The perils of global warming

MD. ASADULLAH KHAN

IN recent times, freakish weather and environmental catastrophes have been increasing in every region of the world. Everyone is suddenly sensing that the Earth, the precious repository of life that we know of, is in danger.

The wanton exploitation of the Earth has continued despite the fact that scientists for more than two decades have warned that cars and factories are spewing enough gases into the atmosphere to heat the Earth in a greenhouse effect that could eventually produce disastrous climatic changes.

Carbon dioxide is released in large quantities when wood and such fossil fuels as coal, oil, and natural gas are burned. As society industrialized in the 1800s, coal-burning factories began releasing carbon dioxide faster than plants and oceans could absorb the gas.

In the early 1800s, people began burning oil and gas at a prodigious rate. Increasing population led to widespread cutting of trees in less developed countries These trees are no longer available to soak up excess carbon dioxide and whether they are burned or left to rot, they instead release the gas.

Estimates by scientists convincingly suggest that by the late 1800s, atmospheric carbon dioxide had risen to between 280 and 290 parts per million. In 1989 it stood at 350 ppm and by 2050 it could reach 500 to700 ppm, higher than it has been in millions of years.

But carbon dioxide, once thought to be exclusively responsible for the greenhouse problem, is now known to cause only half the problem. The rest comes from other gases. Chlorofluoro carbons or CFCs are not only destroyers of the stratosphere's ozone layer, but powerful greenhouse gases as well. So are nitrogen oxides, which are pollutants spewed out of automobile exhausts and power plant smokestacks.

Another greenhouse gas is methane, the primary component of natural gas. Methane is also generated by bacteria living in the guts of cattle and termites, the muck of rice paddies, and the rotting garbage in landfills Each of these sources is fostered by human activities -- even the termites, which on the clearings left after the tropical rain forests are cut down. Human contribution to the greenhouse effect comes from so many basic activities that man cannot realistically stop the process, only slow it down.

The world now knows that the danger is shining through the sky. The evidence is now overwhelming that the Earth's stratospheric ozone layer, our shield against the sun's hazardous ultraviolet rays, is being eaten away by man-made chemicals far faster than any scientist had predicted. No longer is the threat just to our future, the threat is here and now.

The unprecedented assault on the planet's life support system could have horrendous long-term effects on human health, animal life, the plants that support the food chain and just about every other strand that makes up the delicate web of nature.

In 1992 NASA's orbiting satellite discovered record high concentration of chlorine monoxide (ClO), a chemical by-product of a group of man-made chemicals called chlorofluorocarbons (CFCs), were chief agents of ozone destruction.

Mounting evidence has demonstrated that under certain conditions these compounds set off chemical reactions that rapidly destroy ozone. Humans are altering the Earth's surface and changing the atmosphere at such a rate that we have become a competitor with natural forces that maintain our climate.

Indeed if the ozone layer diminishes over populated areas -- and there is ample evidence that it has begun to do so, although nowhere as dramatically as in the Antarctic -- the consequences could be dire. Ultraviolet radiation, a form of light invisible to the human eye causes sunburn and skin cancer. In addition it has been linked to cataracts and weakening of the immune system.

Melting iceberg -- rising sea level

Potentially more damaging than ozone depletion and far harder to control is the greenhouse effect caused in large part by carbon dioxide. The effect of carbon dioxide in the atmosphere is comparable to the glass of a greenhouse: it lets the warming rays of the sun in, but keeps excess heat from radiating back into space. Indeed, man-made contributions to the greenhouse effect, mainly carbon dioxide that is generated by the burning of fossil fuels, it is now widely believed, may be hastening a global warming trend that could raise average temperature between 2 degrees and 8 degrees by the year 2050

Even if it is a fact that region by region effects of rapid atmospheric warming are far from clear, scientists are still confident of the overall trend. In the next half century they fear dramatically altered weather patterns, major shifts of deserts and fertile regions, intensification of tropical storms, and a rise in sea level, caused mainly by the expansion of sea water as it warms up.

