

# I. CITIES AND ENERGY USE

## A. Background

Energy is the lifeblood of modern industrial society. Modern cities rely heavily on fossil fuels for the maintenance of essential services and for powering devices that are used in industry and commerce. Cities draw on their hinterland for primary produce and use human skills and energy to convert it into secondary products. Energy powers homes, transport systems, industry, infrastructure and commerce. The availability of abundant, cheap power has enabled societies to develop machines and systems that can enhance the quality of human life and increase the efficiency and productivity of our work. Industrialised societies have relied on cheap, abundant supplies of fossil fuels particularly oil and coal and their usage has increased steeply for most of the past century.

This pattern is being emulated by many developing nations. However, things are changing as the drawbacks of heavy reliance on fossil fuels become increasingly apparent. Concerns are growing about the environmental and social impacts of the consumption of fossil fuels which include air pollution, global warming, waste disposal problems, land degradation and the depletion of natural resources. Furthermore, cheap supplies of oil appear to be running out. These trends are likely to continue and even accelerate throughout the 21<sup>st</sup> century.

Due to the instability of fuel prices, energy intensive industries will find it increasingly difficult to maintain a competitive position. Householders and government agencies will experience budget over runs on items that are fossil fuel dependent.

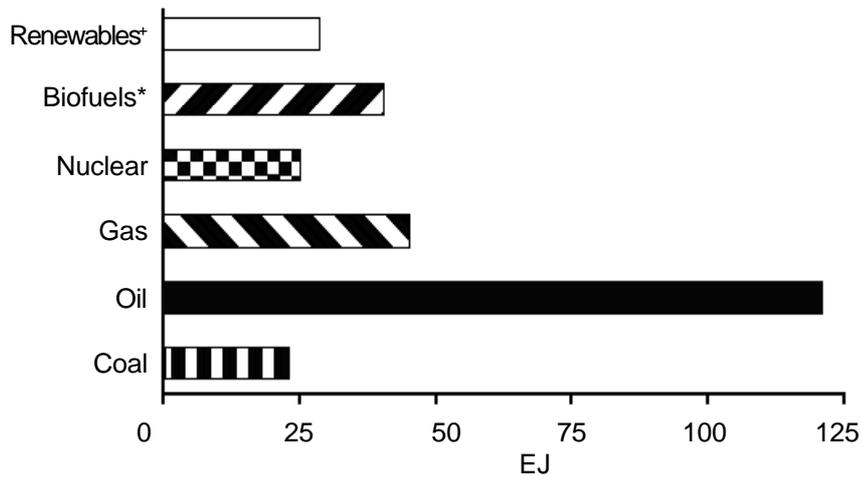
As a consequence of these concerns, attention has been focused on ways of saving energy in both supply and use. Energy management offers the opportunity to stabilise prices and to reduce the adverse environmental and social impacts of energy use in cities. It provides opportunities to make substantial savings in energy bills across all sectors - domestic, commercial, industrial and government - through a various means, many of which require minimal investment of funds. By making such savings the energy costs of production can be reduced with consequent benefits for consumers.

## B. Patterns of Energy Use

Majority of the world's primary energy comes from fossil fuels such as coal, oil and gas as well as uranium. Renewable energy sources at present account very small portion of total energy supply (Figure 1.1).

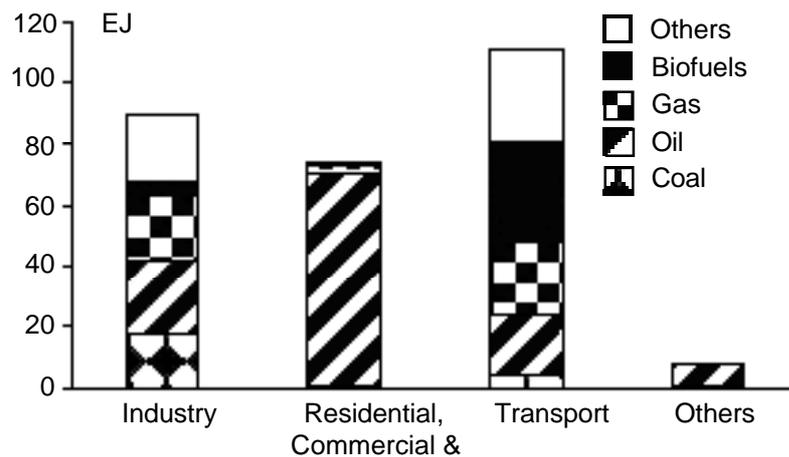
Energy is used in four major sectors in the economy:

