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Relief in Every Window, but Global Worry Too

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In the ramshackle apartment blocks and sooty concrete homes that line the dusty roads of urban [India](#), there is a new status symbol on proud display. An air-conditioner has become a sign of middle-class status in developing nations, a must-have dowry item.

It is cheaper than a car, and arguably more life-changing in steamy regions, where cooling can make it easier for a child to study or a worker to sleep.

But as air-conditioners sprout from windows and storefronts across the world, scientists are becoming increasingly alarmed about the impact of the gases on which they run. All are potent agents of [global warming](#).

Air-conditioning sales are growing 20 percent a year in China and India, as middle classes grow, units become more affordable and temperatures rise with climate change. The potential cooling demands of upwardly mobile Mumbai, India, alone [have been estimated](#) to be a quarter of those of the United States.

Air-conditioning gases are regulated primarily through a 1987 treaty called the [Montreal Protocol](#), created to protect the ozone layer. It has reduced damage to that vital shield, which blocks cancer-causing ultraviolet rays, by mandating the use of progressively more benign gases. The oldest [CFC coolants](#), which are highly damaging to the ozone layer, have been largely eliminated from use; and the newest ones, used widely in industrialized nations, have little or no effect on it.

But these gases have an impact the ozone treaty largely ignores. Pound for pound, they contribute to global warming thousands of times more than does carbon dioxide, the standard greenhouse gas.

The leading scientists in the field have just [calculated](#) that if all the equipment entering the world market uses the newest gases currently employed in air-conditioners, up to 27 percent of all global warming will be attributable to those gases by 2050.

So the therapy to cure one global environmental disaster is now seeding another. “There is precious little time to do something, to act,” said Stephen O. Andersen, the co-chairman of the treaty’s technical and economic advisory panel.

The numbers are all moving in the wrong direction.

Atmospheric concentrations of the gases that replaced CFCs, known as HCFCs, which are mildly damaging to the ozone, are still rising rapidly at a time when many scientists anticipated they should have been falling as the treaty is phasing them out. The levels of these gases, the mainstay of booming air-conditioning sectors in the developing world, have more than doubled in the past two decades to record highs, according to the National Oceanic and Atmospheric Administration.

And concentrations of the newer, ozone-friendly gases are also rising meteorically, because industrialized countries began switching to them a decade ago. New room air-conditioners in the United States now use an HFC coolant called 410a, labeled “environmentally friendly” because it spares the ozone. But its warming effect is 2,100 times that of carbon dioxide. And the treaty cannot control the rise of these coolants because it regulates only ozone-depleting gases.

The treaty timetable requires dozens of developing countries, including China and India, to also begin switching next year from HCFCs to gases with less impact on the ozone. But the United States and other wealthy nations are prodding them to choose ones that do not warm the planet. This week in Rio de Janeiro, Secretary of State Hillary Rodham Clinton is attending the [United Nations Conference on Sustainable Development](#), also known as Rio+20, where proposals to gradually eliminate HFCs for their warming effect are on the provisional agenda.

But she faces resistance because the United States is essentially telling the other nations to do what it has not: to leapfrog this generation of coolants. The trouble is, there are currently no readily available commercial ozone-friendly alternatives for air-conditioners that do not also have a strong warming effect — though there are many on the horizon.

Nearly all chemical and air-conditioning companies — including DuPont, the American chemical giant, and Daiken, one of Japan’s leading appliance manufacturers — have developed air-conditioning appliances and gases that do not contribute to global warming. Companies have even erected factories to produce them.

But these products require regulatory approvals before they can be sold, and the development of new safety standards, because the gases in them are often flammable or toxic. And with profits booming from current cooling systems and no effective regulation of HFCs, there is little

incentive for countries or companies to move the new designs to market.

“There are no good solutions right now — that’s why countries are grappling, tapping in the dark,” said Rajendra Shende, the recently retired head of the Paris-based United Nations ozone program, who now runs the Terre Policy Center in Pune, India.

An Unanticipated Problem

The 25-year-old Montreal Protocol is widely regarded as the most successful environmental treaty ever, essentially eliminating the use of CFC coolants, which are highly damaging to the ozone layer. Under its terms, wealthier countries shift away from each harmful gas first, and developing countries follow a decade or more later so that replacement technologies can be perfected and fall in price.

Concentrations of CFC-12, which had been growing rapidly since the 1960s, have tapered off since 2003, thanks to the treaty’s strict phaseout schedule. In 2006, NASA scientists concluded that the ozone layer was on the mend.

But that sense of victory has been eclipsed by the potentially disastrous growth in emissions from the newer air-conditioning gases. While a healthier ozone layer itself leads to some warming, far more warming results from the tendency of these coolant gases to reflect back heat radiating off the Earth.

When the treaty set its rules in the mid-1980s, global warming was poorly understood, the cooling industry was anchored in the West, and demand for cooling was minuscule in developing nations.

That has clearly changed.

Jayshree Punjabi, a 40-year-old from Surat, was shopping for an air-conditioner at Vijay Sales in Mumbai on a recent afternoon. She bought her first one 10 years ago and now has three. “Now almost every home in Surat has more than one,” she said. “The children see them on television and demand them.”

Refrigeration is also essential for these countries’ shifting food supplies. “When I was a kid in Delhi, veggies came from vendors on the street; now they all come from the supermarket,” said Atul Bagai, an Indian citizen who is the United Nations ozone program’s coordinator for South Asia.

