

X. ASSOCIATED BENEFITS

A. Energy and Sustainable Development

The focus of this publication is on how to save money through saving energy in cities. We have considered strategies for reducing the cost of energy in the domestic, transport, commercial, industrial and administrative sectors of cities. Additionally we have looked at how to utilise local energy resources, such as wastes, solar power and biomass to generate power. Many of these strategies will pay for themselves within a few months or years. However, the best results will be obtained if the strategies are costed, prioritised and organised into a comprehensive and integrated local energy plan.

While the focus has been on cost savings, saving energy has many other important associated social and environmental benefits, some of which have already been pointed out. We will explore these associated benefits further in this chapter.

The integration of economic, social and environmental goals is the basis for sustainable development. This concept was brought to the fore in the *World Conservation Strategy* (1980). In this strategy it was emphasised that humanity, which exists as a part of nature, has no future unless nature and natural resources are conserved.

In 1987 the World Commission on Environment and Development published a report called *Our Common Future* which defined sustainable development as development that “meets the needs of the present without compromising the ability of future generations to meet their own needs.”

In 1991, the IUCN published *Caring For the Earth - A Strategy for Sustainable Living*. The IUCN states that “Most current development fails because it meets human needs incompletely and often destroys or degrades its resource base. We need development that is both people-centred, concentrating on improving the human condition and conservation-based, maintaining the variety and productivity of nature. We have to stop talking about conservation and development as if they were in opposition, and recognize that they are essential parts of one indispensable process.”

This was followed by the Earth Summit at Rio de Janeiro in 1992 where Agenda 21 and the Earth Charter were developed. These set goals and directions for sustainable development in all areas of society. Agenda 21 is now being taken up by local governments around the world (ICLEI). Many municipalities are producing or have produced local sustainability plans which outline strategies to address issues such as energy and resource usage.

The Earth Summit also produced the Framework Convention on Climate Change (UNFCCC) and this is gradually being implemented via the Conferences of the Participants. At a local level the Cities for Climate Protection Initiative is being implemented by local governments in many cities around the world. It involves energy audits and the preparation and implementation of a local energy plan as discussed in Chapter 9. Although the focus of this program is on climate change, it has much in common with energy efficiency strategies.

Increasingly, decision-makers are using “triple bottom line” accounting to assess the economic, social and environmental costs and benefits of the decisions they make. Such an approach is also relevant to energy savings.

There are many associated social and environmental benefits that can be obtained in addition to the economic benefits of taking action to save energy. However, some energy saving measures may be cost effective (such as switching from gas to coal for power generation) but will have undesirable social and environmental consequences.

The use of triple bottom line accounting allows us to distinguish between those measures that bring economic, social and environmental benefits and those that bring only limited benefits and have many drawbacks as well. “In many situations it is possible to find a “Win-Win-Win” solution to an energy supply problem in which the result provides cost savings while bringing social and environmental benefits. The search for such solutions is the essence of sustainable development” (UNDP).

The use of local, renewable energy sources and energy-efficiency measures can produce a range of social and environmental benefits. This list is illustrative only and is intended as a guide to the type of social benefits that may result from energy efficiency programs and the use of local energy resources. Each project should be carefully analysed to determine the specific social benefits associated with it. In many cases the value of these benefits can be expressed in economic terms, although some benefits such as improved quality of life are more intangible.

B. Social Benefits

There are many potential social benefits resulting from energy efficiency and the use of local energy resources. Two major ones are the opportunities for new jobs and greater national security.

1. New Jobs

In a recent paper published by the Worldwatch Institute, a Washington DC-based research organisation, author Michael Renner indicates that moves towards environmental sustainability have already generated an estimated 14 million jobs worldwide. He points out that numerous opportunities for job creation are emerging, ranging from recycling and remanufacturing of goods, to higher energy and materials efficiency and the development of renewable sources of energy.

In response to the Kyoto Protocol and concerns about climate change, many industrialised nations have undertaken assessments of the impact of climate policies on jobs. Renner indicates that these reports affirm the general conclusion that, “for each dollar invested, pursuing energy alternatives will generate far more jobs than the fossil fuel industries can.”

