

ENERGY, CULTURE AND HISTORY

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Our present global energy transition problems have forced all of us to reflect on the significance of energy for our modern civilization -- and, in particular, what impact the end of the era of cheap energy is already having, and will continue to have, on our technologies, social structures, cultures and life-styles.

A look backward at history shows very clearly how our societies have evolved commensurate with man's capacity to harness additional sources of energy. One of the first anthropologists to explore the interactions between energy and culture, Leslie A. White, suggests that our cultural development is determined by "the amount of energy harnessed per capita and by the efficiency of the technological means with which it is put to work." While I personally feel that other factors must also be taken into account in measuring the advance of culture, I certainly agree with the centrality he assigns to energy in humankind's development over the millenia.

For his first hundreds of thousands of years of life on this planet, man relied primarily on the energy generated by his own muscle power to hunt and gather his food and protect himself from the elements.

* Due to shortage of time and other factors, the Rector did not deliver this speech as written but used it as an outline for his remarks to the Panel.

He conquered fire very early, but this remained an essentially unimportant energy source until the invention of the steam engine in the eighteenth century.

So too with water. While primitive man could float freight down a stream, it was only with the invention of the water wheel, shortly before the onset of the Christian era, that water became a significant energy source. Wind was not used as a source of energy until fairly recent times.

The first major transition in man's energy use came with his domestication of plants and animals. Agriculture and animal husbandry were capable of producing far more energy per capita than hunting, fishing or gathering. As the food supply grew more plentiful, populations increased, villages became towns and towns became cities -- leading to the emergence of nations and empires. The state system can be attributed very directly to the Agricultural Revolution.

Methods of agriculture, irrigation techniques, and animal husbandry helped determine the directions taken by the various state systems. It was the utilization of animal traction, in combination with the heavy iron plow, that made it possible for medieval Europe to increase its agricultural production in pace with its population increase. The agricultural society that grew up, with farmland and its workers located conveniently close to the castles and manor houses, encouraged the profound social and structural changes that gave birth to feudalism.

In parts of Africa, the lack of traction animals -- due largely to the pernicious effects of the Tsetse fly -- made agricultural development more difficult and, at least until their recent independence, impeded

the growth of large-scale social systems. In other parts of the world, large irrigation systems and their water-related technologies, led to different social and political structures. The different uses to which agricultural surpluses were put -- whether serving commercial or state interests -- led to further differences in the social structure, culture, and political systems among nations.

The same advances in fuel-wood-based metal-working technology which had made possible the iron plow also put iron axes and saws in the hands of the average workers, increasing their energy output and facilitating their access to the great forests of Europe, and leading to a whole material culture based on wood.

But in the end, population pressures and agricultural expansion led to deforestation of large parts of Europe. Between the thirteenth and sixteenth centuries, Europe experienced what Jeremy Rifkin has called "the last great energy watershed." Hard wood, needed for charcoal production to fuel the early phases of industrialization, was in increasingly short supply. This hastened the transition to coal and the Fuel Revolution. For the first time, man began systematically to consume the globe's non-renewable sources of energy.

As coal miners burrowed deeper and deeper into the earth, drainage pumps were needed -- which spurred the development of the steam engine. Its invention, coupled with the growing inadequacy of soft roads and the canal systems to transport an increasing volume and weight of goods, led to the development of railway systems -- and the Industrial Revolution.

The revolution set in motion vast transformations in the structure

of society -- many of them, in the short run, in no way beneficial to the urban or rural masses. A worker's life in the teeming slums of early nineteenth century London or Paris in many ways resembled that of his twentieth century counterpart in many primate cities in the Third World.

The Industrial Revolution, however, did lead generally to higher productivity -- and the need for external markets for industrial goods and for imported raw materials and primary commodities. Another use of the steam engine, to power a ship, was a decisive factor in the consolidation of European colonialism, started earlier by the effective use of another form of energy, gunpowder.

