REPORT ON GLOBAL WARMING AND ASSOCIATED IMPACTS

(PHASE III)

TATA ENERGY RESEARCH INSTITUTE
NEW DELHI

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Submitted to the
International Development Research Centre, Canada

Tata Energy Research Institute
New Delhi

Contents

INTERNATIONAL ENERGY POLICY ISSUES FROM AN OIL IMPORTING, DEVELOPING COUNTRY PERSPECTIVE

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Introduction

The recent events in West Asia may have several extensive, long-term implications for global fossil fuel supply. The rapidly increasing concern for the global environment, whose degradation has important connections with energy use patterns, is a second important dimension in the current international energy scene.

Energy use patterns have pervasive impacts on the economy, growth, and the international division of labour. Oil importing developing countries (OIDCs) have, thus, a deep interest in assured energy supplies at stable, low prices, the development of alternative energy technologies, and flows of funds for a transition in their development paths to higher growth rates and increased living standards, despite increasing Ricardian scarcity of energy supplies.

In this paper we first review the recent policy analytical literature in the field.

Review of Recent Studies

Several global studies on energy have been carried out since the first oil price shock in 1973-74. Some of the more prominent among them were the global studies carried out by the International Institute for Applied Systems Analysis (IIASA) and the Ford Foundation sponsored project, "Energy : The Next Twenty Years". We are now half way through the 20 year period that was covered in the Ford Foundation study, and it would perhaps be relevant to refer to the major

findings of the study. While, this particular study influenced policy decisions and thinking round the world in a significant way, subsequent changes in the global energy scenario and market conditions triggered off events and influences that have resulted in deviations from the projections and predictions of the study. However, the realities that the study had identified governing global energy supplies are to a large extent relevant even today. These identified realities were, as follows :

a) **"The world is not running out of energy"** : It was concluded that the physical energy resources of the world were huge, at extraction costs not much more than about double those that prevailed at the time. While the use of these energy resources may be constrained by political or environmental factors, the world would certainly not be "running out" of energy in physical terms. With proper policy planning and a willingness to pay the costs, energy supply was expected to meet any reasonable projection of demand, without "gaps" or physical shortages. But it must be noted that the ability and willingness to pay for energy were critical pre-requisites for increasing supply.

b) **"Middle East oil holds greater risks, but is so valuable that the world will remain dependent on it for a long time"** : It was concluded that the world would remain critically dependent on oil "from the politically unstable Middle East", increasing the

probability that otherwise minor events will result in major economic disruption or even war (an assessment that in retrospect seems prophetic). A conclusion of the study was that world dependence on West Asian oil was due to the geographic concentration of easy to produce oil, and to the high costs of alternatives- facts that cannot be much changed by attacking the oil "cartel" (and indeed, which make cartelization in oil possible). All-round efforts at increasing supply and managing demand, it was felt, could reduce this dependence, but only slowly and at high cost.

c) "Higher energy costs cannot be avoided, but demand can be contained by letting prices rise to reflect them" : Higher energy costs were seen as a reflection of physical facts: it was concluded that the easy sources were about gone, while the plentiful sources were expensive to use safely. Higher costs of energy need not have severe effects on economic welfare or lifestyles if they were to be properly managed. However, the authors cautioned that it would be a dangerous misconception to believe that governments can somehow provide dependable, clean, and plentiful energy cheaply. The transition from lower to higher energy costs would be easier if prices were allowed to rise reflecting the economic realities; but finding the political will and the policy instruments to deal with the income distribution and inflationary effects was expected to be difficult.

d) "Environmental effects of energy use are serious and hard to manage" : The study referred to some energy activities, which pose serious threats to human health and to the environment. It was also predicted that the need to reduce those threats would be a major cause of rising energy costs and may even limit the extent to which some particular energy resources would be used. But it was stated that a high degree of uncertainty surrounded the mechanisms and extent of damage and risks, and the costs of reducing these threats would depend critically on how the threats are defined and managed. It was found important that environmental objectives be defined carefully and pursued efficiently, so that they can be achieved as fully as possible in the long run. We see in the world of today that environmental objectives have assumed a newer and larger dimension, particularly with the realisation of global effects. The "polluter pays" principle is particularly important in this arena from both economic efficiency and equity stand points, and no deviation should be considered from this in tackling global environmental problems. (See the accompanying paper "Global Environmental Issues related to Energy Development").