The arena in which such projected climatic warming will be first played out is the atmosphere, the ocean of gases that blankets the Earth. It is a remarkably thin membrane: if the Earth were the size of an orange, the atmosphere would be only as thick as its peel The bottom layer of the peel, the troposphere, is essentially where all global weather takes place; it extends from the Earth's surface to a height of ten miles. Because air warmed by the Earth's surface rises and colder air rushes down to replace it, the troposphere is constantly churning. A permanent air flow streams from the poles to the equator at low altitudes, and from the equator to the poles at higher levels. These swirling air masses distorted by the rotation of the Earth generate prevailing winds that drive weather across the hemispheres. Above this turmoil, the stratosphere extends up to about 30 miles. In the lower stratosphere, however, rising air that has been growing colder at gradually higher altitudes begins to turn warmer The reason can be attributed to ozone.

Ozone is a form of oxygen that rarely occurs naturally in the cool reaches of the troposphere. It is created when ordinary oxygen molecules are bombarded with solar ultraviolet rays, usually in the stratosphere. This radiation shatters the oxygen molecules, and some of the free oxygen atoms recombine with oxygen molecules to form O3 or ozone. This configuration gives it a property that two-atom oxygen does not have: it can efficiently absorb ultraviolet light. In doing so, ozone protects oxygen at lower altitudes from being broken up and keeps most of these harmful rays from penetrating to the Earth's surface.

The first effort to combat the greenhouse effect is to ban the use of CFCs which are used in refrigeration and air conditioning as coolants, as cleaning solvents in factories as blowing agents to create certain kinds of plastic foam, seat cushions, furniture stuffing and carpet padding. Some estimates say that there are about several billions of refrigerators and air conditioners now in use in the world. So ridding the world of the millions of tons of ozone-depleting chemicals is not just a big job, it may be the biggest job the nations of the world have ever taken on.

In the 60 years since Du Pont began marketing the miracle refrigerant it called freon, chlorofluorocarbons have worked their way deep into the machinery of what much of the world thinks of as modern life -- air conditioned homes and offices, climate-controlled shopping malls, refrigerated grocery stores and squeaky-clean computer chips.

CFC accumulation in the atmosphere

Extricating the planet from the chemical burden of that high-tech life style -- for both those who enjoy it and those who aspire to it -- will require not just technical ingenuity but extraordinary diplomatic skill. The goal is to find substances and processes that can replace CFC-based systems without doing further harm to the stratosphere -- an endeavour that is well under way. Except for medical aerosols, some fire-fighting equipment, and certain metal cleaning applications, there are now effective substitutes for every ozone-depleting chemical.

Another strategy is to burn as much methane as possible. This adds carbon dioxide to the air, but getting rid of methane is well worth it. Both gases trap heat, but as a greenhouse gas, methane traps 20 times as much heat as carbon dioxide. Methane from cattle feedlots will be difficult to collect, but the gas in garbage landfills is already being tapped and burned at many sites around the US.

In a certain landfill in New York City's Staten Island, for example, methane that could have escaped into the air is being collected by a gas company and used to heat thousands of homes. The technique involves driving a pipe into the depths of the garbage, and then trapping the gas that rushes out. This could be done at landfills in our country too The next most important step to counteract global warming is to slow, and more precisely, stop deforestation.

That being a daunting task, the most effective strategy should be to plant trees and plenty of them, to absorb carbon dioxide from the air. The planting can be encouraged at all levels of the society, from individuals putting an extra tree or two in the backyards to local communities and private organizations like NGOs and business houses planting an acre at a time and governments reforesting on a more widespread basis.

Unhappily, the country's forest resources are disappearing at an alarming rate. The official figures published in the recent past indicate that Bangladesh at the moment retains only 6 percent of its forest cover. In a survey concluded in the late 2000s, experts have predicted that at present rates, Bangladesh will lose all its forest resources in the next five years. The vast region of unbroken green that surrounds the Sunderbans and Chittagong hill-tracts has been under assault by several groups that include loggers, shrimp cultivators and environmental refugees.

