

Ozone layer depletion: The threat mounts



MD. ASADULLAH KHAN

THE Earth's atmosphere is divided into several layers. The lowest region, the troposphere, extends from the Earth's surface up to about 10 kilometers (km) in altitude. Virtually all human activities occur in the troposphere. Mt. Everest, the tallest mountain on the planet, is only about 9 km high. The next layer, the stratosphere, continues from 10 km to about 50 km. Most commercial airline traffic occurs in the lower part of the stratosphere.

Most atmospheric ozone is concentrated in a layer in the stratosphere, about 15-30 kilometers above the Earth's surface. Ozone is a molecule containing three oxygen atoms. It is blue in colour and has a strong odour. Normal oxygen, which we breathe, has two oxygen atoms and is colourless and odourless. Ozone is much less common than normal oxygen. Out of each 10 million air molecules, about 2 million are normal oxygen, but only 3 are ozone.

Laboratory and epidemiological studies demonstrate that Ultra Violet-B (UV-B) causes non-melanoma skin cancer and plays a major role in malignant melanoma development.

In addition, UV-B has been linked to cataracts. All sunlight contains some UV-B, even with normal ozone levels. It is always important to limit exposure to the sun. However, ozone depletion will increase the amount of UV-B, which will then increase the risk of health effects. Furthermore, UV-B harms some crops, plastics and other materials, and certain types of marine life. Higher air temperatures also increase the concentration of ozone at ground level. The natural layer of ozone in the upper atmosphere blocks harmful ultraviolet radiation from reaching the earth's surface; but in the lower atmosphere ozone is a harmful pollutant. It damages lung tissue and causes particular problems for people with asthma and other lung diseases.

Shockingly, the incidence of skin cancer in the United States has reached epidemic proportions. Health experts predict that one in five Americans will develop skin cancer in their lifetime. Excess UV radiation may also affect the body's general ability to fight off disease. Says immunologist Margaret Kripke M.D. of the Anderson Cancer Centre in Houston, "We already know that ultraviolet light can impair immunity to infectious diseases in animals. We know that there are immunological effects in humans, though we don't yet know their significance". One impending tragedy is the possible blinding of almost all non-nocturnal animals and insects outside the darkest jungle. While humans can certainly protect their eyes, most other forms of life can't.

However, even the small amount of ozone plays a key role in the atmosphere. The ozone layer absorbs a portion of the radiation from the sun, preventing it from reaching the

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planet's surface. Most importantly, it absorbs the portion of ultraviolet light called UV-B.

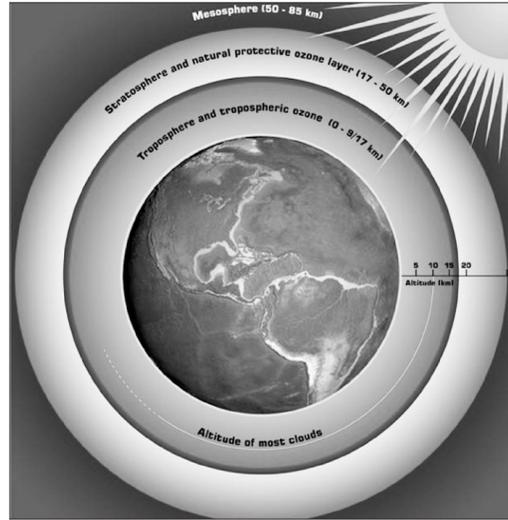
At any given time, ozone molecules are constantly formed and destroyed in the stratosphere. The total amount, however, remains relatively stable. While ozone concentrations vary naturally with sunspots, the seasons, and latitude, these processes are well understood and predictable. Scientists have established records spanning several decades that detail normal ozone levels during these natural cycles. Each natural reduction in ozone levels has been followed by a recovery. Recently, however, convincing scientific evidence has shown that the ozone shield is being depleted well beyond changes due to natural processes.

For over 50 years, chlorofluorocarbons - CFCs (compounds containing Chlorine, Fluorine and Carbon) were thought of as miracle substances. They are stable, non-flammable, low in toxicity, and inexpensive to produce. Over time, CFCs found uses as refrigerants, solvents, foam blowing agents, and in other smaller applications. Other chlorine-containing compounds include methyl chloroform, a solvent and carbon tetrachloride, an industrial chemical, or bromine. When they break down, they damage the protective ozone layer.