e) "Conservation is an essential source of energy in large quantities" : Even at the time the study was completed, it was found that both in the short and the long run,

energy conservation was often the cleanest, quickest, and cheapest way to react to the inevitable higher energy costs. Over the twenty year time horizon of the study, conservation was seen to inevitably become one of the most important energy "sources" in quantitative terms. A major observation in this regard merits direct quotation : "Because effective (energy) conservation involves the decisions of millions of diverse individuals, with a few notable exceptions it cannot realistically be mandated or managed centrally, but requires that information and incentives be provided to energy users who make their own adjustments". This fact needs to be kept in mind in defining global energy strategies too : conservation and energy efficiency gains cannot be mandated for countries and communities.

f) "Serious shocks and surprises are certain to occur" : This was another important reality identified in the study. The energy system was seen as a complex combination of technology and society. Hence, the future was certain to contain serious shocks, most probably involving short-term supply interruptions and price instability in world oil markets. Preparation for such shocks was observed as being perhaps the most important (and neglected) function of energy policy. It was also predicted that there are sure to be surprises, both pleasant and unpleasant, regarding new supply and conservation technologies, so that the long-

term outcome cannot reliably be predicted. A wide range of diverse options must be maintained precisely because we do not know which ones will ultimately prove to be most feasible or acceptable. In other words, uncertainties must be taken into account in developing future energy scenarios and strategies.

g) "Sound R&D policy is essential, but there is no simple technical fix" : The role of technology was seen in a wider context than mere technical questions. New technologies of energy production and conservation were expected to be a major part of the best response to higher energy costs, and government policies toward R&D (and towards other things, such as energy pricing) would be a major influence in determining which technologies are developed and applied, and when. But no single technical solution was foreseen as the answer, nor was there much likelihood that technology in general would be able to reverse the trend toward higher energy costs.

Recent Scenario Changes

In the last several years, three major factors have acquired prominence globally, which must also influence cooperation in the evolution of a global energy policy.

1. A larger proportion of recoverable reserves of hydrocarbons exists in the Gulf region than was the case at the beginning of the 1980's.

2. The geopolitics of oil has changed substantially, particularly with the easing of east-west tensions, and the impacts of the recent Gulf war.
3. Global environmental issues, particularly the threat of global warming, would influence energy decisions and policies substantially in the years ahead.

Since the 1970s, economists have analysed the long term prospects of stable oil prices, shocked as they were after the first oil price increase of 1973-74. It is clear that the long-term ceiling on oil prices, in the event of political developments, in the W. Asian region in particular, would be provided by the development of what are termed "backstop" technologies. The concept of a backstop technology underlies the availability of a method of producing substitute energy supplies, which could be brought into operation competitively when the price of oil reaches a particular level. The cheaper the backstop technology, the lower would be the ceiling that oil prices may rise to in the long-run because consumers would, given a reasonable period of time, switchover to energy from the backstop technologies. Several world leaders in the late '70s saw the rationale of this approach and invested large sums of money for development of alternative fuels, including renewable forms of energy, which it was hoped would provide a large menu of backstop technologies to place a lid on future oil price increases.

Elements of a New Approach

Ten years ago the U.N. organised the U.N. Conference on New and Renewable Sources of Energy. Several heads of Government, participated in this conference and plans were laid for major developments in the field of new and renewable sources of energy. Unfortunately, these plans gradually evaporated or have been dormant during the last decade. In essence the last 10 years represent a period of lost opportunity globally in the evolution of viable renewable energy technologies. In the context of growing environmental concerns at the global level there is now, therefore, a renewed urgency for shaping a purposeful common approach to the global problem of finding clean and sustainable supplies of energy, which would be to the benefit of oil importing states of the North as well as South. The elements of a new approach may be as follows.

1. Restructuring economic systems and improving the efficiency of energy production and use, whereby the intensity of energy employed per unit of output, and particularly of fossil fuels, can be reduced as rapidly as possible. (Some possibilities in this direction are discussed later in this paper).
2. Stabilisation of energy markets to minimise the risk of sudden price changes which are harmful to both consumers and producers. This can be achieved by (i) building large, dispersed global reserves of petroleum, which several national governments or international public authorities can release during periods of turmoil or

sudden reductions in supply, (ii) enhancing the production of conventional energy overall, particularly in those regions where current production is low due to scarcity of capital, technology and other inputs, (iii) finding lasting solutions to political problems in West Asia and the Gulf region, so that the danger of armed conflict in the future, which would almost certainly disrupt oil supplies once again is minimised. While the post Gulf war situatiion may lead to lower oil prices in the short-term, it does not ensure long-term stable political relations among the OPEC cartel members, and the risk of destabilizing episodes continues to exist.

