



CHAPTER 1

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1.1. Foreword

Energy is used for cooking, lighting, air-conditioning and many other activities in our daily lives. It is also used for transporting people and goods, and the manufacturing of consumer products. Energy is thus considered as the prime agent in the generation of wealth and becomes one of the most significant factor in the development of socio-economy of a country.

Based on past data, development seems to result in the growth of consumption of commercial energy - particularly closely related to the consumption of oil. Although energy aspects may not determine development strategy, energy considerations may highly relevant to specific choices connected with urbanisation, location of industries and industrial policy. Energy issues are also major factors in making decisions pertaining to the level and pattern of urbanisation as well as the systems/modes of transportation in a country.

This chapter aims to present the linkages of *energy* to the *economic sector* and how these activities have resulted in significant negative impacts or damages to the global *environment*, particularly the likely environmental pollution situations in Malaysia.

1.2. Energy and World Economy

The identification and analysis of energy issues, and the development of energy policy options, are important areas of study by governments, researchers, and the development community. But until the first oil price shock of 1973, neither developed nor developing countries conducted sector-wide energy planning: such planning as was done was limited to subsectoral institutions with little attempt at coordination or central planning (*Ang, 1986*).

All that changed, of course, in the aftermath of the first oil crisis, the high cost of energy supplies and the concern about the availability of oil have brought pressure on many countries to re-examine their national energy strategies. The increase in international oil prices that took place during the 1970s gave rise to widespread problems of energy adjustment throughout the world.

Higher oil prices lead to accelerated inflation, balance of payments problems, slower economic growth, and through the coupling of the energy system, affect almost every aspect of economic activity. Countries everywhere struggle with the establishment of effective policies and institutions to deal with energy sector problems (*Ang, 1986*).

In the efforts to reduce the cost of energy, energy conservation and oil substitution were given high priority in energy planning. The evaluation of the scope for energy conservation and oil substitution, and hence the appropriate actions that should be taken, entail a thorough understanding of the national patterns of energy consumption. This effort intensified in the aftermath of the second oil price shock, and by the early 1980s most developed and a few developing countries had established some formal energy planning activity.

For today's '*energy forecasters*' the present system may seem to be even more solid than 100 years ago even though during the last 2-3 decades changes have taken place. For instance, the internal combustion engines and cars fuelled by oil have been around for over eighty years and electricity is taken for granted nowadays. Due to various reasons as of over-supply and competition, deregulation, etc. the price of energy is low and in fact, in the developed world in terms of consumer purchasing power, the price is nearly as low as it has never been.

This for sure has an influence on developments in the energy sector be it in choice of type of energy to be used, developing "new" types of energy, energy conversion systems, etc. As the price of oil began to fall, gradually in the first half of the 1980s, then collapsed in 1986, other issues joined the forefront of energy planning activity.

In many developing countries the question of the linkages between fuelwood use and deforestation gained increasing attention, and energy planners took leading roles in the formulation and implementation of policies to arrest rates of deforestation by promoting more efficient use of fuelwood. More generally, energy related environmental concerns that have emerged recently are likely to dominate in the 1990s and beyond.

What is also sure is that oil, coal and natural gas are finite resources. However, no one knows when the world will run out of them. Historically, predictions of impending scarcities for natural resources, including primary energy, have largely proven to be unfounded (*James, 1997*).

In 1950 proven reserves of oil and gas stood at 30 billion tons of equivalent (btoe); in 1990 they exceeded 250 btoe not withstanding the fact that during the 40 year period over 100 btoe had been consumed. Proven reserves of coal rose from 450 to 570 btoe over the same period (*Koopmans, 2000*).

The increase in proven reserves can partly be contributed by the oil shocks of the 70's and 80's. Sharp increases in the oil prices put market forces to work and led to increased exploration, more efficient production as well as increases in end-use efficiency. While energy scarcity may occur in specific countries or in particular circumstances, it seems unlikely that there will be serious limitations on the overall supply of energy.

However, long before the world runs out of fossil fuels, health and environmental impacts of their use will force the world in the direction of clean or cleaner energy systems and/or sources. In future, constraints on energy system management are more likely to derive from environmental considerations than from energy scarcity (*Koopmans, 2000*).

In short, civilisation is not running out of energy resources in any absolute sense, nor running out of technological options for transforming energy resources into the forms our patterns of energy use require. What is running out, rather, is the capacity to expand energy supply at low cost – a capacity which was fundamental to the growth of material wealth in today’s industrial nations and which had been the basis of expectations that today’s less developed countries would be able to follow a similar path to prosperity.

In this connection as in others, “cost” must be understood to include not only monetary but also environmental and socio-political components. This reality has a pronounced influence on predictions what will happen in the future with regard to energy use.

1.3. Energy and the Environment

The development and use of energy have contributed negatively to the environment. It is widely believed that if the present trend of energy consumption continues, it will create environmental problem which in the long run could become a constraint itself for economic growth and social well-being. In this regard, there are three broad but distinct environmental issues related to energy.

Pollution related to energy mining and transportation comes under the first category. Pollutants like methane and sulphur oxides are emitted from energy mining whereas oil spills area are caused mainly by the transportation of crude oil products. The discharge from day-to-day transportation of oil from tankers, pipelines and offshore platforms is also high.

