

# THE THIRD WORLD NEEDS ENERGY TOO

Selecting appropriate technologies for the energy poor involves merging economics, anthropology and engineering

BY JANET RALOFF

Rising energy costs are not unique to world superpowers. In fact, a recent study for Brookhaven National Laboratory by Donovan, Hamester and Rattien, a Washington consulting firm, concludes that Third World countries face "an impending energy crisis as severe or more severe than the one the United States faces several decades from now." And technologies to meet this challenge must be introduced earlier in "lesser developed countries" (LDCs) than in more developed nations such as the United States because LDCs depend almost entirely on imported oil, the study says.

There has been at least a tacit link between a nation's energy consumption and its economic growth. For years, the United States and other developed countries have exploited resources at home and abroad to feed their growing addiction to energy in the name of the gross domestic product. But lately LDCs have become vocal in demanding their share of the world's energy pie. Still generally unable to develop the energy technologies they need to rise out of their Third World status, many LDCs look to nations like the United States for help.

What is a lesser developed country? The term covers a wide range of divergent cultures and economies with one thing in common—a lack of prevalent urbanization and industrialization. Although people tend to think of LDCs as poverty-ridden and agriculturally based, these descriptors hardly characterize

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*Fast-growing leucaena makes good firewood. This Philippine grove is a year old.*

LDCs like the Arab emirates whose oil wealth and nomadic cultures are by now famous.

Even among energy-poor LDCs there is great contrast, particularly in population density. Some have large, dense populations, such as India; others have rural, even aboriginal populations, such as parts of Africa and Asia. What the energy-poor countries do have in common, says the study, are higher than average population-growth rates, high dependency on the developed countries for economic development (many LDCs have international loans outstanding) and questionable ability to pay for modern technology, especially since they have so few indigenous resources. A key that could unlock the LDCs' bondage to poverty and underdevelopment is energy—energy to industrialize; energy to harvest resources for barter, both domestically and in the world markets; and energy to raise their standards of health and well-being.

The Donovan-Hamester-Rattien report says that 88 percent of the energy consumed in noncommunist countries is by developed nations. But as non-oil-producing LDCs begin altering their cultures with and for the use of energy, their percentage of the energy take could increase to nearly 20 percent by the year 2000. The study cautions, however, that such energy-demand estimates are very un-

certain, owing to the varying degree to which industrialization may occur.

Variables complicating the demand picture include such factors as:

- A growing population needs more energy just to sustain current housing, food and transportation standards. The Donovan-Hamester-Rattien study credits the United Nations with estimating that LDC population growth by the year 2000 will be three times the average of developed nations.

- The UN also estimates a major shift of LDC populations from rural to urban areas. Today only 25 percent of LDC populations live in urban areas, but by the year 2000 that figure could be 41 percent. Mexico City, Sao Paulo and Shanghai, each with populations now exceeding 10 million will be among 16 such LDC cities in the year 2000; many may actually have populations nearing 20 million.

- Urbanization is usually associated with per-capita income increases and a corresponding increase in the proportion of spendable income. Goods purchased by urban dwellers tend to be more energy intensive, either in production or end use, than before. And the study also notes that moving to cities is generally accompanied by a switch in energy sources—from sunlight, wood, dung, leaves, and human or animal labor, to kerosene, natural gas, coal, electricity

and gasoline.

- Employing an influx of people to the cities requires more industrialized and fewer agricultural jobs. Industrialization feeds on commercial fuels. Foreign industries, especially attracted by displaced people willing to work at low wages, are often encouraged by LDC governments because of the capital they bring. Therefore, LDC governments often offer foreign investors trade protection and tax incentives.

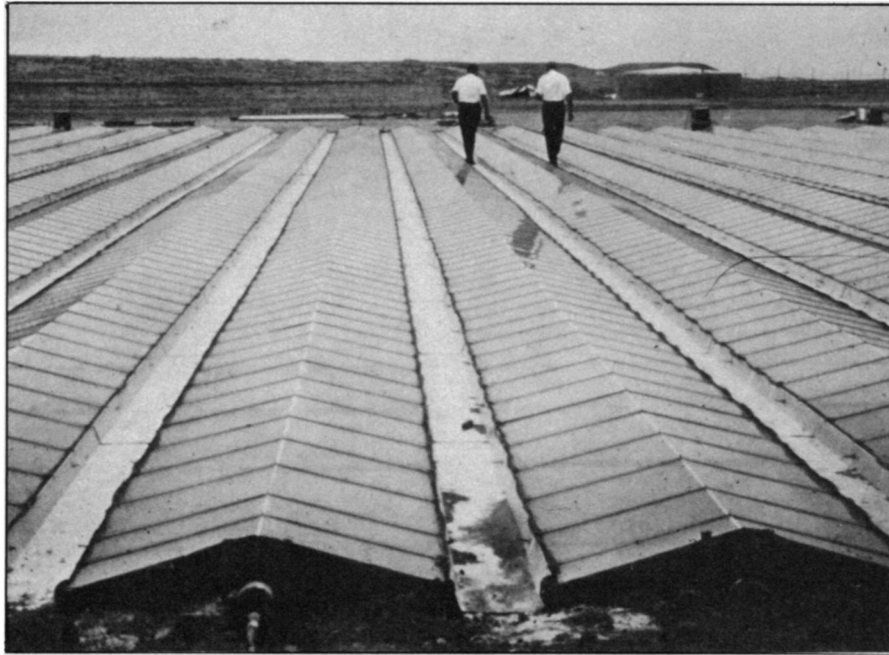
they generally lack major energy infrastructures (electric power networks, oil and gas pipelines). What they need are diverse sources of energy to power such light-energy users as solar grain driers, ovens, water heaters, pumps and small electric generators.