3. Changing the mix of energy with greater use of less polluting forms of energy such as natural gas, renewables and, (wherever safe and feasible), nuclear energy. A major shift in energy patterns is necessary, particularly to reduce emissions of carbon dioxide from the burning of fossil fuels. Several countries have taken unilateral steps, committing themselves to targeted reduction of carbon dioxide emissions by the year 2005, such as Germany and Australia. The equity issues involved in such global environmental concerns are discussed in the accompanying paper : "Global Environmental Issues Related to Energy Development". It must be emphasised that the developing countries would continue to increase their use of fossil fuels, since increased energy use is essential for economic

growth, their resource endowments often comprise fossil fuel such as coal, lignite and natural gas, and because shifts from traditional biomass fuels to fossil fuels and electricity is an important attribute of increasing living standards. This point can also be seen on the basis of the major disparities that exist in per capita consumption levels of commercial energy, such as the case of Bangladesh with barely 50 kgoe per capita per year, versus over 9000 kgoe per capita annually in North America.

4. Transfer of capital and technology for sustainable energy supplies in the developing countries. The developing countries are at a stage of economic development when they necessarily have to increase the intensity of energy use in attaining desirable levels of economic development. Of course, it is not necessary for the developing countries to pursue exactly the same path that was followed by the developed countries at similar stages of economic growth, but a reduction in energy intensity is still very far in the future for the poorest countries of the world. Undoubtedly, the developing countries can leapfrog some technologies, but this would not result in a reduction of energy intensity, or, in some cases, even a reduction in the rate of growth of energy intensity. But change can be initiated through the infusion of capital and technology. If one looks at the potential of natural gas use in the developing countries, for instance, the

fraction of international trade in this fuel among the developing countries is yet very small in relation to their total energy consumption. Yet, there are parts of Asia where new discoveries of natural gas are taking place at a very rapid rate. Consequently, investments in infrastructure for transportation and trade of natural gas would be essential for bringing about greater use of this fuel, which has several environmental benefits.

In essence, a change in energy policies needs to be initiated urgently by countries which have high levels of income and which are the largest users of energy per capita. The scope for restructuring in the developed countries is substantial. For instance, Mr. William Rickett, Director-General of the U.K. Energy Efficiency Office has stated that some 20% of the U.K.'s energy bill could be saved by investing in cost effective energy efficiency measures. The scope in the United States is also quite considerable. For instance, potential savings through the use of the best possible models of domestic appliances as opposed to those currently in use ranges from 50 to 87% as shown in Table 1.

A variety of actions that can be taken in improving energy efficiency as well as introducing less polluting forms of energy use would bring about major reductions in CO_2 emissions are shown in Table 2.

The United States has recently released its National Energy Strategy (NES), which has several laudable objectives, but is premised on increased overall use of energy and carbon dioxide emissions. For instance, according the NES, the total U.S. energy consumption would rise by 37% by the year 2010 and by 50% by the year 2030, compared to 1990 levels. The total consumption of energy would increase from 80 quads (quadrillion Btus) today to 120 quads by 2030. Carbon dioxide releases correspondingly would increase by 25% over the next two decades. On the other hand, the use of energy in other developed countries shows very healthy trends.

Energy efficiency gains and reduction in CO_2 emissions have to be brought about through major restructuring of economic systems and lifestyles in the next few decades in the developed countries, and particular care has to be taken that "dirty" and high energy intensity industries are not merely exported to the developing countries, since this would certainly not be part of a global solution.

It would be most useful to promote energy efficiency gains on a worldwide basis. In this context, developing countries with scarce capital would find it difficult to invest in energy conservation measures, since even investments in enhancement of energy supply are constrained by capital shortages, and institutional arrangements are overwhelmingly geared to supply increases. Funding specifically targeted for energy efficiency programmes

through multilateral and bilateral sources would, therefore, be useful in the adoption and implementation of energy efficiency activities. It would also be useful to promote greater exchange of information among energy organisations in the developed and developing countries. For instance, the experience of the U.S. in promoting small scale power generation after the enactment of the Public Utilities Regulatory Policy Act (PURPA) of 1978 could be extended in several developing countries. Demand side management programmes adopted by electric utilities also provide very useful experience for renovation by utilities in the countries of the developing world.