2. Improved National Security

By reducing fossil fuel usage and employing renewable technologies, nations can reduce their dependence on energy imports and so contribute to national security. Supplies of cheap fossil fuels are limited and rising fossil fuel prices or even supply shortages in the future could lead to conflicts as most economies are so dependent currently on secure supplies of cheap fossil fuels.

The use of local energy resources and the development of local industries can also improve the balance of payments in developing countries and lead to lower costs for essential services.

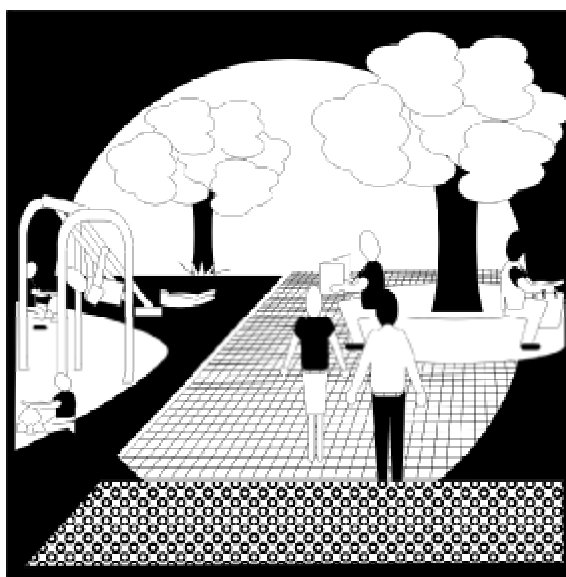


Figure 10.1: Pedestrianised space can offer safe environment for families.

3. Improved Quality of Life

By planning cities and buildings to be more energy-efficient, many improvements can be achieved in the overall quality of life of city dwellers, including:

- Fewer accidents and serious injuries in car-free or less car-dependent cities, and so safer neighbourhoods for children
- A greater sense of community is created in spaces that are based on walking and cycling transport modes, as they allow for more human interaction
- Daylighting and passive solar design have been shown to improve workplace efficiency and lead to greater job satisfaction and less absenteeism. They also bring other health and economic effects.
- Reduced motorised vehicle use cuts down on noise and vibration in residential areas.

C. Environmental Benefits

1. Air Pollution and Health Issues

The utilisation of fossil fuels has numerous negative implications for human health at all stages of the fuel cycle including extraction, processing, transportation and final usage. For instance, the typical coal fuel cycle is given in Figure 10.2.