In 2011, 55 percent of new air-conditioning units were sold in the Asia Pacific region, and the industry’s production has moved there. Last year, [China](#) built more than 70 percent of the

world's household air-conditioners, for domestic use and export. The most common coolant gas is HCFC-22. In 2010, China produced about seven times the amount of that gas as the United States.

With inexpensive HCFC-22 from Asia flooding the market, efforts to curb or eliminate its use have been undercut, even in the United States. For example, although American law now forbids the sale of new air-conditioners containing HCFC, stores have started selling empty components that can be filled with the cheap gas after installation, enabling its continued use.

Trying to Adapt the Treaty

During a four-day meeting in Montreal in April, about 200 representatives attending the protocol's executive committee meeting clashed over how to adapt to the changing circumstances. Should they be concerned with ozone protection, climate change or both?

As developing countries submitted plans to reduce reliance on HCFCs in order to win United Nations financing for the transition, delegations from richer nations rejected proposals that relied on HFCs, because of their warming effect. Canada raised a proposal that countries should use only compounds with low impact on global warming.

Phasing out HFCs by incorporating them into the treaty is one of the most cost-effective ways to reduce global warming, said Durwood Zaelke, president of the [Institute for Governance and Sustainable Development](#).

But India, China and Brazil object that this could slow development and cost too much. All the acceptable substitutes under development for air-conditioners are either under patent, demand new equipment or require extensive new regulation and testing procedures. "This appears simple, but it's not standard, and it imposes a new burden," said Wang Yong, of the Chinese delegation.

Said Suely Carvalho, the Brazilian-born chief of the United Nations Development Program's Montreal Protocol and Chemicals Unit: "The developing countries are already struggling to phase out, and now you tell them, 'Don't do what we did.' You can see why they're upset."

Commercial interests foster the stalemate. Though the protocol aggressively reduces the use of HCFC-22 for cooling, it restricts production on a slower, more lenient timetable, and as a result, output has grown more than 60 percent in the past decade. Even in the United States, HCFC-22 is still profitably manufactured for use in older appliances, export and a few other industrial purposes that do not create significant emissions, like making Teflon.

Politically influential manufacturers like Gujarat Fluorochemicals in India, Zhejiang Dongyang

Chemical Company in China and Quimbasicos in Mexico (of which Honeywell owns 49 percent) have prospered by producing the coolant. They even receive lucrative subsidies from the United Nations for making it.

For their part, manufacturers are reluctant to hurry to market new technologies that are better for the climate, until they get a stronger signal of which ones countries will adopt, said Mack McFarland, an atmospheric scientist with DuPont.

Othmar Schwank, a Swiss environmental consultant who has advised the United Nations, said: “In many countries, these targets will be very difficult to achieve. With appliances growing in India and China, everyone is making money, so they want to delay this as much as possible.”

Technologies Stalled

The Montreal Protocol originally gave the developing countries until 2040 to get rid of HCFCs, but its governing board accelerated that timetable in 2007. “We saw consumption going through the roof,” said Markus Wypior, of the German government agency GIZ Proklima. The new schedule says developing countries must “stabilize” consumption of HCFCs by Jan. 1, and reduce it by 10 percent by 2015.

But the industry is growing so fast that meeting the targets, which were based on consumption in 2009-10, would now require a 40 percent reduction from current use in India. Many countries, including India, are trying to satisfy their 2013 mandate with one-time fixes that do not involve the cooling sector — for example, replacing HCFC-22 with another gas in making foam. Meeting the next reduction target, in 2015, is expected to be much harder.

In the meantime, the Montreal Protocol has started using its limited tools to prod developing countries moving from HCFCs toward climate-friendly solutions, offering a 25 percent bonus payment for plans that create less warming. Experts say that is not sufficient incentive for the drastic changes needed in machine design, servicing, manufacturing and regulation.

Promising technologies wait, stalled in the wings. In China and a few other countries, room air-conditioners using hydrocarbons — which cause little warming or ozone depletion — are already coming off assembly lines in small numbers but have not yet been approved for sale, in part because the chemicals are flammable.

Yet in Europe, refrigerators that cool with hydrocarbons have been in use for years, and some companies in the United States, like [Pepsi](#) and [Ben and Jerry's](#), have recently converted in-store coolers from HFCs to hydrocarbons as part of sustainability plans.

In a statement, the United States Environmental Protection Agency said it had recently

approved some of the new climate-friendly gases for car air-conditioning and refrigerators and is “evaluating additional alternatives for other air-conditioning applications,” most notably a newer HFC variant called R32.

But when will they be on the market? Even small steps forward have been frustrated.

Last year the European Union began requiring automakers to use climate-friendly coolants in cars, considered a relatively simple transition. A chemical called 1234yf was deemed suitable, and the tiny amounts of coolant in car air-conditioners make flammability and high cost less of a deterrent.

But this year, the European Union [postponed the plan](#): Chinese factories that make the compound are still in the process of obtaining government registration. The patent, owned by Honeywell, is being disputed. And the German government has still not finished safety testing.

Said Mr. Wypior, whose agency is trying to promote climate-friendly air-conditioning industries in India and China: “The technologies are available. They’re well known. They’re proven — though not at scale. So why aren’t we moving?”



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