem.

Hypothermia is not a major cause of winter mortality; the main culprits are cardiovascular (heart) and respiratory (lung) disease. A key defence against cold is to minimise bodily heat loss by reducing blood supply to the skin, leading to an increase in blood concentration and a heightened risk of clot formation.^{12,13} Respiratory disease pathways are more complex but can involve the weakening of respiratory tract defences, thereby increasing susceptibility to infections; bronchoconstriction, exacerbating asthma and chronic obstructive pulmonary disease; and inflammation of the lower airways, also affecting asthma.¹⁴

The precise contribution of cold housing to winter mortality is not clear. People who live in warm homes are also at risk if they fail to wrap up properly before going outside on cold days. It is likely that cold homes and

outdoor cold make similar contributions to excess winter deaths. In the Siberian city of Yakutsk, the coldest city in the world, there is no increase in death rates during the winter months thanks to the attention paid by residents to keeping warm both inside and outside.

Cold homes also make people ill. Most of the illnesses associated with cold homes are due to the presence of damp which encourages the spread of mould. Mould thrives in the organic materials in walls and cavities such as plaster, wallpaper and wallpaper paste and can easily spread to carpets, furniture and clothing. Mould growth can cause respiratory illness and infections, although its contribution to asthma is small.¹⁴ Damp and mould are linked in adults to a range of symptoms including nausea, breathlessness, backache and fainting. In children, symptoms are worse and include vomiting, wheeze, irritability, fever and poor appetite.¹⁸

Cold and damp homes also have effects on mental health. Problems arise because of the struggle to keep warm and pay fuel bills, the sight and smell of mould, and the stigma of living in unclean conditions.



Combining energy efficiency measures with health improvement

The usual route to improving affordable warmth in cold homes is to install energy efficiency measures such as loft insulation, cavity-wall insulation and draught-stripping. Although this addresses the health problems described above, other problems can arise.

If ventilation is overly restricted, indoor air quality can suffer as pollutants build up. Environmental tobacco smoke is a health risk, especially for children. Other indoor air pollutants with established health risks include carbon monoxide, particles, radon, nitrogen dioxide, volatile organic compounds and formaldehyde.¹⁹

Furthermore, if ventilation is inadequate homes may become not only warm but humid – the ideal conditions for dust mite proliferation. Dust mites are linked to asthma, eczema, dermatitis and perennial rhinitis. In order to tackle dust mites, ventilation which reduces relative humidity to less than 50% must be combined with other measures such as steam cleaning mattresses and protecting them inside an air-tight plastic seal.²⁰

The hidden health impacts of energy consumption

Coal-fired electricity generation is the dirtiest form of energy. Yet, for the user at home, it could not be cleaner – the distant power station is simply unknown. This paradox highlights the ease with which the adverse impacts of energy can be ignored. Even when fuel is burnt at the point of use, such as in road transport, the consumer is likely to be protected from its immediate effects.

In order to fully appreciate the adverse health impacts of energy consumption, the effects of every stage of the ‘fuel cycle’ must be identified. A fuel cycle is the complete journey of an energy source from extraction to waste disposal. It includes the effects of transportation, plant construction and the actual use of the fuel. Such life cycle analyses have been conducted in great detail for many forms of energy consumption in a large pan-European study: ExternE, the Externalities of Energy²¹ ‘Externalities’, or external costs, are the hidden costs which are not internalised in prices.

Although the ExternE project was designed to describe all the hidden impacts of energy use, including both environmental and social impacts, the public health impacts of air pollution from burning fuels emerged as the single biggest external cost. However, the adverse effects of energy use on

climate change were also recognised as a long term problem which is currently difficult to quantify.

Air pollution

In the UK, most energy-related air pollution is caused either by power stations or by road transport, although indoor air pollution is also caused by coal and wood fires and gas appliances.

Power stations produce plumes of air pollutants which are then dispersed across a wide geographical area. Populations living within this area will be affected by raised levels of pollution. The pollutants and their effects are diverse, but the main culprits are particulate matter, especially particles smaller than 10 microns, carbon monoxide, sulphur dioxide, nitrogen dioxide and ozone.