In the colonies, the massive influx of industrial goods from Europe overwhelmed and destroyed local capacities in fields like textiles and iron work. As a result, the villages were reduced to mere food production units or sources of cheap plantation labour. By contrast, Japan, the single non-Western nation to have thus far joined the ranks of the affluent, was able to modernize relatively easily because it could draw on unbroken traditions of toolmaking and artisanship. Incapable of building on a similar base, the former colonies now had to industrialize through national bureaucracies, with all the problems attendant on such a situation.

It was in the context of the imperialistic setting that the exploitation and control of the new oil resources, outside the USA, passed first into the hands of the Europeans and later the Americans. From that control sprang the era of cheap energy that made possible the creation of modern mass society as we know it.

The higher productivity made possible by cheap energy triggered profound social changes. To cite but one example, women, particularly in the affluent societies, have been released from much former daily drudgery -- opening up opportunities for a fuller life, greater participation and more gainful employment in society. At the same time, the mechanization of agriculture, fueled by cheap energy, has deprived women of income earning activities in many parts of the developing world.

But there are also the roots here of the present deep and untenable structural dichotomy between the affluent North and the poor South -- and the centre periphery relationship which characterizes so much of the global society today.

Cheap energy has made possible the worldwide transportation and communications infrastructures which make for increasing global interdependence -- even though profoundly and unacceptably asymmetric -- a fact of our daily lives. But they, in turn, increasingly heighten the legitimate expectations and demands of the hungry, the poor and the powerless all over the globe.

The challenge now before us, as we face the hard reality of the end of the era of cheap energy, is in finding ways for the South to fuel its own Industrial Revolution -- which must come about if it is to provide jobs for its rapidly increasing millions. In Asia alone, there will be one billion more people by the dawn of the twenty-first century. If jobs are not created, the massive outflow of migrant workers, illegal immigrants, and refugees across national boundaries and into the affluent areas of the world is bound to overwhelm the regulative capacities of governments.

The pressure for jobs in the Third World over the next decade or so, resulting from a long-term lowering of the median age of its populations, could well become of explosive character. The number of young people in the Third World today is extremely disquieting -- in the ASEAN nations alone we are talking about 110 million below the age of fifteen. Creating employment opportunities for the young throughout the developing world is perhaps the most perplexing and difficult problem that we face -- it is bound to strain in the next two decades the political systems of many Third World countries to the utmost, whatever their ideological persuasion.

In addition, these younger generations simply will not settle for the lives of indignity and misery that their parents, in the rural countryside as well as in many urban areas, have known. They will not accept another 10 years of waiting for electricity to come their way or continue to accept the present global imbalance in energy consumption. The people of the United States and Canada use more than five times the per capita average of global energy consumption -- while the peoples of South and Southeast Asia use only one-tenth of the global average. Rapid increase in energy demand in the populous, low-income countries in the Third World is inevitable.

In coping with these pressures, we will have to evolve broad-based development strategies that will ensure high growth rates but are also less energy-intensive and ecologically sustainable. Perhaps nowhere is this need so starkly vivid as in the food and energy interlinkage -- with rising costs of energy threatening to drive food prices out of the reach of increasing numbers of the poor. Our best hopes here may

lie in advances in the field of biotechnology: biological nitrogen fixation, genetic improvement, improvements in photosynthetic efficiency and the like. Most of these basically involve improved efficiency in our use of solar energy. But these technological advances will have to be adapted to the needs and values of small-scale farming in the populous agricultural societies who will use them. This will take time, and money, and, in particular, innovative thinking.

We need to recognize further that we are talking here essentially about the needs of some half of all humanity, living in poverty and hunger, whose daily lives are largely untouched by oil and other commercial energy sources, and most of whom rely on fuel wood and organic wastes for their basic household energy.

Thus any discussion of the energy transition problem turns inevitably to the problems of the poor. Innovative social energy systems must be developed to meet the needs of the rural poor. At the same time, the poor also need access to commercial energy, in order that industrialization can advance and that non-agricultural jobs can be created in the rural areas more rapidly. The energy available to the poor must be more than that required for mere sustenance, it must be enough to ensure development and growth.

