

Global Warming, by Ashok Khosla

Global warming is a trans-boundary problem; it has to be dealt with by the international community working together. Despite growing scientific evidence that our present patterns of consumption and production are leading to massive disruption of the planet's life support systems, particularly of our climate and our living resources, most governments continue to hide their respective heads in the sand.

The rapidly changing environment forces us to take a two-pronged approach: to *mitigate* climate change by dealing with its causes and to *adapt* to the change that will now inevitably take place, no matter how successful our mitigation measures are. It is perhaps not surprising that any good strategy for coping with change and disasters is not very different from that for preventing it in the first place. Adaptation, then, requires much the same types of action, as does mitigation – because both depend on the adoption of sustainable development trajectories. The motivation may be different but the action required is often, and largely, similar.

The trouble is that world is run by powerful people (and countries) who don't like to give up their interests, much less what they already have. The most-talked about Kyoto Protocol turns out to be a fundamentally flawed treaty. It basically says that every country will have to reduce its emission of carbon dioxide (which means of energy consumption) by an equal proportion from what they were doing in 1990. The developing countries, including India were exempted when the treaty was initially signed, but they are now under pressure to sign on as well. Which means that the ones that had higher emissions in 1990 will continue to have the right to put out higher emissions at the end of the treaty's validity period, 2012. Despite the fact that they were one of the ones whose historical emissions over the past two centuries are the cause of the problem in the first place. Is that just?

Countries like India wanted a fairer approach. So while they are of course parties to the more general United Nations Framework Convention on Climate Change, they have insisted on a change in the terms of the specific provisions of the Kyoto Protocol to put the onus on all countries to converge to a level of emission that the planet can tolerate. Some countries are big and others are small: the aggregate measurement of carbon emission at the country level is misleading, it should be based on per capita emission.

By the year 2050, if things continue the way they are and if we don't have any major catastrophes in the meantime, the Earth will have some 8 to 9 billion people. Each of those nine billion human beings will presumably be living in a world that believes in democracy and social justice; so each one of these nine billion people will demand the right to use the same amount of energy as everyone else. Multiplying nine billion by the amount of energy an average American consumes today, anyone can see that this is not a pathway to planetary survival.

Most governments drive into the future with only the rearview mirror to guide them. Despite growing scientific evidence that our present patterns of consumption and production are leading to massive disruption of the planet's life support systems - particularly its climate and living resources – the momentum of our economies seems only to grow. International treaties have been negotiated to slow this headlong race to self-destruction, but the foot on the accelerator pedal continues to press harder than the one on the brake; the biggest polluters are still the biggest defaulters. The geo-political reality is that nobody is going to give up their lifestyles overnight unless nature forces him or her to do through some catastrophe. Unfortunately, it will need a whole succession of Hurricane Katrinas to bring about change.

What they should have been actually negotiating was what is now being called as the contraction and convergence: set a limit to which everyone has to converge. People who are consuming too much should come down; people who are using too little should go up. Equity offers the only solution that can be acceptable in the long run. A viable future depends on widespread recognition that everyone in the world should be entitled to the same environmental space – in this case quantity of carbon emitted. This can only be achieved if the emissions in the industrialized countries are contracted and the emissions in the developing ones are allowed to rise so that both converge to a limit that is below the threshold above which climate change becomes unacceptable.

This becomes all the more important in a world where both population and economic activity can be expected to grow for a long time to come – probably for as long as we continue to have the inequities that characterize the world today. As we hit against the limits set by nature's finite resources, we will find it more and more essential to save, reuse, recycle our resources and simplify our lives.

But this is not a popular insight, either among the affluent whose basic needs are already met or among the poor who do not see why they should be deprived of the things the affluent already have.

India:

India is going to use a lot more energy. Its energy sources willy-nilly are either non-renewable carbon from very dirty coal or from renewable biomass (plant and animal based fuels of which India has plenty). In the future, we can also hope for electricity from sun, wind and hydro. So we have to switch to energy sources like these. Biomass at the moment is the only source that is really commercially successful. Wind is becoming commercially successful. And sun will also become viable in due course.

Climate change and biodiversity loss will cause human suffering and damage in developing countries that will far exceed their impacts on industrialised ones. Global environmental change is very much a developing country problem and its urgency has to be fully recognised by them.

As a result we need to be investing much larger amount of resources into development, research, and commercialization, to make them competitive. By and large they are carbon neutral, and their large-scale use can have a very significant effect in reduction of carbon emission. And also make money out of this process because in order to reduce their carbon footprints, developed countries can buy some of it from us; CERs and CDM projects. Both these are good ways for us to earn money. So the idea is not reduction of consumption of energy for our people but delivering energy to them in a sustainable fashion, and by doing things more efficiently.

India is actually quite far ahead of almost all the countries in this area. Indian business is pretty smart; they have figured it out very well. Many of them had never heard the word renewable energy but now are heavily into it, getting their core into this idea. That's a pretty good thing.

But ultimately much of India's energy reduction will have to be by better design of our development processes. Our energy systems, our industry, our agriculture and our infrastructure. Our cities cause unnecessary waste of energy for faulty zoning of activities, inefficient transportation systems and poor choice of technology. Many of our urban systems are predicated on highly personalized and centralized approaches. Whether it is cars, or lighting, or air-conditioning we are using completely wrong systems, even by today's science.

The questions are: how do we redesign our industry, transportation and agriculture so that they emit less carbon dioxide into the atmosphere and at the same time to make them less vulnerable to the climate changes that will inevitably take place? The name of this game is "resilience". Making human activities more resilient takes proactive thinking and advance planning. Industrial processes have to be made less dependent on resources that will be adversely impacted by the external changes that are taking place. Agriculture, including the choice of crops and cropping patterns, has to be redesigned to be resistant to droughts, floods, pests. Transportation and power generation have to make greater use of renewables.

