Science & Technology
Deccan Herald, Tuesday, February 18, 2003

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A breath of clean air

CLIMATE/ Extensive afforestation, shift towards cleaner technologies and conservation of soil and water could go a long way in reducing atmospheric greenhouse gas emissions

Recently in Delhi, Dr Sherwood Rowland, who was the first to warn of the Ozone hole in the Earth's atmosphere and its damaging effects and who shared the 1995 Nobel prize in atmospheric Chemistry with Mario Molina and Paul Crutzen, lucidly highlighted the complexities in the entire Climate Change(CC) debate not through complicated calculations, but through something we all know quite well - the good old cow.

Dr Rowland was disturbed about a newspaper article mentioning an industry using an additive in the grain fodder it sold to Africa which, it said, reduced the methane cows emitted through their dung, thus claiming 'carbon credits' through the exchange system set up under the UN's Kyoto Protocol, whereby greenhouse-gas curbing industries receive various benefits.

"How does one fix the rate of credit for methane emissions?", asked Dr Rowland of the entire panel of CC experts assembled at the Delhi Sustainable Development Summit, hosted by Tata Energy Research Institute. No one knew. All agreed though, that methane was a stronger greenhouse gas than carbon

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dioxide even though its staying power in the atmosphere was shorter (about ten years).

That's exactly how cloudy the entire question of reducing greenhouse gases is at the moment. No one knows for instance how much methane will be emitted in coming years; in fact no one knows the future evolution of forces that drive global warming, from population change, economic development to energy systems and land-use patterns, says Dr Nebojsa Nakicenovic of Austria's Institute for Applied Systems Analysis.

The IPCC (Intergovernmental Panel on Climate Change) predicts an increase of anywhere from 1.4 °C to 5.8°C in the average global temperature by 2100. The uncertainty in predicting accurately, evident by the high margin, is because it is not known how sensitive the climate will be to increasing concentrations of greenhouse gases and also because of the uncertainty of future emission paths themselves.

Climate Change, resulting from human activities, has three basic atmospheric phenomena: statrospheric ozone depletion, photochemical smog and global warming. Chlorofluorocarbons (CFCs), released mainly through refrigerators and aerosols photolyze in the mid-stratosphere to release highly reactive chlorine and bromine atoms which then initiate long chain reactions that remove stratospheric ozone.

Ozone-depletion, which allows the penetration of harmful ultraviolet sun's rays into Earth, also happens through biomass burning. Though the UN's Montreal Protocol has fairly effectively banned CFC production, Dr Sherwood Rowland speaks of dramatically visible ozone-rich cloudy plumes seen from NASA aircraft over the central Pacific, caused by the combustion of agricultural wastes and forests thousands of miles away in southern Africa.
The second factor of CC is smog, which is the photochemical formation of ozone in the lower atmosphere through release of burnable carbons and nitrogen oxides mainly from vehicular traffic, and its mixing with ultraviolet, abundant in sunlight in tropical latitudes.
In the late 1800s(most atmospheric measurements began only in the mid 1800s) ozone-concentrations at ground level were 10 parts per billion by volume (ppbv); now they are 50 -100ppbv at summertime in the northern hemisphere. As vehicular traffic increases, ozone levels are now spreading through whole latitudinal zones and happening through other human combustion activity too. In Mexico City and Santiago for instance, the most abundant hydrocarbons recorded are from cooking LPG!

Art & Culture

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THOUGHT FOR THE DAY

"To govern is to choose."

Duc de Levis

Greenhouse gases (GHG) carbon dioxide(CO_2), methane (CH_4), nitrous oxide(N_2O) occur naturally in the Earth's atmosphere, warming its surface by a global average of 32°C. The earth intercepts daily an amount of energy from the sun, much of it in the visible spectrum from red to violet, the rest from ultraviolet and nearby infrared. An equal amount of energy escapes daily from earth to maintain a balance (otherwise the earth would become very cold if all the radiation escaped from it).

GHGs in the atmosphere intercept some of this far infrared radiation, while earth naturally emits more infrared needed to make up for the shortfall from the absorption by the GHGs and to maintain its average surface temperatures. But as GHG concentrations increased rapidly in the last century and newer ones (CFCs) were added, they absorbed more of the earth's infrared, which in turn has required an increase in earth's temperatures, resulting in global warming. Global surface temperatures increased by about 0.6°C during the 20th century, half of this during the last quarter alone. 1998 was the warmest year since the recording first took place in 1860. Correspondingly, CO_2 has increased from 280 parts per million by volume (ppmv) in the 19th Century to 315ppmv in 1958 to 373ppmv now. Methane increased from about 0.70ppmv in the early 1800s to 1.52ppmv in 1978 to 1.78 ppmv currently. Nitrous oxide in turn increased by about 13% in the 20th century.

Even more ominous is what Prof. Rowland says, "Temperatures will continue to change as long as mankind continues to do what it is now doing."
Obviously we need to put a cap to further GHG emissions. To achieve stabilisation of GHG, the UN Framework Convention on Climate Change (UNFCC) says CO_2 must decline to at least one-third present levels by the end of this century. But to look beyond this century to get back where we were once, GHG emissions must eventually come down to zero. How that is going to happen is beyond the comprehension of anyone right now.

The IPCC says innovative technology is important to work towards stabilisation levels. Energy-related technology involving efficiency improvement, decarbonisation of fossil energy, carbon capture and storage (over thousands of years!) and a shift towards less carbon intensive energy as well as afforestation are measures to be adopted.

That's easier said than done, at least for developing countries without help from others. Advanced GHG-reducing technology is costly, replacement is slow, and 'improvement research' for existing technology is uncertain. India till now has no

clear policy on climate change technology.

That doesn't stop the doing of what urgently needs to get done : extensive afforestation, whether government or private, to serve as carbon sinks, shift towards cleaner technologies especially in the oil and energy sector, conservation of soil and water which indirectly alleviates CC by staving off drought amongst other benefits, and that most vital of phenomena: the participation of the community.

Climate Change might be a global atmospheric phenomenon but it has starkly local effects for India. Most visible are floods, droughts, desertification of land and polluted air and water sources both depleted and polluted.

Keya Acharya