In rethinking energy strategies, it is essential that we understand just how delicately balanced are the support systems of our planet and how much these will be effected by the activities of the hundreds of millions of poor and hungry people around the world. Problems like deforestation, soil loss, agricultural depletion and climatic change are all interconnected -- and play a role in hunger

and poverty. If they are not overcome, they could spawn global disruptions that no technology, no matter how ingenious or large scale, could solve. The financial resources needed for an immense worldwide effort at improving the energy systems of the poor must inevitably turn our attention to the importance of somehow reducing the pathological spending on nuclear weapons and other arms that threaten the destruction of all humanity. We have now accumulated on this globe the destructive power equivalent to one million Hiroshima bombs -- another perverse form of energy use -- and we are spending some 500 billion dollars a year on arms, about one million per minute.

The efforts to resolve the energy and job creation problems of the poor and populous countries will probably lead to different trajectories of industrialization and rural modernization from those of the industrialized world. These will be less energy-intensive but equally sophisticated and may eventually lead to a variety of modern civilizations based on non-Western value configurations. These alternative modern civilizations in various parts of the world -- possibly the Sinitic, Hindu and Islamic as well as others -- could take their rightful place side by side with Western civilization in an interdependent world that recognizes, in a spirit of common dependence, the urgency of conserving the finite resources of this planet and using its new and renewable sources of energy to their fullest potential. Whether there will be a future for human civilization will really depend on our ability to make such a transition in energy use.

I have concentrated on the Third World because it is there, it seems to me, that the critical impact of energy on society will take place in the next few decades. However, we should remember that what happens in the industrialized countries during this period will also be of crucial importance.

Already, with the recent oil glut and price drop -- which surely is only a temporary lull -- we are hearing voices saying that the energy crisis has been exaggerated and that we can probably manage it without too much discomfort or change.

I think I have said enough to show how myopic and dangerous are such views. And I must emphasize that the problems of the Third World which I have outlined will become infinitely greater, and will threaten the whole fabric of our international society, if the first world does not put its own energy house in order.

Industrialized countries have the scientific and technological muscle to find ways of using energy more efficiently and to discover and exploit new sources of energy. They must use this strength. But muscle power alone will not be enough. The societies of industrialized countries now face profound ethical and moral decisions on energy.

One of the most obvious is over nuclear power and already we have seen in some countries that this is not a decision that a government -- an elected government -- can make alone. Further, we are beginning to recognize the need for a new kind of national and international debate as the prospect of fast-breeder reactors brings nearer the era of the plutonium society with consequences that have hardly been considered for their impact on human rights and the structures of

democracy.

Another agonizing choice will be over the life-styles of the first world's consumer societies and their ever-increasing appetite for energy. How long can these be sustained? Will the inevitable change be forced on the rich countries by the poor or will we see the conscience of the industrialized world and the need for change being articulated and motivated by what I call "the movement from below" -- those movements of ordinary concerned citizens which have dominated political and social life in the past twenty years and brought about many fundamental changes which were once thought politically and socially impossible.

One cannot be over-optimistic about the ability of the industrialized nations to face these issues. The problem is usually traced back to the events of 1973 -- but the United States became a net importer of oil in 1947 after having been an exporter since 1870. Can it be said that these thirty-four years have been used to adjust to the inevitable consequences of that fact? In 1979 the Gallup Poll reported that 45 per cent of Americans surveyed did not know that the United States imported any oil! There is little evidence that those countries which are wholly dependent on oil imports -- France, West Germany, Japan for instance -- have developed coherent policies in response to the inescapable consequences of this situation.

But the issues I have outlined have to be recognized by governments and peoples in all countries, rich and poor, and recognized as a single, global fact.

This recognition will shape the decisions on energy made by governments. These will be essentially political decisions -- and

they can have immense and far-reaching consequences. The United States decided in 1956 to launch an interstate highway system that has vastly altered American life and produced a society which uses one-third of the world's oil, most of it in the cars and trucks that use those highways. President Carter similarly made a political decision not to proceed with commercialization of the breeder reactor -- with great implications for the future US energy "mix." The decision the world must now make is what the global energy "mix" should be -- and these discussions here in Nairobi can provide much valuable input in helping us make that decision wisely and in accordance with the collective interests, hopes and aspirations of all humankind.