- Industry ~ 30%
- Transport ~ 25%
- Domestic ~ 20%
- Commercial and others ~ 25%

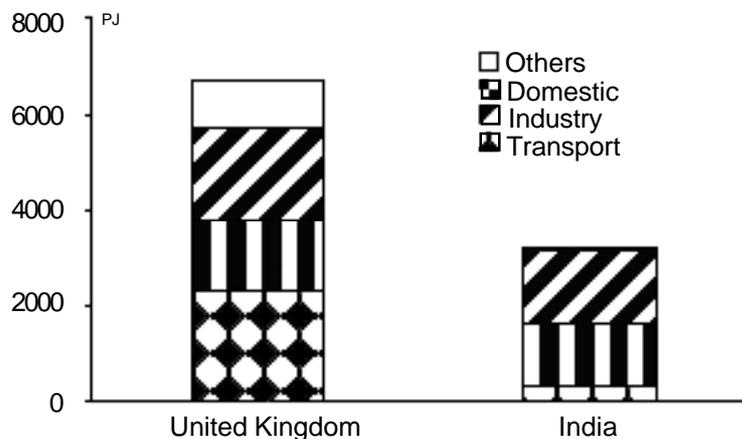


**Figure 1.1:** Worldwide pattern of primary energy use by fuel type (Year 1999).  
 +*Renewables* include cogeneration, heat pumps, solar, wind, wave, ocean, geothermal and hydro energy.  
 \**Biofuels* include biomass, wood waste, municipal waste, animal and agriculture waste etc.

Figure 1.2 shows worldwide pattern of energy use by major sectors. The patterns of energy use vary considerably within countries and particularly between industrialised and developing nations. For example, Figure 1.3 shows the pattern of primary energy use by sector for the United Kingdom and India.