I think the future of India lies in what we call "Biomimicry". This means learning from nature and using the techniques it has perfected over the eons of time it has had at its disposal. Over five billion years of careful and rigorous experimentation, Nature has evolved many very useful technologies that work. Those that did not work were recalled long back. Many of these technologies do exactly what we need. Instead of building huge, expensive and energy-guzzling mechanical water treatment plants of the type every one of cities wants, purification of water can be done by wetlands and by forests for free.

Instead of putting heavy, energy-consuming air conditioning systems in our buildings, we can learn from termites and zebras, both of which, over millions of years of trial and error, have mastered temperature control to perfection. Here is an excellent example of biomimicry. Termites, which are little ant-like creatures that live in nests that look like little hills have developed an architecture that enables them to control quite precisely the

temperature inside their homes. No matter what the outside temperature is, inside the termite hill the temperature is always within a degree or two of 24 degree Celsius. How do they do it? They don't have any air-conditioners and fans. They don't have any radiation heaters. They figured out ways in which you get forced ventilation inside nests using the coolness of the earth to keep the temperature steady. Our buildings can be built using the same principles. And you know what? Much of this knowledge was recorded in the Vastu Shilpas. In our pursuit of "modern" technology, aping the West, we have lost our own well founded solutions that were developed over the millennia. The traditional knowledge of India has much of value and we have to rediscover it.

Do you know why the zebra has black strips alternating with its white strips/ Because it's a natural, built-in air-conditioner. The black strip on Zebra has an extra half inch of fat under the skin. The whole thing is set up so that the air circulates by convection, and this keeps the animal cool. The same principle can be applied on a large scale to buildings. In Harare, the capital of Zimbabwe and more recently in Tokyo, architects have actually built buildings based on termite and Zebra principles. The air conditioning costs are zero. The comfort levels are high. We need to do many more such things.

In rural India our organization, Development Alternatives, does a lot of mud structures that saves huge amount of materials and energy. We have large number of building technologies that are energy saving. We actually developed a brick-kiln that saves 55 percent of energy compared to existing brick-kiln. That's a lot considering that 4 percent of India's energy goes into making bricks.

Beyond the vast physical and biological resources that India has, we have a vast base of traditional knowledge that gives us an inherent advantage. Traditional Indian architecture; manufacturing and agriculture that consume far less energy and produce fewer wastes. Given this knowledge, it should be easy for our country to reject agriculture and food processing practices that use huge amounts of energy and chemicals to produce foods for sale in supermarkets.

To get one calorie of food energy out, the modern agriculture practices require 100 (and sometimes as much as 500) calories worth of energy for growing, transporting, processing and packaging. By the time this carton of juice reaches my table, four, maybe five hundred calories worth of energy is spent to give me each calorie of food energy. This is clearly unsustainable.

CEOs of big multinational companies would like to set up a big factory, bring in the raw materials from all over the countryside, process them in one place and transport the products out, all over the country. This makes financial sense only because there are huge subsidies that camouflage the costs of all this to-ing and fro-ing. Energy is subsidized, roads are paid for, wastes and pollution are dumped into the surroundings and the company does not have to pay the costs of any of these. The consumers don't have to pay for littering the environment with all the junk that is thrown away, the packages, wastes. The reason is simply that the actors are all getting the wrong

economic signals. The reason for this is that we have under priced resources, particularly water and energy.

The biggest problem that has not yet fully come onto the environmentalists' radar screens is materials. Leaving aside the ocean currents, the amount of material that is physically moved in the biosphere today is comparable to the amount that geological processes move. This means massive disruption of natural processes and cycles, such as the carbon cycle, nitrogen cycle; water flows and natural drainage. When we wear a gold ring, which would weigh something like, let us say, twenty grams, the amount of material moved to make it is twenty tonnes. That is mindless. We could understand having done such things when we did not know about it. Now that we do know, we no longer have an excuse.

These environmental issues are almost as big as climate change, which itself is one of the greatest challenges faced by humankind. They, together with climate change, are indications that our unthinking exploitation of nature is destroying the life support systems and everyone, including ourselves, will have to pay a very big price for it.

We need good science to get out of this mess. And the good science will come from a new way to look at the world, such as adopting bio mimicry and learning from nature. As far as I can see, the technology of the future is going to substitute small creatures -- microbes, bacteria, algae, fungi, plants, animals and the other things that nature provides -- for the gears, wheels, pulleys, levers, high temperatures, large pressures, and huge turbines that we employ today to do our work.

Our rivers have gone, without which we cannot ensure that everyone has the water they need. Our forests are going without which our water systems are not able to regenerate themselves. Our soils are disappearing rapidly, without which our agriculture will get less and less productive. That's where there is a need of a real action. Everything will be retrieved in due course, but the question is whether it is possible in our life span. Good science can certainly help bring back the health of the environment, but not if all of us together don't make a serious effort to achieve this. But let's be clear we can't do it with business as usual.

Government has a role to play here. Use of force and regulations are of little help. They are usually not the best ways because a few people will buy, cheat and bribe their way to get unfair advantage, so that makes these interventions on the part of government not an optimal solution. The best way is to ensure that the pricing signals indicate accurately what the real cost of doing something is -- that the total cost to be paid includes the cost to nature, cost to future generations for not having that option, and so on. I would say it is better both from the economic and social point of view for these signals to be given, mainly as a result of government policy, not by fiat but by fiscal measures such as taxes, incentives, rebates and public procurement. By internalizing the total cost, the biggest costs that are usually missed, such as pollution, social deprivation and resource depletion can become part of the decision process.