The effects of this pollutant mix include increases in deaths, respiratory problems and cardiovascular disease. Most of the evidence for these effects focuses on acute illness following rises in pollution levels. For example, mortality, respiratory symptoms and respiratory and cardiovascular hospital admissions have all been associated with short-term increases in particulates and other pollutants.^{22,23,24} However there is also evidence that long-term exposure to raised background levels of air pollution, especially particulates, increases mortality rates.²⁵

Traffic pollution has a more immediate impact because of its proximity, in urban areas, to dense populations. As well as the pollutants described above, road vehicles produce many other harmful emissions including volatile organic compounds, benzene and diesel particles.

Climate change

Energy consumption is the principle driver of climate change. Burning non-renewable resources such as coal, oil and natural gas increases the concentrations of carbon dioxide in the atmosphere. This leads to the greenhouse effect: light energy penetrates the atmosphere but heat energy is increasingly trapped within it.

Climate change is a global process with a very long time scale. This makes it difficult to predict the range and extent of its impacts. Much will depend on how climate change interacts with other changes in human society including population growth, migration patterns and land use changes. Nonetheless a range of distinct health impacts have been identified by the Inter-governmental Panel on Climate Change.²⁶ These are international impacts, many of which will be most severe in regions with the least resources to cope.

Any increase in outdoor temperatures will reduce the incidence of cold-related illness and mortality. However, there will be an increase in heat-related stress, especially in large urban areas. With the rising temperature will come a higher incidence of extreme weather events such as droughts, floods and storms. These can result in the loss of crops and water supplies and the breakdown of infrastructure leading to malnutrition and water-borne diseases.

Patterns of disease prevalence will be affected both by changing environmental conditions and by the effects of climate change on human populations and their public health resources. Some vector-borne diseases such as malaria, dengue and leishmaniasis may extend to higher altitudes and latitudes. Water-borne diseases may proliferate where access to clean water becomes increasingly difficult. Food-borne and other infectious diseases, such as fungal infections, may also become more common in warmer conditions.

Climate change is likely to adversely affect food yields in the developing world, increasing the incidence of

undernourishment and starvation. This will be one of many pressures on human settlements: salination, land degradation, waterlogging, desertification and water scarcity may lead to mass migrations. Again, the health impacts will depend on the pace of change and the resources available. Rapid, catastrophic change in poorly resourced areas will result in major public health emergencies.

Other impacts of fuel cycles

Every fuel cycle presents risks to people working in that industry. However, only the risks of the coal fuel cycle are well known. Occupational diseases among miners include pneumoconiosis, bronchitis, emphysema, skin disorders, hearing loss and back pain.

Within the nuclear fuel cycle, radionuclides present a highly controversial health risk. The health impacts of exposure to radionuclides include increased risk of cancer and the potential for severe hereditary defects.²⁷ The release of low levels of radionuclides occurs during normal operation of nuclear power plants, but public concern is more focussed on releases through waste disposal, transport and accidents.

Where waste incineration is used as an energy source there are potential risks to health not only through the release of the air pollutants described above but also from dioxins, furans and heavy metals. These are highly toxic and carcinogenic. As with the nuclear fuel

cycle, the risks are low under normal operating conditions, but concern remains about the possibilities of unexpectedly high emissions at other times, for example under start-up conditions.

Making healthier energy choices

Renewable energy resources such as wind and solar power are not only good choices for mitigating climate change, they also have the lowest adverse health impacts overall because they do not produce pollution when in operation. Biomass power plants, which burn agricultural wastes or energy crops, are also a good choice for minimising climate change, although in some cases they produce more air pollution than natural gas power stations. Coal and oil-fired plants have by far the worst impacts on both air pollution and climate change.²⁸

Switching to renewable energy is clearly a healthy choice, both for the UK population living downwind of today's power plants and for the global population that will suffer the future effects of climate change. However, the best energy choice is always to use less, either through better demand management or improving energy efficiency.

Maximising the efficiency of energy generation is also important. Combined heat and power plants deliver far more useful energy per kilogram of pollutants than an ordinary power plant using the same fuel. Hydrogen fuel cells are also

very efficient in their use of fossil energy, usually natural gas. Hydrogen fuel cells powered by renewable energy offer the long term possibility of pollution-free, healthy transport.