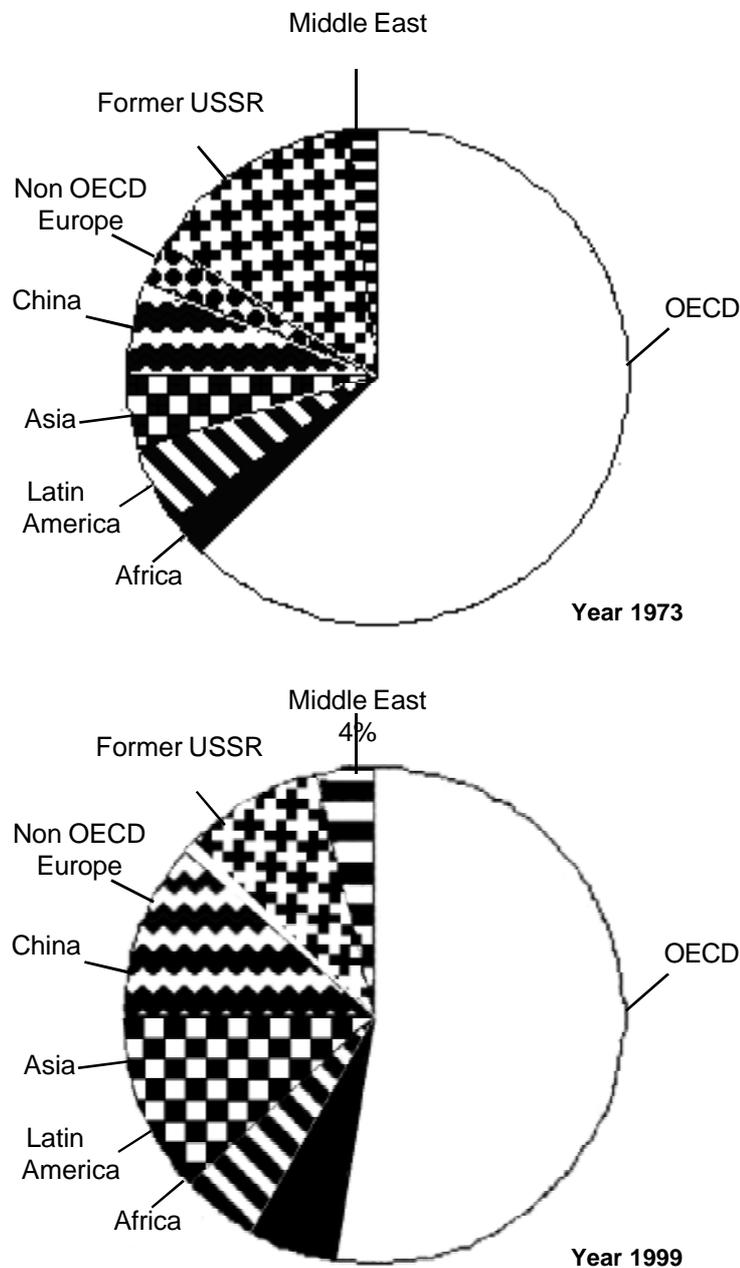


**Figure 1.2:** Worldwide pattern of primary energy use by sector (Year 1999).



**Figure 1.3:** Comparison of primary energy use by sector for UK and India.  
 \**Others* include services, agriculture, construction etc.

Worldwide, energy consumption has continuously been increasing during last three decades. Figure 1.4 shows total final energy consumption by region for Year 1973 as compared to the Year 1999. There have been overall 33% rise in the total final energy consumption during last 25 years. More of this data may be found on the International Energy Agency (IEA) website.



**Figure 1.4:** Comparison of total primary energy use by region for the Years 1973 and 1999.

### Domestic

The domestic sector uses about 20% of the energy in cities and is one of the most promising areas for achieving energy savings. Consumers are usually willing to adopt measures that will save money and many options are available for saving energy and money in this sector. The major uses of energy in the home are for water heating, space heating and cooling, refrigeration, cooking and appliances. Local authorities can influence domestic energy use through building codes or by providing information and incentives to use energy efficient appliances. The measures available for energy savings in the home are discussed in more detail in Chapter 2.

## Transport

In the transport sector strategies for saving energy range from technical solutions to full-scale urban planning solutions. The transport sector is a large user of energy and uses primarily liquid fuels, which are often imported and subject to price fluctuations. In industrialised countries private cars account for up to 80% of the passenger kilometres travelled. These vehicles use primarily gasoline and diesel fuel. Considerable scope exists for energy savings through the improvement of driver habits, better vehicle maintenance and improved vehicle design. Incentives to produce fuel efficient vehicles or to use public transport should also be considered. Public transport is a significant user of energy in cities, particularly in the developing world where there are considerable opportunities to save energy through improved vehicle design, fuel substitution and driver training. Chapter 3 addresses these issues in detail.

## Commercial

The commercial sector uses energy for heating and cooling of buildings, running appliances such as computers and office machinery and for lighting and cooking. It has similarities to the domestic sector because efficient appliances and building design are key factors in achieving energy savings. There is some incentive in the domestic sector for modifying user behaviour with regard to use energy since the home occupier generally pays the energy bills. However, in commercial situations energy audits, incentives and employee training are often more effective ways to promote saving of energy. These matters are discussed in detail in Chapter 4.

## Industry

The major area of primary energy, accounting for approximately 30% of total energy use, there are significant opportunities for energy savings is industry. Significant areas of industrial energy use are primary industries, such as agriculture and mining, which usually occur outside of cities. Power generation, construction, manufacturing and mineral and oil refining often take place within cities and there are large opportunities for energy savings through improved processes and operating procedures. Possible measures include supply side efficiency, cogeneration, demand management, fuel substitution, energy audits and operating procedures. There is considerable scope for industrial energy savings and these are addressed in Chapter 5.

## Government

Local Government Authorities are major users of energy as their operations encompass a range of activities such as road construction, waste management, street lighting, park maintenance and operation of public buildings. Some activities have elements in common with the commercial sector while others are quite unique. Public authorities can influence community behaviour by setting an example or by regulation and incentives. There are many opportunities for local government agencies to save energy and money through energy efficiency and waste management practices which are discussed in Chapter 6.