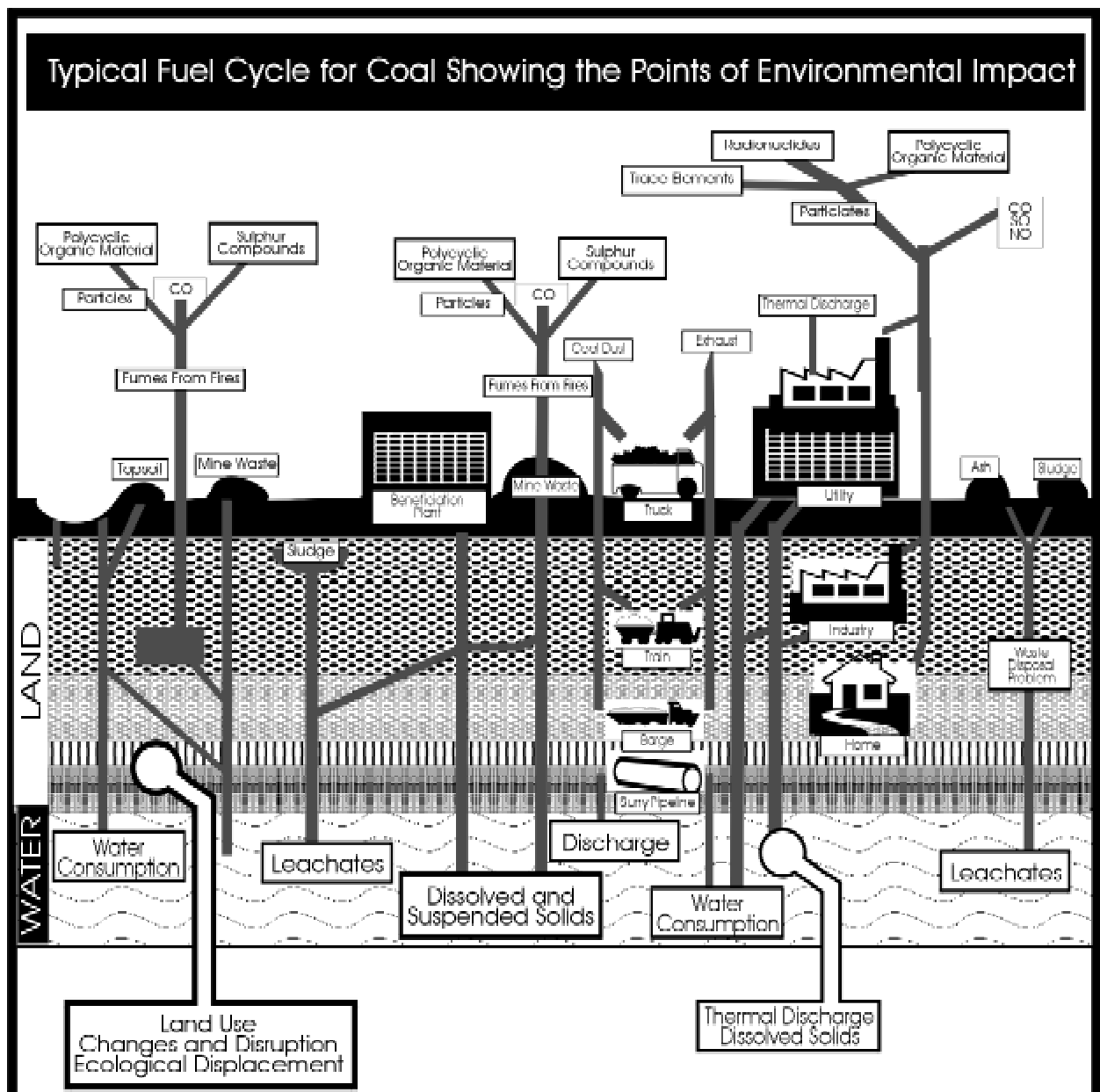


Figure 10.2: The Typical Fuel Cycle for Coal Showing the points of Environmental Impact.

Coal mining, particularly underground, results in accidents and health-related illnesses from the inhalation of coal dust. Processing of coal for the production of processed fuels and coke is also linked with occupational disease and risks.

Hazards associated with the petroleum and natural gas industry are less extensive than coal and exist mostly in the exploration and development phases of new oil fields.

Combustion of fossil fuels is the biggest contributor to atmospheric pollution. This process generates large quantities of sulphur and nitrogen oxides, heavy metals, hydrocarbons, particulates, and carbon monoxide, among other health-damaging pollutants. Such pollution results not only from fossil fuel combustion in power plants and industry, but also from motor vehicles and domestic use.

In the United Nations Development Program report *Energy after Rio: Prospects and Challenges* it is stated that “Considering six indicators of air quality: sulphur dioxide, solid particulate matter, lead, carbon monoxide, nitrous oxide, and ozone, the air pollution situation in twenty megacities (of which sixteen are in developing countries) is such that 38% of the indicators register as either “serious problems” or “moderate to heavy pollution”. In fact, most developing country megacities have air pollution levels well above WHO guidelines, and the situation is getting worse.”

The first study ever to look at the global short-term health impact of fossil fuel consumption - *The Hidden Benefits Of Climate Policy: Reducing Fossil Fuel Use Saves Lives Now* - projects serious consequences for people’s health and mortality worldwide. In this study it is stated that “Much of the debate over global climate policy misses one basic point: The same activities that will eventually threaten the earth’s climate also threaten human health today. The combustion of fossil fuels poses a double jeopardy. It produces carbon dioxide and other gases, which contribute to the gaseous greenhouse that warms the earth, and it releases fine air-borne particles, which can make people sick and damage their lungs.”