On the other hand, hydropower development normally requires the development of dam structure across rivers and the creation of reservoirs which may be large depending on the concept of development propose. The environmental impacts due to the construction of dams and the creation of reservoirs are often significant.

Second category of pollution will be the problem of clean air. Combustion of fossil fuel generates a variety of pollutants which affect human health and the natural environment. Similarly, fossil fuel power plants also create several local and regional problems. In addition to the emission of sulphur oxides, nitrogen oxides, carbon monoxide, carbon dioxide and particulate matters, power plants create the problem of acid rain too.

Acid rain can harm trees, agricultural crops, aquatic lives and other vegetation. In addition to the damage on physical environments, acid rain also affects human health. However, such impacts differ from place to place and may depend on acid precipitation of the area concern. It is thus both a local as well as a regional problem which entails more focus in the study of air pollution.

Third issue arising from energy consumption is the problem of greenhouse gases. Carbon dioxide, methane and nitrous oxide which are the main greenhouse gases, emitted mainly from the combustion activities of fossil fuel.

It is thus clear that the main cause of environmental problems related to energy use, specifically in terms of air pollution, is the use of fossil fuels (coal, oil and gas) either in power production, transportation or industry. More comprehensive discussion on the environmental impacts of energy consumption will be made in Chapter 2: Literature Review.

1.4. Objectives and Scope of Study

- **Socio-Economic Analysis of Energy Consumption in Malaysia:**

The economics of energy is concerned with the way in which it may be affected by changes in energy costs and by changes in the availability of other factors of production.

Similarly in the study of energy-economic-environment interactions, energy analysis, especially for future projections, is impossible without a reasonable knowledge of past and present energy consumption. Through better understanding of their historical and existing patterns of energy consumption, wiser policies for energy use and emission reduction will emerge (*Ang, 1986*).

Energy forecasting actually directed towards the development of energy scenarios that illustrate possible problems that may occur and give guidance on energy planning for governmental and other organisations. However, different forecasts show large variations depending on which scenario is taken.

Population growth, economic development, improvements in the efficiency rates of energy conversion efficiency rates and, environmental considerations are some of the factors that could influence the outcome of the predictions. The best starting point for an appraisal of the country's future energy needs is to understand exactly where the energy is now being used and where are the main factors that have led to this position (*IMechE, 1998*).

It is thus to be highlighted here that the energy analysis presented in this study does not necessarily aim to predict the future, but it seeks to show how a variety of possible futures depend on certain basic assumptions which may include policy variables that are, at least in part, under the control or influence of governments or planners concerned with energy decision making.

- **Energy Consumption and the Emissions of Sulphur Oxides in Malaysia:**

Apart from the analysis of energy consumption patterns in Malaysia, the study also aims to demonstrate that Malaysia could run into severe environmental problems in regard to its air quality if no significant efforts are made in the future to reduce the emissions of SO_x arising from the consumption of energy i.e. fossil fuels.

The production of energy usually depends on natural resource endowments, although extraction technologies, infrastructure, processing facilities and economic costs are also relevant (*James, 1997*). In this regard, the principal indigenous sources of energy in Malaysia are crude oil, natural gas and hydropower. Other sources of energy would be coal and traditional fuels such as fuelwood, palm oil wastes and charcoal.

However, the location of hydro-resources does not match the location of demand centres. Only 14 per cent of Malaysia's hydro-resources exists in Peninsular Malaysia where 82 per cent of the total population resides and more than 90 per cent of the electricity is consumed. Malaysia, as did most countries in the world, took advantage of relatively inexpensive and apparently plentiful global oil supplies over the last two decades (*MICCI, 2000*).

Malaysia is also fortunate in that coal does not represent an energy source of significant magnitude. On the other hand, biomass like agricultural waste, wood and other organic material, is used only in a few industries such as palm oil mills, rubber smoking and brick manufacturing, and for domestic purposes largely in rural communities.

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In view of such energy consumption scenario in Malaysia, the focus of this study will base on the environmental impacts brought by the consumption of the various choices of fossil fuel, especially the oil and natural gas as the main energy sources in Malaysia.

- **Emissions of Sulphur Oxides as the focus of study on air pollution:**

It was concluded by Petroleum Economics Limited (London) in a study completed in mid-1992 on energy and environment that, of the three main global energy related environmental hazards, i.e. the greenhouse effects, air pollution and dangers to flora and fauna, threats to clean air and natural habitats are much more tangible than to the as yet unproved impacts of global warming.

No firm conclusions have been reached within the scientific community, nor are they likely regarding the extent of accumulation of greenhouse gases, past and future global temperature changes and consequent impacts on weather patterns and sea level change. Until conclusive evidence is established, it is most unlikely that governments will take draconian measures to alter patterns of energy use and consciously or otherwise jeopardise economic growth (*Sharma, 1994*).

The study here have thus focused on the most significant airborne pollutant, i.e. sulphur oxides, in terms of the creation of acid rain. Although nitrogen oxides are important contributors too, curbing their emissions necessitates changes in burner technology whereas sulphur dioxide has broader ramifications for the quality of fuel use, which is, the scope and approach adopted in this study.