In the early 1970s, researchers began to investigate the effects of

various chemicals on the ozone layer, particularly CFCs, which contain chlorine. They also examined the potential impacts of other chlorine sources. Chlorine from swimming pools, industrial plants, sea salt, and volcanoes does not reach the stratosphere. Chlorine compounds from these sources readily combine with

water and repeated measurements show that they rain out of the troposphere very quickly. In contrast, CFCs are very stable and do not dissolve in rain. Thus, there are no natural processes that remove the CFCs from the lower atmosphere. Over time, winds drive the CFCs into the stratosphere.



The CFCs are so stable that only exposure to strong UV radiation breaks them down. When that happens, the CFC molecule releases atomic chlorine which is highly active. One chlorine atom can destroy over 100,000 ozone molecules. The net effect is to destroy ozone faster than it is naturally created.

Large fires and certain types of marine life produce one stable form of chlorine that does reach the stratosphere. However, numerous experiments have shown that CFCs and other widely-used chemicals produce roughly 85 percent of the chlorine in the stratosphere, while natural sources contribute only 15 percent. Large volcanic eruptions can have an indirect effect on ozone levels.

One example of ozone depletion is the annual ozone "hole" over Antarctica that has occurred during the Antarctic Spring since the early 1980s. Rather than being a literal hole through the layer, the ozone hole is a large area of the stratosphere with extremely low amounts of ozone. Ozone levels fall by over 60 percent during the worst years.

In addition, research has shown that ozone depletion occurs over the latitudes that include North America, Europe, Asia, and much of Africa, Australia, and South America. Over the U.S., ozone levels have fallen 5-10 percent, depending on the season. Thus, ozone depletion is a global issue and not just a problem at the South Pole.

Reductions in ozone levels will

lead to higher levels of UV-B reaching the Earth's surface. The sun's output of UV-B does not change; rather, less ozone means less protection, and hence more UV-B. Studies have shown that in the Antarctic, the amount of UV-B measured at the surface can double during the annual ozone hole.

Just as worrisome is the threat to world's food supply. High doses of UV radiation can reduce the yield of basic crops such as soybeans. UV-B penetrates scores of metres below the surface of oceans. There the radiation can kill phytoplankton (one celled plants) and Krill (tiny shrimp like animals) which are at the bottom of the ocean food chain. Since these organisms form in greatest concentrations in Antarctic waters and nourish larger fish, the ultimate consumers - humans - may face a maritime food shortage.

Let us think for a moment about the world's one billion refrigerators, hundreds of millions of air conditioners, mountains of foam insulation, seat cushions, furniture stuffing and carpet padding, streams of cleaning fluids, rivers of industrial solvents, wafting clouds of aerosol spray, all of them setting free the CFCs that destroy the ozone layer.

Ridding the world of the millions of tons of ozone depleting chemicals is a huge, costly and complex task requiring unprecedented international cooperation. Since Du Pont began marketing the miracle refrigerant called Freon, CFCs have worked their way deep into the machinery of what much of the world thinks as modern life. Extricating the planet from the chemical burden of that high-tech lifestyle will require not only technical ingenuity but extraordinary leadership qualities.

The technical challenge is to find substances and processes that can replace CFC-based systems without doing further harm to the stratosphere. Happily, that endeavour has worked. In fact, it has turned out to be much easier than anyone expected. Except for medical aerosols, some fire-fighting equipment and certain metal cleaning applications there are now effective substitutes for virtually every ozone-depleting chemical. Assuringly, in a surprising number of cases, the new processes are actually cheaper and better than the old.

But the harm or danger is lurking in somewhere else and so replacing CFCs in newly built equipment, however, is only half the job. Virtually every existing refrigerator and air conditioner is a CFC reservoir. The chemicals are not a problem as long as they continue to circulate within an appliance. But if the machine is carelessly drained, junked or damaged, the CFCs can escape to attack the ozone. The real task for those countries that invested heavily in CFCs in the past is to develop systems for recovering and recycling the chemicals they have already used. Undoubtedly true, the US, Europe and other industrialised countries bear direct responsibility for most of the damage that has been done and they can best afford the costs attached to switching technologies. But what about the countries of the Second and Third World? Many of them are just beginning to enjoy the comforts of CFC technology, and they cannot easily go for a change-over.

Md. Asadullah Khan is a former teacher of physics and Controller of Examinations, BUET.

Promoting eco-tourism in the Sundarbans

MOHAMMAD ASRAFUR RAHMAN

MANGROVE is a peculiar type of ecosystem in the inter-tidal region. Because of its interesting environmental conditions, it offers a wide range of outdoor recreational opportunities. Naturally, mangroves can attract a large number of tourists and be a source of earning through national and overseas tourism. In many countries, tourism in the mangrove environment has been developed. Revenue earned through eco-tourism from one hectare in a wildlife sanctuary in Kenya, exceeds many times the most optimistic projected return from agriculture. There is also evidence that the economic benefits

derived from forest-based eco-tourism surpass the revenue earned from timber harvesting. It is important to note that preservation of forests, specially mangroves can be compatible to tourism if well planned.

