

Electrification and population growth

An enduring topic of discussion among energy professionals is risk perception and public attitudes toward the costs and benefits of increases in energy production, conversion, distribution, and usage. Because risks and costs are usually identified as additional mortality, health-related effects, or adverse environmental impacts, and benefits tend to be diffuse and difficult to enumerate, it is not hard to guess which side of the ledger accumulates the public relations deficit.

There are many activities that illustrate the energy cost/benefit conundrum, but a handful appear to be of immediate global importance. One is electrification. The "traditional" electrification model includes fossil-fueled, nuclear, and hydroelectric central stations feeding into a high-voltage transmission grid that in turn connects to local distribution systems. Here, the putative operational risks are well-publicized—air pollution, local and regional ecosystem disruption, and nuclear waste disposal to name the most prominent.

The "alternative" electrification model features distributed generation sources and includes many, much smaller energy conversion devices using renewable sources or cogeneration technologies located at end-user sites or connected to local distribution systems. In this case, the operational risks are not as well delineated—but include, for example, fuel-cycle impacts (related to biomass harvesting, natural gas production and transmission), manufacturing impacts (involving fuel cell or wind turbine blade fabrication), and disposal of such consumables as lead batteries used for photovoltaic or wind-derived electricity storage.

Slowing population growth. Whether traditional or alternative

methods, or a combination, are used, the benefits of "full electrification"—comprehensive access to reliable and reasonably priced electric energy—seem to be taken for granted and are barely discussed. A general benefit of electrification is the social and political enfranchisement of the citizenry, while specific benefits include reductions in both the use of liquid fuels for lighting and wood for direct combustion and charcoal production.

There are countless other benefits resulting from electrification, but one of the most important is certainly the contribution of increasing per capita electrification to slowing rapid population growth. The delineation of the relationship of electrification to human fertility is the subject of academic studies and is a demanding statistical exercise. There is conclusive evidence, however, that increased electrification is directly correlated to increased access to and utilization of educational opportunities—particularly for women—as well as improvements in agricultural and commercial productivity. These factors have in turn been positively correlated with declines in the total fertility rate (TFR).

According to "World Population Profile 1998," prepared by the U.S. Agency for International Development and the U.S. Bureau of the Census, 96% of world population increase now takes place in the world's less developed countries (LDCs) and, in fact, the report projects that population in the more developed countries (MDCs) will slowly "deflate" (that is, the TFR reaches or goes below the replacement level of 2.1 births per woman) from the year 2020 onward; thereafter, all of the net annual gain in global population will come from the LDCs.

Reductions in the human population growth rate in the last

decade have been widespread—indeed, the populations of 79 nations and territories are already deflating, according to the 1998 population report. These countries hold about 45% of the global population and are mostly—but not exclusively—MDCs. (Note that there are, of course, other major social issues raised by this demographic development, the most important being the care and maintenance of an aging and deflating population.)

While MDC population trends are heartening to those working to bring the human population in line with sustainable resource utilization, the overall trends are still alarming. The 1998 population report projects that world population will rise to about 9.3 billion by 2050—a 50% increase from the present 6.1 billion—and virtually all of this growth will take place in countries least able to deal with it. Electrification may be the wild card in mitigating this growth because, while the "proof" is difficult, it seems intuitively obvious that the costs of electrification are mostly understood and more controllable. On the other hand, the costs of overpopulation—deforestation, "desertification," and other ecosystem disruption, malnutrition, premature mortality, urban migration, etc.—are both less knowable and less controllable.

The task at hand is to attempt to elucidate the relative costs and benefits—or risks and rewards—of various methods to expedite "full electrification" in LDCs, understanding that the definition of full electrification will differ based on geographical location, cultural mores, and the like. Clearly there are many specifics at issue in the debate—one of the most obvious being technology choices for power generation—but the essential point is that all anthropogenic "negatives" for the global environment will be reduced if there are fewer people. ■

By CHRISTOPHER BERGESEN