The authors point out that “polluted air can cause immediate or acute effects ranging from asthma attacks to death in those whose lungs are already weakened.” Additionally, there are other indirect health impacts that may be considerable. Climate change as mentioned in the previous section may have major impacts on human health because of changing temperatures, sea-levels, and disease-vector ecology. Damage to biodiversity through acid rain or local deforestation from fuel harvesting are other examples of energy-related environmental hazards with potentially grave health consequences.

The study by the Working Group on Public Health and Fossil-Fuel Combustion makes the following statements:

“The benefits of reducing CO₂ emissions go substantially beyond averting potential disruptions of the Earth’s climate. Even relatively small reductions in emissions worldwide could prevent 700,000 premature deaths a year by 2020.

The benefits of adopting climate policies extend to both developed and developing nations. Four out of every five of those who might otherwise die by 2020 are in developing countries. In the developed world, the number of lives potentially saved each year is also substantial, equalling the number projected to die from traffic injuries.

Implementing climate policies now will yield immediate benefits locally and globally by reducing particulate air pollution, by slowing the build-up of greenhouse gases, and by protecting public health. Over the next two decades, at least 8 million deaths could be avoided.”

The *Energy After Rio* report identifies the use of biomass in developing countries as having a negative impact on the health of household members, especially when it is burned indoors without either a proper stove to help control the generation of smoke, or a chimney to draw the smoke outside. A number of studies of the health effects of indoor air pollution show a positive correlation between indoor pollution generated by the use of traditional fuels and the incidence of respiratory illness or congestive heart failure. Often the users of biomass are people in poverty and so using cleaner, more efficient technologies will improve the health of poor people and consequently reduce health costs and improve work productivity. In energy plans, special consideration needs to be given to making new technologies available to the urban poor.

2. Climate Change

In the *Third Assessment Report* of the Intergovernmental Panel on Climate Change, titled *Climate Change 2001* it is stated:

“Human activities—primarily burning of fossil fuels and changes in land cover—are modifying the concentration of atmospheric constituents or properties of the Earth’s surface that absorb or scatter radiant energy. In particular, increases in the concentrations of greenhouse gases (GHGs) and aerosols are strongly implicated as contributors to climatic changes observed during the 20th century and are expected to contribute to further changes in climate in the 21st century and beyond. These changes in atmospheric composition are likely to alter temperatures, precipitation patterns, sea level, extreme events, and other aspects of climate on which the natural environment and human systems depend.”

The report identifies natural systems as being especially vulnerable to climate change because of limited adaptive capacity, and it is predicted that some of these systems may undergo significant and irreversible damage. Glaciers, coral reefs and atolls, mangroves, boreal and tropical forests, polar and alpine ecosystems, prairie wetlands, and remnant native grasslands are some of the natural systems most at risk.

Human systems that are sensitive to climate change include mainly water resources; agriculture (especially food security) and forestry; coastal zones and marine systems (fisheries); human settlements, energy, and industry; insurance and other financial services; and human health. The vulnerability of these systems varies with geographic location, time, and social, economic, and environmental conditions.

In *Climate Change 2001*, the following projected adverse impacts are given based on models and other studies:

- general reduction in potential crop yields in most tropical and sub-tropical regions for most projected increases in temperature
- general reduction in potential crop yields in most regions in mid-latitudes for increases in annual-average temperature of more than a few °C
- decreased water availability for populations in many water-scarce regions, particularly in the sub-tropics
- increasing numbers of people exposed to vector-borne (e.g., malaria) and water-borne diseases (e.g., cholera), and an increase in heat stress mortality
- widespread increase in the risk of flooding for many human settlements (tens of millions of inhabitants in settlements studied) from both increased heavy precipitation events and sea-level rise
- increased energy demand for space cooling due to higher summer temperatures

On the issue of severe weather events such as droughts, floods, heat waves, avalanches, and windstorms, while there are still uncertainties attached to estimates of such changes, some extreme events are projected to increase in frequency and/or severity during the 21st century due to changes in the mean and/or variability of climate, so it can be expected that the severity of their impacts will also increase in concert with global warming. Conversely, the frequency and magnitude of extreme low temperature events, such as cold

spells, is projected to decline in the future, with both positive and negative impacts. The report indicates that “the impacts of future changes in climate extremes are expected to fall disproportionately on the poor.”

