

January 9, 2007

THE ENERGY CHALLENGE

Paying in Pollution for Energy Hunger



A generator fueled in part by biomass in Baharbari, India.

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BAHARBARI, India — A toxic purple haze of diesel exhaust hangs over the rice and jute fields here in northeastern India, and bird songs are frequently drowned out by the chug-a-chug-a-chug of diesel generators.

Across the developing world, cheap diesel generators from China have become a favorite way to provide electricity. They power everything from irrigation pumps to television sets, allowing growing numbers of rural villages in many poor countries to grow more crops and connect to the wider world.

But as the demand increases for the electricity that makes those advances possible, it is often being met through the dirtiest, most inefficient means, creating pollution in many remote areas

that used to have pristine air and negligible emissions of carbon dioxide and other [global warming](#) gases.

“There has been a mushrooming of these decentralized diesel generators,” said Ibrahim Rehman, a rural energy expert at the Energy and Resources Institute in New Delhi.

While many generators are purchased initially to power irrigation pumps, they have also opened up a huge new market for television sets, which in turn creates demand for even more diesel generators.

“You either want clean air or television” in many villages, said Nandita Mongia, the chief of the United Nations Development Program’s regional energy program for Asia and the Pacific. In nearly all cases, television wins.

Rising prices for diesel fuel have improved the commercial potential of alternatives, but renewable energy sources have been in an often-losing race against smoke-spewing backyard diesel generators, and occasionally coal, to become the energy source of choice in outlying areas.

Renewable sources have made some inroads, including tiny hydroelectric dams for Himalayan streams, biomass generators for India and Southeast Asia, solar-powered lanterns for India and Africa and rooftop water tanks in southern China.

But demand for electricity has been growing even more swiftly across the developing world, particularly in China and India.

When night falls here in Baharbari and countless stars blaze from an inky sky virtually uncontaminated by outdoor lighting, many of the thatch huts glow softly with the violet light of television screens, and occasionally a small bulb providing reading light for a child.

Three years ago, practically no one had a television set in this isolated community tucked between Nepal and Bangladesh. It is an area so remote and roadless that the only access is on foot or by bullock cart, after monsoon rains turn dirt paths into bogs that become impassable even for farm tractors.

Even so, half of the 1,000 households have TV, paying about 40 cents every few days to the owner of a diesel generator to recharge the batteries that power the sets. Ranvir Kumar Mandel, a slender 22-year-old, has built a bamboo hut here just to serve as a television repair shop.

“Before, there was no market,” he said, sitting near a pile of mostly black-and-white sets to be fixed.

Lavish government subsidies for diesel, kerosene and other fossil fuels have held down prices in many developing countries and made it harder to introduce renewable energy technologies.

While entrepreneurs and organized crime syndicates frequently raise the subsidized price of kerosene and pocket the profits, it remains very cheap and is frequently mixed with diesel to reduce the cost of running generators. The mixture shortens the life of the generator, however, and can make pollution even worse.

Given the popularity of generators, perhaps the most promising alternative is a new type like the one at the edge of the village here that contributes much less to air pollution and global warming. It burns a common local weed instead of diesel, costs half as much to operate and emits less pollution.

The main material is dhaincha, a weed commonly grown in India to restore nitrogen to depleted soils. The dhaincha grows 10 feet tall in just four months, with a green stalk three inches thick. Wood from shrubs and trees is used when there is not enough dhaincha.

“Other villagers were surprised,” said Ravindra Prasad Mandal, a village leader. “How was it possible that from dhaincha and wood, power was produced?”

For all its potential advantages, the toughest part of the project here has been to persuade change-resistant villagers to try it. Many projects fail in rural areas, development economists said, because governments or foreign aid organizations donate money or equipment without requiring any ongoing commitment. And they often threaten existing ways to obtain power, making it even harder to overcome resistance.

The biomass generator in Baharbari is owned by a collective of village residents, and has been supported by Hindus and Muslims alike. But local landlords, some with their own diesel generators that they rent out to charge batteries, have been wary.

