ENERGY

The modern economy would appear to be headed for a world where cheap machines produce ever cheaper products for other cheap machines to use. As a consequence, human beings have less and less to do. It is common to see more and more automation in the face of more and more unemployed people -- followed by more and more products chasing less and less purchasing power. At every step, more energy is consumed, and more entropy is created. Today's labour saving technologies and mechanistic economic structures can only lead to growing supply and stagnant demand -- until, of course, we reach the catastrophic environmental transition when supplies will have collapsed altogether and both human populations and their demands have collapsed with them.

The technology choices on which our current systems of production are based and the paradigms of economic development that determine the allocation of what is produced simply do not work. They place people over nature and machines over people. Growth, they claim, must come first, even at the expense of distributive justice and human well-being. Efficiency is more important than equity and the interests of the rich must be given higher priority (in action, if not in words) than those of the poor. They do not lead to outcomes that satisfy either the basic human values of social fairness or the imperatives of ecological balance. In fact, as this year's Nobel Prizes underline, they are often not even economically efficient.

But the global economy, which is based on these assumptions, is heading for trouble. No fine tuning of the neo-classical doctrines, no more of the same medicines -- that, after all, are causing the problems in the first place -- can get us out of it. When the social, environmental and natural resource costs of the past century's experiments with "modernisation" are all counted, it will become obvious that the current form of "development" is not sustainable. The widespread social and economic ills of today are just the early symptoms of a terminal disease that human society can avoid not by a change of dosage or even a change of the medication, but by a fundamental change to an altogether different system of social (and economic) medicine.

SUFFICIENCY AND EFFICIENCY

The goals of sustainable development clearly cannot be reached with today's urban-industrial lifestyles. Nor with the disparities that exist within or between countries. Sustainable development implies not only efficient and ecologically sound management of resources, but also the need to establish social equity and political empowerment. What hope is there for this planet if the countries of the South start to consume energy and other resources as the North does today? Or if the vast numbers of poor in our world demand what the rich few already have? They are not only entitled to do so under any concept of fairness and justice, but are also being encouraged to by the forces of the global market.

And what will be the demographic, economic and environmental impact in the longer term if poverty and marginalisation in our economy further delays the stabilisation of our population?

In the perennial international debate that pits northern consumption patterns against southern population growth, the central issues are, of course, sufficiency and efficiency. How much is enough, and how little do we have to use to get it? This means that sustainable development goals also require us to reorient the way we produce the goods and services that we consume.

The sustainability equation inexorably brings together sufficiency of consumption and efficiency of production. And this means that all sectors of society, the public, the private and the civil will have to work more closely together to redefine the goals of development and the roles they play in the economy.

The central goals of our production systems have to be not only the generation of goods and services, but equally the creation of jobs and the efficient use of natural resources. Today's industrial methods are no good. They involve too much capital. They waste too many resources. They cause too much pollution. And they disrupt too many life support systems -- the material flows generated today by mankind are estimated to be already comparable to geological flows. Such flows cannot be sustained for long. Large scale industry is not necessarily the only way to produce the goods that people need: it can cause large scale disruption, both ecologically and socially.

We need new technologies and also a new science of economics. We need to create work places - jobs - at one tenth and even hundredth the cost of the ones we are creating today in our globalized economy. And we need to increase the productivity of material resource use by at least 10 times what it is today. Sustainable industrialisation will unquestionably have to be more decentralised, efficient and responsive to social and natural constraints than it is today. And it must be based on a better understanding of resource pricing, environmental accounting, scales of production, financing systems and the many other factors that are in need of fundamental change.

A synthesising concept that might offer some clues to the directions needed is that of sustainable livelihoods. A sustainable livelihood is one that gives dignity and meaning to life, provides adequate remuneration and thus creates purchasing power, and produces goods and services that people need. Above all, it does not destroy the resource base. Sustainable livelihoods tend to strengthen local economies, empower women and regenerate the environment. Large scale (but widely dispersed) generation of sustainable livelihoods and adoption of more sustainable lifestyles – concepts ultimately applicable both in the North and the South – may well be the surest way to attain our sustainable development goals.