Tree planting will have negligible impact, however, if people continue to pump carbon dioxide into the atmosphere at current rates. Realistically, wood and fossil fuel burning can never be eliminated, but they can be cut down significantly. This goal can be achieved through conservation. It is worth mentioning here that in the United States tax on CFCs helped to encourage the development of non-ozone depleting substitutes. Imposition of tax in Sweden on sulphurous diesel fuel helped the development of new and less polluting fuels. The carbon dioxide tax would be a powerful incentive for consumers to switch from high carbon dioxide fuels, such as coal and oil to power sources that produce less carbon dioxide, notably natural gas

To ward off the increasing catastrophic scenario, the world, and most importantly Bangladesh, must move away from fossil fuels for most of its energy needs. Of all the known non-fossil energy sources, only two have hit world attention. These are solar and nuclear, neither of which generates any greenhouse gases at all. Solar power is especially attractive. It produces no waste and it is inexhaustible. Not all solar power comes directly from the sun: both wind and hydro-electric power are solar, since wind is created by the sun's uneven warming of the atmosphere, and since the water that collects behind the dams was originally rain, which in turn was water vapour evaporated by solar heating.

Since wind and hydro-electric power can be generated at only a few sites, governments in all countries, including Bangladesh, have to increase financing for research to develop efficient, low-cost photovoltaic power. Photovoltaic cells which produce electric current when bathed in sun-light were in vogue during the energy crisis of the 70s.

Some time early in this century, solar enthusiasts hope to see vast tracts of photovoltaic collectors producing cheap electricity that can be transmitted over long distances. At the same time, this electricity could be used to produce hydrogen from water. That could open up vast possibilities. Cars, for example, could be redesigned to run on hydrogen that would produce dramatic reduction in carbon dioxide emission.

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Need for conservation biodiversity

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MAY 22 was the International Day for Biological Diversity. Each year it is observed to increase understanding and awareness of biodiversity issues. Biological diversity is defined as: Life on earth -- the variety of all plants, animals and microorganisms.

Observance of the day also marks the signing of the International Convention on Biological Diversity by 150 government leaders at the 1992 Earth Summit in Rio de Janeiro, Brazil, dedicated to promoting sustainable development. Thought as a practical tool for translating the principles of Agenda 21 into reality, the Convention recognised that biological diversity was about more than plants, animals and micro-organisms and their ecosystems. It is also about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live. Biodiversity is the source of the essential goods and ecological services that make up the source of life for all. The celebration each year of the International Day for Biological Diversity is an occasion to reflect on our responsibility to safeguard this precious heritage for future generations.

Sadly, the earth's biological foundation is now eroding at a rate unequalled in at least 65 million years. Globally, species have been disappearing at 50-100 times the natural rate. Based on current trends, an estimated 34,000 plant and 5,200 animal species -- including one in eight of the world's bird species -- face extinction. Only a fraction (1.6 million species) of the world's total number of about 30 million species, science has identified. Global warming is already changing habitats and the distribution of species, how much we don't know.

'Biodiversity: Life insurance for our changing world'

An added focus for 2005 is the Millennium Ecosystem Assessment. More than 1,300 scientists in 95 countries took the study into effect of human practice of the world's ecosystems. This five-year programme, pioneered by the UN Secretary-General, studied the correlation between ecosystems and human well-being. The report findings underline the gravity of biological diversity in providing concrete services on which human life depends, including all-important security and provisioning works.

Growing human populations and expanding consumption are placing great pressure on biological Diversity. This year's theme for Convention on Biological Diversity (CBD), reminds us that, by providing the physical conditions for all life, biodiversity also plays an important role in protecting life and making it resilient to the pressures brought about by change.

Bangladesh context

Excerpt from Biodiversity Conservation and Bangladesh by Ainun Nishat -- IUCN Bangladesh Country office -- states, it is the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Diversity in genes, species and ecosystems has contributed to the productivity of agriculture, forestry, fisheries, and industry. Wild species provide people with food, dyes, fibres, building materials, and medicinal plants, while home gardens and agricultural plots plant with distinct domesticated crop varieties.

Over the last 100 years, Bangladesh has lost about 10 percent of its mammalian fauna, 3 percent avifauna, and 4 percent reptile species. Altogether, 10 species of mammals, 2 species of birds and 1 species of reptile are nationally extinct.

IUCN Bangladesh has identified 58 species of fish, eight species of amphibians, 63 species of reptiles, 47 species of birds, and 43 species of mammals in the country threatened under different degree of risk of extinction. Illegal harvesting and export of medicinal plants and other economically valuable species such as reptiles and amphibians affect many ecosystems and habitats.