In the field of renewables the U.N. has recently set up a group to look at the possibilities for promoting worldwide the use of renewable technologies. One major recommendation being considered is to set up a string of centres of excellence for development of renewable energy technologies in different parts of the world. While this attempt would have obvious benefits, it needs to be ensured that the centres of excellence are not new ivory towers, but serve to strengthen existing institutions and linkages to maximise the benefit of financial resources made available for this purpose. The agricultural research institutions under the CGIAR system have done valuable work over the past few decades, but one major criticism voiced against them is that they have not strengthened the capabilities of local research institutions, nor have they developed adequate linkages with then. We should not repeat this error with

renewable energy research and development. In fact, the mode of operation to be followed in R & D programmes in this area should emphasise close partnership and collaboration across different countries and between institutions in the same country.

Conclusion

The long-term prospects of a stable peace in the W. Asia/Gulf region are the key to stabilization of global energy markets which are in the clear interest of oil importing developing countries. In the interests of both the producers and consumers of oil, resolution of the long-standing political crisis in the region must be given the highest priority in the international arena.

In any event, the world must pursue a broad menu of policies for transition to an era in which fossil fuels are progressively more costly. These include the development of alternative technologies, technology and capital transfers to LDCs, and institutional changes by which incentives are created for users to conserve energy. The developed countries are still profligate in energy use and this has led to a high rate of fossil fuel depletion, leading to significantly higher energy prices at the time that LDCs have sought to accelerate their growth rates. It has also led to major global environmental problems, on account of which the content of economic growth itself must be altered worldwide. A reduction in energy use intensities in DCs is imperative, even as developing countries are assisted in eschewing unsustainable patterns of growth.

Table 1

Comparison of Energy Efficiencies and Regulated Appliances

Appliance	Average Annual Energy Consumption			Estimated Cost-Effective Potential[a]	Potential Saving[b] (percent)
	In-Use Models	New Models	Best Commercial Model		
Refrigerator [c]	1,500	1,100	750	200-400	87
Central Air Conditioner[c]	3,600	2,900	1,800	900-1200	75
Electric Water Heater[c]	4,000	3,500	1,600	1000-1500	75
Electric Range [c]	800	750	700	400-500	50
Gas Furnace[d]	730	620	480	300-480	59
Gas Water Heater[d]	270	250	200	100-150	63
Gas Range[d]	70	50	40	25-30	64

[a] Estimates are made of potential efficiency (by mid-1990s) if further cost-effective improvements already under study.

[b] Percent reduction in energy consumption from the average of those appliances in use to the best cost-effective potential.

[c] Energy consumption for these appliances measured in kilowatt-hours per year.

[d] Energy consumption for these appliances measured in therms per year.

Source : Geller, 1986b.

Table 2

Emissions Reductions from Current Policy Initiatives by 2000
(in 10^6 metric tons on a CO_2 Equivalent Basis)*

POLICY OPTIONS	CO_2	CO_2 as CARBON
Tree Planting	**30.0**	**9.0**
U.S. DOE Efficiency Initiatives	**92.7**	**25.3**
Commercial Buildings Lighting	8.2	2.2
Promote State Least Cost Utility Planning	30.0	8.2
Interim Building Standards	27.3	7.4
Expand Energy Analysis	20.0	5.5
HUD Adoption of Standards	2.7	0.7
U.S. DOE Renewable Initiatives	**14.0**	**3.8**
Expand Hydropower	12.2	3.3
Transfer of Photovoltaic	1.8	0.5
U.S. DOE Appliance Standards	**13.6**	**3.7**
Clean Air Act Provisions	**57.3**	**15.6**
Acid Rain	54.5	14.9
Biofuels	0.9	0.2
Natural Gas	1.8	0.5
Landfill Regulations	**160.0**	**44.0**
CFC Phaseout	**693.0**	**189.0**
TOTAL	**1060.6**	**290.0**

* Based on conversion to a CO_2-equivalent basis using 100 year GWPs.