ENERGY AND THE DEMOGRAPHIC TRANSITION

Next to the need to create sustainable livelihoods and sustainable lifestyles, and as a primary factor in achieving these goals, the central issue facing society, globally, is the need to create sustainable energy systems. Sustainable energy, like sustainable livelihoods, is a synthesizing concept that is applicable under a wide variety of circumstances, and can help us design more viable economic systems for the future in any country, rich or poor. The question for which we now must find an urgent answer is: "how can each person on this, our one planet have access to adequate energy to make those livelihoods possible?"

The implications of energy use, both in terms of resource depletion (e.g., growing scarcity of fossil fuels, materials consumption) and in terms sink overload (e.g., carbon emissions, air pollution, climate change) are cumulative and increase with time. As per capita energy use rises, and the population grows, the impacts multiply, leading to exponentially increasing pressures on both reserves and sinks. The difference between the pressures that will exist, say in the year 2050, as a result of current trends in energy use and population growth and those that would exist if either or both of these factors increase more slowly could be enormous.

There is now considerable evidence that overall energy use and materials flows – including those caused by the extraction of energy and other resources -- must be reduced considerably if we are to avoid causing a massive disruption to the earth's life support systems. In the case of energy, this recognition has already led to the signing of the UN Framework Convention on Climate Change and the Kyoto Protocol. Much more political work will be required to bring about international recognition of the threats posed by current trends in anthropogenic material flows. However, considerable evidence collected by the Factor 10 Initiative and others shows that even current levels of material use are not sustainable in the long run and will have to be cut down by a substantial amount.

Whether it is energy or materials, the one half of the world's population which lives in poverty will need to use substantially more resources before their legitimate basic needs are met. They will need even more of these resources if they are to achieve some kind of parity in lifestyle with the other half, which has had the benefits of two centuries of industrialization. Of course, the additional resources they will actually need could be lower in quantitative terms than was the case for their counterparts in industrialized countries if they have access to more efficient technologies. But use of more energy and materials is an inevitable requirement if the poorer half of the world's people are to fulfill their legitimate development aspirations.

And the need to accelerate the process of achieving these aspirations becomes a primary concern not only of the poor but also of everyone on this planet. This is simply because the concept of sustainability implies a longer time horizon. The consumption of energy and material resources need to be brought down quickly and kept down thereafter. This means that both the resource consumption patterns and global population growth must be drastically reduced. Carbon emissions or material flows in the year 2030 or 2050, say, will depend primarily on three factors: per capita resource consumption, technical efficiency of resource conversion and the total population. The sooner we bring the resource consumption and population growth down to sustainable levels and raise the efficiency of our technologies, the higher are the chances of attaining a sustainable trajectory for the global economy.

On current trends of resource use and population growth, there can be little hope of bringing energy and material flows down to levels that no longer disrupt the biosphere. These trends must, therefore, clearly change drastically. To accelerate the demographic transition in the poorer countries, which is one primary requirement, what is needed is to raise the quality of life of their people. This means a substantial and immediate *rise* in the energy they use and the efficiency with which they use it, both of which serve as surrogates for the quality of life they have.

SOME ENERGY OPTIONS FOR THE SOUTH

Energy issues are, of course, conceptualized and designed by those who control the "modern" sector - the elites for whom commercial (i.e. non-renewable, fossil based) fuels are the only acceptable, legitimate sources of energy. In such a society, it is natural that development becomes identified with growth, and growth with increasing energy uses; energy with electricity; electricity with centralised grid systems; and national grids with petroleum based fuels. Within this modern sector, decisions are made primarily by economists and engineers. Because of their grand scale, hydro-electric projects and nuclear power plants have also come to acquire a legitimacy close to that of fossil fuel based power stations - of all these, we have many in the countries of the South. The installed capacity for generating electricity in any developing country is more than enough for energy-hungry industries and towns, and an increasing amount is available for agricultural needs to satisfy another important political constituency, the farmer.

The poor have to be satisfied with what are euphemistically called "non-commercial" energy sources such as wood, cow-dung, twigs and agricultural wastes. Non-commercial energy in many developing countries constitutes nearly 50% of the total energy used! This is a trend that has continued over the decades and given present growth rate of different energy sources, can be expected to continue into the future. Only a massive forestation programme in these countries can help to prevent total destruction of the forests.

Despite sizable investments made by governments, international agencies and even some corporations, the penetration of commercial sources of renewable energy has a long way to go. A few isolated successes have been reported with solar photo-voltaic systems for use in pumping, lighting, community TV and other special applications, primarily in remote locations which are too expensive to wire up to the national grid.