Eco-tourism is a sustainable form of land use, which contributes to environmental conservation, while providing accrued socio-economic benefits to the indigenous people through the non-consumptive uses and indirect values of the natural biological resources. Considering the vulnerable nature of our environment eco-tourism should be encouraged. Eco-tourism must be based on the following principles: (i) optimum multiple use of the resources; (ii) maximum sustainable use; and

The Sundarbans represents a charming mystery. It is home of the Royal Bengal Tiger. It provides a peaceful and relaxing refuge from the population density of Bangladesh. Every year innumerable people visit this unique forest. But most of them do not have any sound knowledge about eco-tourism. Their actions often harm the environment in many different ways. The development of eco-tourism in the Sundarbans should be given top priority both by the Forest Department and the Sundarbans Biodiversity Conservation Project.

(iii) conservation and development of natural resources. Obviously, tourist products should be used in such a way that they are not destroyed. Tourists, who mindfully or without caring litter the spots leftovers cause damage to the local environment and eventually the earth.

One way to handle such problems is to regulate tourists visits to

each place. Restrictions can be imposed on the number of tourists, and on how they undertake their visit, before a site becomes overcrowded. Without controls, it is obvious that the more tourists visit a place, the more its ecological balance may be threatened or degraded. However, we do not restrict tourism. If we can apply the principles of sustainable development, tourism could be encouraged to grow. More forests could be declared as sanctuaries for tigers, deer, elephants and crocodiles to attract more tourists. There are good laws in Bangladesh to protect the environment but these are rarely enforced. The goal of eco-tourism development in Bangladesh should be to capture a portion of the enormous global tourism market by attracting visitors and using the revenues to fund local conservation and fuel economic development.

The Sundarbans is a unique ecosystem. Its exceptional scenic beauty and rich wildlife can be source of attraction to different levels of people and is convenient for outdoor recreation. Eco-tourism may be developed without causing damage to vegetation and wildlife. Because of weather condition tourism may be limited to winter months when the climate is favourable. The only way to visit the Sundarbans is by water transport.

Adequate water transport and accommodation facilities inside the forests are to be created to attract local and foreign tourists. In fact the recreational potentiality of the Sundarbans has never been utilized. Facilities needed for the tourists have not been developed. There is immense potentiality of the Sundarbans for earning through tourism. Eco tourism spots in this World Heritage site can easily attract the tourist from everywhere. Some of these sites are as following:

Katka is an eye catching and quiet island located in the north-west part of Sundarbans. Katka is an excellent and favourable spot, where visitors can enjoy bird watching, wildlife especially Royal Bengal Tiger and deer, roaming around by country boat through small creeks and canals and also by walking through the forest. One can also enjoy swimming and sun bathing at Katka's desolate white sand beach.

Kachikhali is a roaming and breeding ground for the Royal Bengal Tiger and is also known as "Tiger Point". There is a Forest Department resort, which is used by the tourists. Visitors spend their time by walking around the tiger point, Katka-Kachikhali beach and visiting the Egg Island or Dimer Char, a small island close to Kachikhali.

Nilkamal is a beautiful place along the Bay of Bengal. The World

Heritage plaque was unveiled at Hiron Point of Nilkamal. The combined beauty of sea and green mangroves Nilkamal must attract visitors from the watchtower of Keorasuthi another attractive spot there. Thousands of spotted deer, birds and sometimes a Royal Bengal Tiger can be seen from the tower.

Dublar Char is an island famous for drying fish during the month of November-February in the winter season. This place is also famous for religious festival of Hindu community popularly known as "Rashmela" that takes place at the end of November. Visitors come here to see the life of fisherman and their unique fish drying. These dry fish or 'sutki' is exported to domestic and foreign markets as a delicacy.