Two important requirements of technologies for LDCs are that, as much as possible, they be simple enough that unskilled natives can understand how they work and that they use and be con-

pires are among nations developing anaerobic digesters to convert animal, human and other wastes into biogas—predominantly methane—for use in home heating and cooking.

For the United States and other technology exporting countries, good intentions are not sufficient. The key is “appropriateness.” Energy systems must be simple to construct and maintain by the people they serve. Fuels should be readily available and inexpensive. Components should be designed to use indigenous resources. (For example, unlike the United States, where labor is one of the most expensive commodities, most Third World countries are labor rich. Energy systems that may be prohibitively expensive here because of land-use or labor requirements could be ideal for LDCs.) Most important, energy systems should provide energy in the form in which it will be used. Solar photovoltaics that produce electricity, for instance, are not “appropriate” for cultures that need only hot water and space heating.

As Roberto Salas Capriles, a Venezuelan engineering professor, writes in the July-September issue of *IMPACT OF SCIENCE ON SOCIETY*, most underdeveloped countries mistakenly import unfavorable technologies that “are designed for markets on a different scale and, in most cases, take no account of our natural resources or our ways of life . . . . It would be an unforgivable historical mistake to copy the pattern of development of the industrialized countries,



*Solar stills, such as this experimental one in Australia, desalinate water.*

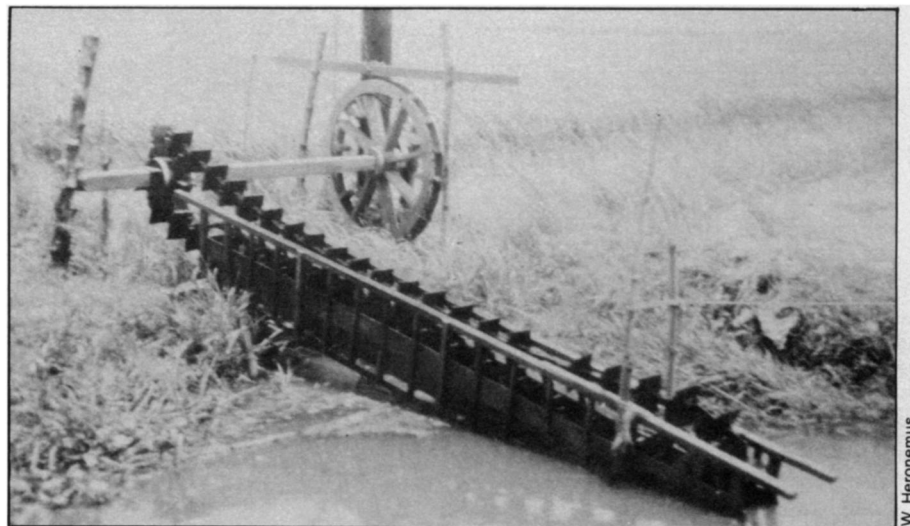
- Industrialization tends to lure people out of rural areas into cities where pay and the standard of living are higher.

Thus, the study clearly suggests that LDCs are soon going to require and demand more energy, and more refined energy sources.

The National Academy of Sciences offered a corollary study earlier this year, entitled *Energy For Rural Development*. It includes not only a minicatalog of small-scale, 10- to 100-kilowatt solar, wind and geothermal technologies, but also suggests how to transfer technology from major technology exporters such as the United States.

A panel of the Commission on International Relations, which prepared the report for the NAS, found that although a variety of energy technologies suitable for LDCs already exist, “with the exception of a few devices (e.g. homemade windmills, solar driers), there are no [significant] cheap” alternatives to fossil or nuclear-power generation “for either industrialized or developing nations, and there probably will not be any in the near future.”

Further complicating the situation is the fact that “inexhaustible” energies, such as solar, wind and geothermal, are precisely the ones most needed by LDCs. Most underdeveloped countries have little or no need for electricity. Further,



*A cloth and bamboo windmill drives water-scooping buckets in this Thai water ladder.*

structed of indigenous materials—such as bamboo in the Orient, dung in India, wood or clay in Mexico.

Brazil, for example, is experimenting with fermenting plantation crops, such as sugar and cassava, into alcohol for use as gasoline substitutes. The National Research Council has just released a report suggesting that the tropical legume, leucaena, be cultivated for use as firewood (SN: 10/1/77, p. 216). India, the People's Republic of China, and the Philip-

because . . . it has led their inhabitants into a state of dissatisfaction and unhappiness and concomitant impoverishment of the quality of life. The developed countries offer us warnings rather than examples. The fundamental objective of our development should not be to close the gap which separates us from the industrialized countries, but to arrive at a degree of economic growth, well-being and progress *which will satisfy the aspirations of our own country.* □