Since many bulk applications of energy (such as cooking, water heating and space warming) need only a low grade energy source, it makes good sense to make solar thermal devices available to households on a large scale. Some countries have had some success with improved cookstoves, solar water heaters and other similar devices, but the usual experience is that the market for these dries up when the government subsidies introduced to popularize them are withdrawn.

Next to power production and transportation, the sector that uses the most amount of energy is construction, both because of the energy embodied in the building materials and for lighting, heating and cooling buildings. Since current manufacturing practices in most developing countries are quite inefficient, vast energy savings can be achieved in the manufacture and delivery of building materials. In addition, major energy savings can be achieved through the use of solar passive systems for heating and cooling buildings. Apart from the few isolated architectural experiments, not much has been achieved in this area.

Biomass is another form of solar energy conversion, the one that is the most common in developing countries. Large quantities of biomass are burnt for cooking and heating and a small amount is converted to methane gas by an anaerobic digestion or producer gas by pyrolysis. This area offers great benefits and needs to be promoted actively.

Many countries and regions have meteorological conditions that favour the use of wind energy and mini-hydro, two technologies of great promise. Unfortunately, the economics of commercially available designs in these areas is not yet sufficiently attractive to scale up this technology.

STEPS TOWARDS AN ENERGY TRANSITION

The first step in initiating the energy transition is to introduce technologies and systems that are less wasteful of energy. Many such solutions already exist and are technically and economically quite simple and straightforward to introduce. Measures to conserve energy range from technical interventions to reduce frictional losses (First Law of Thermodynamics), all the way to matching the quality of energy to the types of use to which it is put (Second Law efficiencies). Much of the technology needed to achieve this step is already available but policies and fiscal incentives will be needed to accelerate the process.

The second step is reduce our dependence on fossil fuels and nuclear energy, use of which are the major causes of today’s threats to sustainability: both as resources and as sinks for the

waste products. It would appear obvious that we have now to switch to other, more accessible, more benign and more sustainable forms of energy: energy that, if used wisely and carefully, does not get exhausted: renewable energy. While renewable energy is not without its environmental problems, it does offer numerous advantages over fossil fuels. The greater use of renewable energy will require quite fundamental changes in fiscal and technological policies, pricing systems, subsidies, procurement procedures, and other factors. It will also require significant investments in R&D, marketing systems and infrastructure involving actors in government, corporations and the research community.

The third step, with deeper societal impact and more difficult to introduce, is to redesign production systems, infrastructures, habitats and other institutional frameworks to make them more energy conserving. Huge savings of energy are possible by transforming industrial processes, designing cities and transportation systems and substituting communication for physical movement. However, these involve massive investments in infrastructure and in creating new patterns of living and work. They require the involvement of large institutions, including governments, construction agencies and all sectors of society.

And the fourth step, with the deepest and longest lasting impact is changes in lifestyles, in the concepts of consumption and production, and in the understanding of individual and social purpose. Given the market and other forces at work, such a transition will not be easy to achieve and will involve all actors in society from the individual and the community, through the institutions of learning and faith to the machineries of global governance.

INTERVENTIONS FOR SUSTAINABLE ENERGY

- Real energy savings can only come from rational energy policies that not only promote energy efficient and renewable energy based technologies, but also introduce energy pricing based on real resource cost. To achieve this, various taxes and fiscal measures are available and are well known.

- The most important action required is to remove the “perverse” subsidies with which governments and international agencies support the use of unsustainable energy systems. A recent study of the Earth Council and the International Institute of Sustainable Development shows that in the field of energy alone, these subsidies total close to 500 Billion dollars. In the face of such price distortions, it is difficult for any competing technology, such as renewable energy, ever to take off.

- Governments, with the encouragement of international investors, should actively seek to develop decentralized solutions to the energy needs of rural or remote communities. Local power production based on local, renewable energy sources offers great promise and should be explored much more actively than in the past.

- Governments and international agencies should greatly increase the R&D funds available for innovations in both renewable technologies and the delivery systems needed to make them available on a large scale

- Public procurement at the local, national and global level is a powerful instrument to promote and bring down the cost of new technologies such as renewable energy and governments, international agencies and others should use this instrument much more effectively for improving the availability of sustainable energy technologies.

- Promotion of sustainable energy solutions must be done within the broader context of generating sustainable livelihoods on a large scale.