The Sundarbans comprises 45 percent of the total productive forest of the country, contributing about one-half of the forest related revenue. About 50 to 60 thousand people work regularly and continuously for about six months, while the number of people entering the forest in a year can be as high as 3.5 million for minor forest product collection and fishing. Of these about 25 thousand work for fish drying, 200 thousand get engaged in shrimp fry collection in the rivers and creeks around the Sundarbans. About 2.5 million people live in the villages surrounding the Sundarbans, while the number of people within 20km of the



this largest mangrove forest. The Sundarbans represents a charming mystery. It is home of the Royal Bengal Tiger. It provides a peaceful and relaxing refuge from the population density of Bangladesh. Every year innumerable people visit this unique forest. But most of them do not have any sound knowledge about eco-tourism. Their actions often harm the environment in many different ways. Sound pollution is one of them. Many visitors like to enjoy music very loudly, which can be upsetting to the quiet and serene environment. The development of eco-tourism in the Sundarbans should be given top priority both by the Forest Department and the Sundarbans Biodiversity Conservation Project.

Mohammad Asrafur Rahman is with the Institute of Forestry and Environmental Sciences, Chittagong University.



Sustainable energy: Highway to environment-friendly development

MD. MAHFUJUR RAHMAN

SUSTAINABLE energy is closely related to sustainable development; it is not exactly possible to make the development process sustainable unless the energy production, distribution and utilization are ensured to be sustainable. In fact, the notion of sustainable energy had been derived from the concept of sustainable development. Utilisation of energy is very vital for development. The developed world utilises much more energy than the developing countries. The least amount of gross energy is used by the third world poor countries. The utilisation of more energy is positively correlated with the economic growth. Thus energy harnessing and utilization is a good indicator of development. But when energy use surpasses the sustainable level, the development will not sustain, it will collapse.

Sustainable energy in brief is a shift to cleaner energy sources that is harnessing most energy from renewable sources ensuring no or least pollution from energy industries. Sustainability has three characteristics:

- Durability of development i.e. development will not collapse
- Economic opportunity for future generation will not be hindered
- Development of an area will not harm people outside the area

Features:

- Ensures health safety of workers in the energy industry and consumers of commercial energy
- Minimizes the pollution due to energy harnessing, distribution

and utilization

- More emphasis is given to renewable energy sources than conventional energy sources that are limited in stock. In fact it aims at complete shift to renewable energy sources
- Where we are bound to use fossil fuel try to increase the efficiency of energy conversion at every stage from harnessing of primary energy, to conversion to secondary energy, to energy distribution and utilization at consumer level.
- Less green house gas emission, less ozone layer depleting substance and minimal discharge of NOx, SOx are maintained.
- Socially acceptable energy sources indicate a part of humanity will not be affected by the production, distribution and utilisation of energy by another part.
- Sustainable energy is economically viable and able boost durable economic growth.

Indicators: Energy is essential for economic and social development and improved quality of life. However, much of the world's energy is currently produced and used in ways that may not be sustainable in the long term. In order to assess progress towards a sustainable energy future, energy indicators that can measure and monitor important changes will be needed, such as -

- Energy consumption per capita
- Indigenous energy production
- Net energy import dependence
- Life time of proven fossil fuel reserves
- Quantities of air pollutant emissions (SO2, NOx, particulates, CO, VOC)

Sustainable energy is an essential element for implementing sustainable development that gives people perpetual economic, social and environmental security. In practical field, sustainable energy implies efficient use of conventional fossil fuels ensuring the least pollution with a future plan of permanent shift to renewable energy sources. Yet there are various barriers to promote sustainable energy and there are also ways to overcome those.

- Quantities of greenhouse gas emissions
- Radio nuclides in atmospheric radioactive discharges
- Generation of solid waste
- Land area taken up by energy facilities and infrastructure
- Fraction of technically exploitable capability of hydropower currently in use
- Rate of deforestation
- End-use energy prices with and without tax/subsidy
- Energy supply efficiency: fossil fuel efficiency for electricity generation
- Expenditure on energy sector: total investment, environmental control, hydrocarbon
- Exploration and Development, RD&D, net energy import expenses
- Proven recoverable fossil fuel reserves
- Life time of proven fossil fuel reserves

Resolving energy crisis

An environmental scientist can find out better energy option in terms of environmental safety and economic benefits among tools and techniques to cope with the energy crisis and meet the growing energy demand in a sustainable manner.

Sustainable energy options

Solar PV systems: Studies for solar resource assessment in Bangladesh

under the Solar and Wind Energy Resources Assessment (SWERA) project show availability of good annual global horizontal radiation levels all over the country, in the range from 4.1 to 4.5 kWh/m²/day. During the pre and post monsoon the country has high solar radiation. The highest radiation occurs during the hot dry period from March to May. In those rural areas which cannot be electrified by grid extensions, off grid centralised or single Solar Home Systems (SHS) for lighting 100,000 households through SHS by 2008 is quite feasible. 100,000 SHS would annually displace 18 million litres of kerosene. Since both kerosene and diesel are imported in Bangladesh, any reduction in their consumption would help reduce foreign exchange expenditure besides making the country that much more secure in terms of energy supply.