Over-fishing of commercial fish species in the riparian and coastal wetlands, as well as poaching and sport hunting of large mammals and birds are causing populations of many species to decline. With more than 130 million people and a population growth rate of 1.6 percent, the pressure on the nation's natural resources is intense.

Pollution of Bangladesh's soil, air, and water has escalated over the last two decades and makes up a significant threat to biological diversity.

Educating people and raising awareness of biological diversity and the need to conserve is important.

Global warming is already changing habitats and the distribution of species. Scientists warn that even a one-degree increase in the average global temperature, if it comes rapidly, will push many species over the brink. Disturbing biological diversity could seriously disrupt our food production.

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Opening a new dimension in rice cultivation

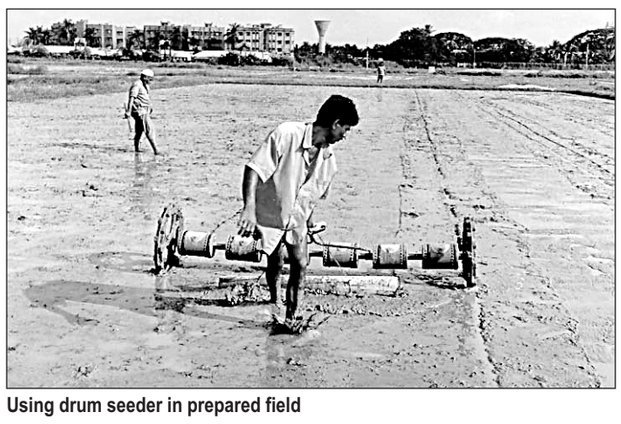
DR. MUSHERRAF HUSAIN

IN Bangladesh, rice is cultivated on around 10.5 million hectares of land. The country is now producing about 25 million tons of clean rice to feed her 140 million people. However, the population of Bangladesh with its present growth rate of 1.48 will approach 160 million in the year 2020. For that increased population the country will have to produce about 27.26 million tons of rice. The additional rice production has to come vertically via application of superior technologies and intensive management practices e.g. improved variety, better cultural practices, higher input use etc. since, agricultural land is being steadily shrinking due to urbanisation, industrialisation and infrastructure development. An estimate has shown that every day we are loosing about 220 hectares which is approximately 1 per cent per year of the total cultivable land. That means, we will have no cultivable land after 100 years if the situation remains unchanged.

Rice production system is undergoing changes due to progressive advancement in technologies and changes in the socio-economic conditions throughout the rice growing countries in Southeast Asia. With the advent of improved agricultural machinery coupled with shortage of farm labour, mechanisation is becoming inevitable and as such we must strive to take advantage of those.

Rice cultivation in Bangladesh is predominantly practiced in transplanting method which involves raising, uprooting and transplanting of seedlings. This is rather a resource and cost intensive method since, preparation of seedbed, raising of seedling and transplanting are labour and time intensive operations. Research reports show that labour involvement in these operations consume nearly one third of the total cost of production in Bangladesh. In addition, transplanting is not a health friendly method as the farmers are to bend their heaps and stoop while transplanting rice seedlings which cause often health hazard in the older age. The countries like Japan and Korea have shifted from conventional manual transplanting to machine transplanting because there is scarcity of labour in those countries. For such machine transplanting seedlings are grown in trays under green house condition.

In China, rice crop establishment is partially done following seedling throwing method which is also a time and labour saving method. In Southeast Asian countries like the Philippines, Malaysia, Vietnam and Thailand labour shortage has resulted into a shift from transplanting to either direct dry seeding or wet seeding of rice. Direct wet-seeding of rice establishment has mitigated labour scarcity and production costs. In fact, this method can reduce labour requirement as much as 80 per cent. Direct wet seeding via hand broadcasting has been found to give 10-15 per cent increased yield. Direct seeded crops also mature 10-20 days earlier than transplanted crops. Despite these advantages, this method has also the difficulties of weed control and other cultural management resulting in little or no adoption of the practice in Bangladesh. However, much of the problems associated with direct wet-seeding by broadcasting are successfully overcome by the use of drum seeder without deteriorating yield or any other advantages of the technique.