By saving energy, emissions of greenhouse gases such as CO₂, CH₄ and NO_x are reduced thus helping to mitigate global climate change. All hydrocarbon fuels produce greenhouse gases when burnt while most renewable energy sources have minimal greenhouse impacts. Biomass and biogas utilisation can produce CO₂ but this is a less potent greenhouse gas than CH₄, which may have been produced if the biomass was left to rot. Often the full biomass cycle has a positive greenhouse benefit although parts of it do produce greenhouse emissions.

3. Acidification

Fossil fuel emissions can cause problems of acid rain. This issue came to media attention in Europe in the 1980s when forests started dying. It is stated in the *Energy After Rio* report that “Emissions are projected to increase in many parts of Asia, Africa, South and Central America, creating potential for serious damage in many parts of the world that have not experienced this type of pollution problem before.”

The report indicates that there is one important difference between the impacts on Europe and North America and on the developing countries, namely that in many areas agriculture is carried out on marginal soils which have a low buffering potential. Soil quality and yields could be affected significantly by anticipated depositions. In Europe, agricultural soils are limed and acidification of arable land does not represent a serious problem. However, liming is not carried out to any great extent in many countries of the developing world due to its high costs.

The recovery process for acidification is quite long and therefore, it is preferable to try to avoid damage at the outset rather than ameliorating it once it has occurred.

4. Land Reclamation

The *Energy After Rio* report concludes that, “While the unsustainable harvesting of biomass for energy purposes (e.g., fuel wood for cooking) has been one of many contributors to land degradation, the sustainable production of biomass via energy-efficient conversion processes for the production of modern energy carriers (electricity, liquid and gaseous fuels) can be a powerful mechanism for stemming and reversing land degradation.” Where the rainfall and soil quality are adequate to support high-yielding energy crops, this process can make it feasible to restore degraded lands for food production. Furthermore, biomass fuels grown sustainably are CO₂ neutral and low in sulphur, and returning the ashes created as a residue of biomass fuel processing to the land lessens the need for fertilisers in the growing of new biomass.

The report points out that carefully conceived and politically committed national programmes supported by policies and programmes at the international level could lead to significant biomass energy production on degraded land and thereby contribute positively towards improving farmers’ income and employment opportunities, promoting rural development, reducing urban migration, and reducing poverty and insecurity of food supplies, while rehabilitating abandoned and marginal lands

D. References and Resources

There are many excellent books and web sites that develop the theory and practice of sustainable development and apply it to energy supply and use. A few of the most important ones are:



Agenda 21

<http://www.un.org/esa/sustdev/agenda21.htm>

<http://www.igc.apc.org/habitat/agenda21/>

<http://www.igc.apc.org/habitat/agenda21/ch-09.html> (Energy section)

Caring for the Earth - A Strategy for Sustainable Living

<http://coombs.anu.edu.au/~vern/caring/care-earth1.txt>

The Earth Charter

<http://www.earthcharter.org/>

UNDP (1997) *Energy after Rio: Prospects and Challenges* <http://www.undp.org/seed/energy/#afterrio>

Energy, Environment and Security in North-East Asia <http://www.nautilus.org/papers/energy/ESENAfinalreport.pdf>

'The Hidden Benefits Of Climate Policy: Reducing Fossil Fuel Use Saves Lives Now' –

http://www.wri.org/climate/ghg_text.html

Interactive Learning about Sustainable Development

<http://iisd.ca/educate/learn.htm>

Intergovernmental Panel on Climate Change

<http://www.ipcc.ch>

Intergovernmental Panel on Climate Change (2001) Third Assessment Report - *'Climate Change 2001'* - has been published and consists of three books: *The Scientific Basis*; *Impacts, Adaptation and Vulnerability*; and *'Mitigation'*

International Council for Local Environmental Initiatives <http://www.iclei.org/>

ICLEI's Local Agenda 21 Campaign

<http://www.iclei.org/iclei/la21.htm>

US EPA greenhouse site

<http://www.epa.gov/globalwarming/>