The project has succeeded here partly because it has the active backing of one landlord family, the Sharans. Family members have gone on to successful business careers in big Indian cities and in Europe, and have dedicated themselves to helping their home village.

That makes it an unusual case, although the Sharans are trying to replicate it by setting up a school and training managers to establish similar cooperatives in nearby villages.

The biomass project has attracted interest and [World Bank](#) support because it appears to offer significantly cheaper electricity than diesel, at least at current prices. Another popular approach being tried in India and elsewhere — using solar energy to recharge lanterns by day — has run into difficulty even as diesel prices would seem to make it more competitive.

The problem is that prices for photovoltaic panels for solar energy have surged as governments in industrialized countries, especially Germany, have encouraged greater use of renewable energy, said Hemant Lamba, the coordinator of Aurore, a renewable energy service company in Auroville, India.

“It’s harder to do any solar energy projects in India,” he said.

In mountainous countries like Nepal, development agencies have focused on designing very small, inexpensive hydroelectric systems to install in streams. But deforestation has denuded many hillsides in the Himalayas and elsewhere, causing rainfall to surge into streams much more quickly. A Japanese project in Bhutan was recently destroyed this way.

“The villagers shrugged and said, ‘Nobody asked us, we knew every third year there would be a flood,’ ” Ms. Mongia, the [United Nations](#) energy expert, said.

Wind energy has found few applications in rural villages, because the turbines, even though far more capable than in the past, are still too expensive.

China has tried another approach: supplementing an expansion of electricity from coal-fired power plants with cheap rooftop solar water heaters that channel water through thin pipes crisscrossing a shiny surface.

Close to 5,000 small Chinese companies sell these simple water heaters, and together they have made China the world’s largest market for solar water heaters, with 60 percent of the global market and more than 30 million households using the systems, said Eric Martinot, an expert on renewable energy at Tsinghua University in Beijing.

Wang Youyun, a 27-year-old lettuce farmer in Wangjiaying, a village of 3,000 people in southwestern China’s Yunnan Province, bought one such hot water system a year ago for \$360 and installed it on his family’s roof next to a spot where ears of corn dry in the sunshine.

The village now has electricity, and some residents use it for water heaters, but Mr. Wang calculates that the solar system will pay for itself in two years. There is so much competition that even without government subsidies, the same size model now costs \$330 and the price is still falling, he said.

The water heaters can be installed only on a sturdy, flat concrete roof, however, and not on the beautiful but fragile tile roofs that still adorn many of the houses in the village. The systems pose another drawback as well, Mr. Wang acknowledged: “If there is no sun for two or three days then there’s no hot water.”

Big conventional power plants, even those that burn coal, are often cleaner, safer and more efficient than crude household stoves and other small systems. So many economists say that the first step in developing countries should be the construction of power lines connecting as many villagers to national grids as possible.

Cooperation across national borders can help make this happen. Vietnam has made electricity available to 84 percent of its households, up from 50 percent in the early 1990s, partly by building a high-power line from China across Vietnam’s impoverished northern highlands.

But power plants have actually closed in some of the poorest and most chaotic parts of the developing world, from Africa to dysfunctional states in India like Bihar, which includes Baharbari. Causes range from corruption to a failure of government-owned electricity boards to invest in maintenance and replacement parts.

Mohamad Aslam, 21, who sells time on a shared phone in Harwa, a village near Baharbari, said that he could remember lights shining outside homes when he was a boy, and when power from the national grid was still available. “It gradually decreased until it was gone: 10 to 12 hours a day, then five to six hours, then three to four hours and then there was no more,” he said.

So for now, diesel generators remain the favorite choice of millions across the developing world — so much so that the International Energy Agency plans to assess the extent of their use as part of a detailed look next year at energy use in India and China.

Mohan Lal Yadav, the 55-year-old owner of a diesel station in Vehbra, a community of 4,000 people near Baharbari, calculates residents there have bought 100 diesel generators and 100 to 150 diesel-powered irrigation pumps in recent years. “It’ll keep on increasing,” he said.