Using drum seeder in prepared field

Cultivated crop in the field

What is a drum seeder?

Plastic drum seeder was first applied in Vietnam during the year 2000 and now about 20 per cent of the rice land, particularly in Mekong Delta is covered by direct wet-seeded rice. Drum seeder is a simple machine made of high density plastic with six to eight drums (16 cm dia) each having a pair of rows of holes (8-9 mm dia) on each side of the drum. It is used for seeding well sprouted rice seeds in rows on well prepared puddled soil directly. The machine weights only about 6 kg when empty and is very easy to transport from one place to another. When loaded with pre-germinated seeds, it weights 18-20 kg. One farmer having average health can easily pull the machine for seeding without bending his heap. This is also a farmers' health friendly device. Drum seeder is an appropriate technology to combat low profitability of rice cultivation caused by increasing production costs, lower yield per unit area and shortage of farm labour at planting time.

Introduction in Bangladesh

Drum seeder was first experimented in Bangladesh during Aman season of 2003 by the Adaptive Research Scientists of Bangladesh Rice Research Institute (BRRI), Gazipur. Several experiments conducted at research farm have very clearly demonstrated that irrespective of rice varieties, direct wet-seeded rice using drum seeder has out yielded the conventional transplanted rice by 15-20 per cent both in the Aman (July-November) and Boro (November-May) seasons. The absolute difference between direct wet-seeded and transplanted rice yields was around 1.0 t/ha. Higher grain yield in drum seeded rice is the result of many more panicles per unit areas (500-600/m^2) compared to those in transplanted rice, usually 300-350/m^2. Although, number of grains/panicle is reduced in direct seeded rice, this effect is more than off set by the increased number of panicles/units in direct seeded rice.

Only two persons could sow seeds on 1.0 hectare compared to about 45 persons required for uprooting and transplanting. The area of land in the transplanting method seed requirement for direct wet-seeding by drum seeder was only about 25 kg/ha (if seeded by single thin rows of the drum seeder) which is one third of that normally used by the farmers for transplanting, thus resulting in a saving of one thousand taka/ha. In addition, the drum seeded crops matured 10-20 days earlier than the transplanted rice of the same cultivars. This reduction in growth period is because this crop remains always undisturbed throughout its life cycle or never experiences any uprooting and transplanting shock. Thus, direct seeded rice has healthy and vigorous growth.

Ten to twenty days early harvest has particular significance in Bangladesh condition. In Aman season, drought occurs during the reproductive phase of rice crops (October-November) causing yield reduction. Supplemental irrigation is, therefore, necessary to realise potential yield of T. aman rice. Thus, drum seeded rice maturing 10-20 days earlier can easily escape drought. In addition, 10 days early harvest can helps the poor farmers mitigate food crisis at that time, particularly in the northern part of Bangladesh. In boro season, ripen paddy often goes under water due to flash flood in the low laying areas (during May). Ten-day early harvest can thus save the paddy crop from losses caused by climatic hazard.

Farmers also feel that use of drum seeder would reduce cost of irrigation. It has been estimated that use of drum seeder could enable rice farmers to earn an additional income of up to Tk 10,000/- per ha.

Being encouraged by the tremendous performance of drum seeded rice, efforts have been undertaken to extend the technology to the farmers' field. Results obtained from about 50 farmers' field demonstrations were very consistent with those of the research farm trials. Most of the farmers were highly impressed by the performance of drum seeded rice. However, expansion of drum seeder method is likely to be rather slow since it is a knowledge intensive technology. Some 2500 units of drum seeders were imported by the Department of Agriculture Extension in collaboration with IRRI in 2004. These machines were delivered to about 300 upazilas during the Boro 2005 season. In most cases, the results are very encouraging. The Minister and the State Minister for Agriculture and a few dignitaries have observed the impressive performance of drum seeded rice in many locations and they have emphasised for dissemination of this technology along with farmers' training. Efforts are now underway to manufacture drum seeder in Bangladesh.

How to use?

Direct wet-seeded rice using drum seeder is a knowledge intensive technology. Farmers must be trained before they apply the technology for achieving desired results.