For each sector, case studies have been provided to illustrate the use of different strategies. In many cases the information has been taken directly from the relevant sources such as the internet.

The establishment of the Global Environment Facility has resulted in a significant increase in the number of energy efficiency projects, particularly in areas such as commercial buildings, industrial projects and economic measures, including subsidies for energy efficiency equipment. At the time of print, few projects have reported on the evaluation of technical, social and economic benefits which provide a wealth of information on the lessons learned and should serve as an excellent background resource for organisations considering applying for this type of funding.

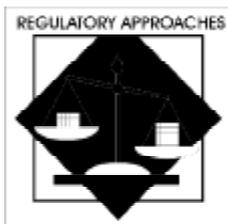
### C. Approaches to Saving Energy

There are many opportunities for saving energy in cities and strategies can be classified by four major categories.



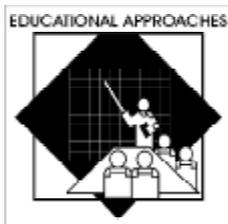
#### Technical Strategies

Technical strategies involve either new energy saving technologies or retrofitting existing technologies. Such changes often require considerable capital investment and can produce significant savings even in the short term. The implementation of technical strategies therefore is often limited by the availability of financial assistance such as grants or low interest loans.



#### Regulatory Strategies

Regulatory strategies are based on the introduction of local laws or regulations such as building codes or energy efficiency standards. These strategies pass most of the costs on to the users, but regulatory authorities must administer and enforce them.



#### Economic Strategies

Economic strategies involve incentives or penalties, which create a climate for energy efficiency. They can include 'no regrets' or voluntary measures as well as tax credits for energy efficiency and renewable energy research investment. These strategies are more costly for government, but they are generally more popular with industry and the public. In some cases economic strategies can generate considerable income by imposing taxes on fossil fuels or excessive energy use. Such taxes may be directed into the development of technical and education strategies for further energy savings.



#### Education Strategies

Education strategies involve the use of education, training and information to raise awareness about alternative energy systems and energy efficiency. It is a powerful agent of social change and can produce substantial energy savings for a minimal cost. Typical measures include driver training and raising public awareness of energy savings options. Education and training is also important for sales people, maintenance personnel and consumers.

### D. Importance of Energy Planning

Considerable synergy is present between energy saving measures. Economic measures can generate income that may be used to implement educational, regulatory and technical measures and these can lead to further savings. In order to maximise energy savings some cities have adopted an energy plan which provides a comprehensive and integrated approach incorporating a range of measures and including implementation schedules and appropriate costings.

This energy plan may be part of a larger regional or national plan and it could be funded from national or international sources. It needs to be prepared carefully in consultation with stakeholders and implemented through an open process with support from local government authorities. The process of developing such a plan relies on identifying the major opportunities for energy savings, considering the methods of funding them and the possibilities of synergies between them, and the development of an implementation plan. The process is described in detail in Chapter 9.

## **E. Financing**

Many opportunities for energy savings require some initial expenditure in order to realise the savings. Some measures produce a return on investment in the short term, whilst others are very cost effective in the long term. Finance is often available through national and international programs aimed at reducing pollution and greenhouse gas emissions. These opportunities will develop further in the years ahead as a result of the United Nations Framework Convention on Climate Change (UNFCCC) and the flexibility mechanisms it contains such as the Clean Development Mechanism. These are discussed in detail in Chapter 8.

## **F. Associated Benefits of Saving Energy**

Although the emphasis in this publication is on energy savings in cities, there are many associated benefits from this approach. Power generation is a major source of air pollution, global warming and land degradation. Saving energy can help to reduce the severity of environmental and social problems. Energy efficiency planning is probably the most effective method of reducing greenhouse gas emissions and moving towards sustainability in the short term, some of these issues are discussed in Chapter 10. This publication also contains many examples of successful energy saving projects with web links and contact details to facilitate follow up. These are presented in Chapter 10.

## **G. References and Resources**

International Energy Agency (IEA). <http://www.iea.org/>

United Nations Framework Convention on Climate Change (UNFCCC)  
<http://unfccc.int/>