Solar Water Heating System (SWHS): Introduction of SWHS in health complexes, hospitals, hotels and industries should be a good option in Bangladesh to reduce its electricity demand from conventional sources and to lower the GHG emission. In Bangladesh there are now around 230 hospitals and 400 rural and urban Thana Health Complexes (THC), with an average of 30 beds per complex. Most of these use electricity for water heating. It has been found that around

1400 tons of GHG emission reduction is possible annually if 100 of these use SHWS. Similarly, hotels, textile industries, dairy farms and rest houses across the country have a good scope for GHG reduction through SWHS.

Micro-hydro power: According to a survey jointly made by BPDB and BWDB(1980s) to explore the feasibility of micro-hydro power in the country there are 19 prospective sites in the hilly area of Chittagong hill tracts which could generate electricity in the range of 4 to 64 KW. Recently LGED has explored the potential of mini and micro hydro power by their integration with irrigation and flood control projects. An initial estimation shows that Baman Chara Irrigation Project, Chittagong has the potential to generate electricity to the tune of 20 MW.

Wind energy: Different studies show that some inland locations and islands in the coastal part of Bangladesh have a fair potential of wind energy for electricity generation. Predictions at 50m height show that some selected areas in Kutubdia, St. Martin's, Sawndip, Hatya and Charfassion islands and some of the coastal areas like Kuakata have a fair potential with wind power density above 150 w/m².

Biomass energy: Biomass is completely renewable. Production of biomass reduces CO₂ in the atmosphere just as the opposite process of burning fossil fuel. As production of biomass is harmless to environment and Bangladesh has in a natural region of the earth where its primary production is satisfactory we should adopt economic and technological measures to utilise this source of energy. Improved stove and biogas plant are two major technologies by which we can utilise biomass energy efficiently and in more sustainable manner.

Natural gas: Though natural gas is not a renewable energy it is least harmful among fossil fuels. Most part of natural gas is CH₄ but upon burning produces CO₂ which is less severe green house gas than CH₄. We should promote all technologies regarding natural gas and reduce use of mineral oil from abroad. CNG conversion of petrol and diesel driven vehicles is a welcome move.

Nuclear fuel: Government of erstwhile Pakistan in 1961 took an initiative for setting up nuclear power plant by adopting "Roppor Nuclear Power Project". Different companies from USA, USSR, UK and Switzerland conducted a number of feasibility studies on the project. Later, a site for it was selected at

Roppor in Pabna. The executive committee of the National Economic Council approved the project for three different sizes on as many occasions - 70 MW in 1963, 140 MW in 1966, and 200 MW in 1969. But no physical progress of the project was observed before and after the independence except some reshuffle in policies.

What measures should we take?

Importance of technology: It is getting a common acceptance that though technological advancement is responsible for commencement of various types of pollution and environmental degradation to a significant extent, abatement of pollution thereby protection of environment is also possible through technological interventions, such as green technologies for fossil fuels: coal gasification, catalytic converter in automobile; energy efficiency: cogeneration, efficient technologies.

Redirecting public choice: People's choice has greater importance in environmental issues. Scientists may invent environment friendly techniques, industries can produce products with improved efficiency. But none of these can make people buy the environment friendly products. That depends solely on the knowledge, consciousness of the consumers and their responsibility to the environment. We have noticed how innovative invention, economically viable better technology dedicated for environment can fall against social choice in the case of 'improved stove'. So, if we want to promote sustainable energy we must try to redirect the social choice towards sustainable

development campaigning in favour of environment.

Economic aspect: Only technological advancement cannot promote sustainable energy since there are other barriers not less important that include policy barrier, market barrier and it we want to popularise renewable energy technologies they must be economically viable. Price of solar panels, wind generator, battery and other materials must be lowered through mass production. If the machinery required for the technological shift to renewables are produced locally with indigenous raw materials then it will be far more viable for general people since price will then obviously be lower than the imported ones.

Conclusion

Sustainable energy is an essential element for implementing sustainable development that gives people perpetual economic, social and environmental security. In practical field, sustainable energy implies efficient use of conventional fossil fuels ensuring the least pollution with a future plan of permanent shift to renewable energy sources. Yet there are various barriers to promote sustainable energy and there are also ways to overcome those. But we should start right now our journey to sustainable development through sustainable energy; otherwise, it will be too late to protect the people and the planet.

Md Mahfujur Rahman is an environment activist.