The economic and social impacts of energy policy and their effects on health

Releasing resources for health and social care and public health

Energy is the fourth biggest cost to the NHS, after staff costs, drugs and medical purchases. Hospitals alone account for just over 1% of all the primary energy use in the UK.²⁹ The NHS is therefore in a good position to promote health not only by reducing energy-related emissions but also by saving money for health and healthcare.

The same argument can be made for the broader public health responsibilities of local government and for the voluntary sector. Although not faced with the task of keeping hospitals warm, local authorities typically have substantial estates which may include energy intensive service such as swimming pools.

The NHS already knows how to build very low energy buildings³⁰ such as St Mary's Hospital on the Isle of Wight which is very energy efficient, uses

natural ventilation and has its own combined heat and power plant.³¹ Such developments are typically informed by detailed consideration of the local impacts of the building and its environment.

Good energy management in the NHS has the potential to encompass all the issues discussed in this booklet: ensuring security of supply, choosing fuels which minimise harm and promote a healthy environment locally and internationally, and tackling the problems of fuel poverty by supporting and promoting local energy-saving measures for service users – an issue which can be critical when vulnerable people are discharged from hospital.³²

Employment and regeneration

The government's vision of transforming our current fossil fuel-driven economy into a 'low carbon' economy will require huge investment

in technology and infrastructure. This change will itself have impacts on health.

There may be adverse impacts where existing industries and their linked communities decline. The link between unemployment and poorer health is well-established.³³ However there will also be many new opportunities for regeneration and employment in the growth industries of energy efficiency and renewables. The prospect of more distributed generation, where power is generated locally, for example through small wind farms or shared solar heating systems, offers the possibility of greater community ownership or participation in energy issues. Well-managed inward investment in new energy industries which takes account of local interests and involves local people can have a beneficial impact on the health of local communities.³⁴

Summary

- Energy policy often involves trade-offs between positive and negative health outcomes. Energy services typically help to sustain health whereas the generation of energy through the combustion of fossil fuels tends to have negative health impacts.
- The goal of a healthy energy policy should be to maximise the benefits of energy services while minimising the negative impacts of energy generation.
- A secure supply of energy is essential to maintain energy services and public health infrastructure.
- A shortage of affordable warmth presents serious health risks for many households in the UK every winter.
- Cold homes contribute to the excess winter mortality in the UK and to a range of symptomatic illness.
- All the possible health impacts of energy efficiency measures should be considered in their design, not just those related to indoor warmth.
- Many of the health impacts of energy use occur far from the point of consumption, making them relatively invisible to the user.
- Air pollution caused by burning fossil fuels, especially in power stations and transport, increases deaths and illness.
- Burning fossil fuels is also the key driver of climate change which is likely to have profound consequences for population health across the globe.
- Reduced demand for energy, energy efficiency and the use of renewable resources for generating electricity are all much healthier choices than using fossil fuels.
- The costs of poor energy performance in the public sector divert resources from health and social care and public health.
- Building the new energy economy presents opportunities to build healthier communities through regeneration, employment and local participation.

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About the London Health Commission

The London Health Commission seeks to improve the well-being of all Londoners and reduce inequalities in health. The LHC promotes a co-ordinated approach to the factors that influence health in London, and will do this by:

- Building partnerships involving the health sector, local and national government, the private sector, community and voluntary groups
- Influencing decision-makers
- Supporting local action

To find out more about the work of the London Health Commission, see our website: www.londonhealth.gov.uk

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Health Impact Assessment (HIA)

HIA is an approach to ensure that decision making at all levels considers potential impacts on health and health inequalities, and identifies actions that can enhance positive effects and reduce or eliminate negative effects.

Although HIA is a new and developing approach, it is increasingly being recognised nationally and internationally.

Developing and promoting the use of HIA is one of the supporting priorities of the London Health Commission.

A number of resources are now available to support those considering or conducting health impact assessments. Please see our website at: www.londonhealth.gov.uk/hia.htm

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