Seed preparation and seeding: Good quality healthy seeds are to be used. Seeds are to be dried up before soaking. Seeds are to be soaked for 24 hours followed by incubation for 3-5 days depending on temperatures or seasons. Well sprouted seeds (with 4-5 mm radicles) are to be sown by the drum seeder. Before, loading in the drums, the sprouted seeds are to be lightly dried up for 1-2 hours in a shady place. Two third of the drum space be filled in by seeds and one third be left empty to ensure uniform seeding. Once the drums are filled in, approximately one acre land can be sown. Two persons can complete seeding about more than one hectare land per day. Best time for drum seeding is 01-15 July for Aman and 1-15 December for Boro.

Land preparation: The land must be well prepared to puddled condition. All weeds and stables should be decomposed. Particular attention has to be given to land leveling. This is crucial to direct wet-seeding, since sprouted seeds sown in standing water would result in seedling mortality and uneven crop establishment. Any standing water must, therefore, be drained out before sowing by drum seeder. In the boro season, the land should preferably be finally prepared one day before sowing. Seed preparation and land preparation should be synchronised. In the low laying mono crop (only boro) areas many farmers have tried drum seeder under zero tillage condition successfully. After the recession of flood water, the farmers just removed the stables from the land and leveled off the land before sowing. This enabled them saving irrigation and ploughing costs.

Water and fertilizer management: There is no need to apply irrigation up to five days after sowing. After that, water should be applied to keep the soil moist and water can be applied as the seedlings grow. However, 5-7 cm standing water is enough for the growth of rice crops. Fertilizer requirement is as usual as for transplanted rice, but Leaf Colour Chart may be used for urea management.

Weed management: Weeds could be the main agronomic constraint to direct wet-seeded rice by drum seeder, since saturated land promotes weed seeds germination and growth. Therefore, appropriate measures are to be taken to control weeds in time. Better land preparation decomposing weeds and stables is the precondition for weed free crops. However, weed infestation is very much ecology specific. In some areas, particularly the low laying single boro cropping areas, weed infestation is normally very low and only two hand weedings are adequate for keeping the rice crops weed free. BRRI developed push weeder known as "BRRI Weeder" is suitable for mechanical weed control. However, in the ecosystem where weed infestation is usually more, chemical weed control can be practiced. Farmers are now habituated in the use of herbicides in the transplanted rice. Application of herbicides (Ronstar) @ 25-30 ml mixed in 10 liters of water may be applied in 5 decimal land during 7-10 days after seeding. There must be water 2-3 mm standing at the time of applying herbicides. Inappropriate use of herbicides may result in seedling mortality. The land shall have to be kept saturated with 3-4 mm standing water for 3-5 days after application of herbicides.

Limitations and ecological niche

Besides tremendous advantages of the drum seeder technology, it has also some limitations. Water management is crucial for direct wet-seeding. During boro season, about 30 days early irrigation facility is to be ensured. The farmers who have their own shallow tube-wells are in favourable position. Farmers under deep tube well command areas must be organised to install irrigation infrastructures in time. Availability of electricity is also important for this purpose. Thus, community approach would be highly effective for dissemination of the technology. Drum seeder is most suitable for Boro season since water management is in control of the farmers. Particularly, in the low laying areas of Gazipur, Tangail, Sirajganj, Pabna, Natore, Mymensingh etc. where just after the recession of rainy season water in the month of November, farmers can start seeding with minimum tillage. The technology is also adaptable for Aman season on the high and medium highland areas where there remains no standing water at the time of seeding, and heavy rainfall would not disrupt the sprouted seeds sown in lines.

In the northern districts, where low temperatures in the month of December may cause seedling mortality, seeding should be completed by early December. Mid November to mid December sowing would result in optimum yield. Farmers have also started the use of drum seeder for Aus season. They have successfully established Aus rice in many viz. in Faridpur, Barisal, Jessore, Gazipur, Mymensingh, Moulvibazar etc. Among the biological constraints weed infestation has been observed as the most serious one. Use of pure seeds would help controlling weedy rice in the drum seeded rice land.

Conclusion

Direct wet-seeding of rice using drum seeder may bring a revolutionary change in rice cultivation in Bangladesh. Farmers may earn additional Tk one thousand per bigha (33 decimal land) through adoption of this technology. Policy makers may extend support to facilitate rapid dissemination of the technology.

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