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country have been primarily along ethnic and religious, rather than economic or "class," lines.

Beginning in the early 1960s, research by such "new pluralists" as Daniel Patrick Moynihan and Nathan Glazer at Harvard, Lee Benson at Iowa, and Andrew Greeley at the University of Chicago, has indicated that the main points about the melting pot are: that it did not happen; that ethnic groups have always comprised a series of subsocieties; that this persistent diversity is necessary and healthy; that ethnic diversity continues to play a vital part in party politics. Even the fourth and fifth generations of some mid-19th century immigrants —Dutch, German, and Scandinavian—have yet to be fully assimilated.

Some major historical studies in the field are already underway. (The federal Ethnic Heritage Studies Program, begun in 1972, provides some of the research funds.) The Philadelphia Social History Project has been compiling data on the social characteristics of local blacks, Germans, and Irish between 1850 and 1880. Swierenga himself is studying the impact of migration on 17,500 America-bound 19th-century Dutch families. Nevertheless, he concludes, the new ethnic consciousness "has clearly caught [most] sociologists and social historians off guard."

RESOURCES & ENVIRONMENT

The District Heat Alternative

"Prospects for District Heating in the United States" by J. Karkheck, J. Powell, and E. Beardsworth, in *Science* (Mar. 11, 1977), 1515 Massachusetts Ave., N.W., Washington, D.C. 20005.

The use of waste heat (50°–100°C) from electric plants and other sources for space and water heating could be an efficient energy alternative for colder, urbanized areas of the United States. (Space and water heat now account for about 19 percent of U.S. energy needs.) Such "district heating" has been used with success in almost all European countries, report the authors, members of the Fusion Technology Group at Brookhaven National Laboratory. With this system, Denmark serves 32 percent of its people and Sweden 25 percent. The authors believe the district heating approach could provide more than half of the U.S. population with "cost-competitive" heat and hot water, reduce American reliance on foreign fuel, and promote the principle of "total energy use."

Other technologies, the authors contend, do not match district heating in terms of cost or efficiency. Coal gasification consumes a "finite resource." Solar heating must rely on conventional back-up systems. And nuclear power creates more waste heat. After the substantial initial capital investment, the authors add, annual expenditures by consumers for district heat will remain essentially stable.

The difficulties facing district heating on a national scale—it involves laying a grid of buried transmission and distribution pipes—are enormous. (The European systems were mostly installed during post-World War II reconstruction and urban expansion.) The authors recommend a central role for the federal government and estimate the total cost at $180 billion, paid for by annual reductions of $13 billion in the cost of imported oil. Finally, to ease the transition, a variety of tax incentives should be made available for cooperating utilities and individual consumers.

Disposing Safely of Nuclear Waste

"High-Level Radioactive Waste from Light-Water Reactors" by Bernard L. Cohen, in *Reviews of Modern Physics* (Jan. 1977), American Institute of Physics, 335 E. 45th St., New York, N.Y. 10017.

In a light-water reactor, enriched (3.3 percent) uranium is exposed to neutrons. Many of the products of these reactions (isotopes of strontium, cesium, and plutonium, for example) are high-level radioactive waste and pose a potential health problem. Several solutions have been proposed. Most involve burial of atomic waste deep in the earth. But critics of nuclear power contend that such disposal is unsafe, since the dangerous nuclear material could easily enter the environment. What exactly are the risks in burying nuclear waste?

In a complicated computer study, Cohen, a University of Pittsburgh physicist, traces the decay history of a year's worth of nuclear waste (about 4,000 canisters, each 10 cubic feet in size) over a period of a million years. He takes hundreds of variables into account—rate of decay, levels of toxicity, possible leakage, geological stability, volcanic action, inadvertent human intrusion, even the possibility of a meteor hitting the disposal site. He concludes that atomic waste deeply buried (to at least 600 meters) could cause 0.4 deaths from cancer per million years. If a cure for cancer is found, the figure becomes 0.04.

Cohen notes that buried waste is most dangerous during the first 500 years, after which toxicity will have decreased by several orders of magnitude. Ground water is the most likely pathway to the environment, but waste could be put in deep salt formations (one site in New Mexico is being considered) that have been dry for 250 million years. That aside, ground water travels very slowly, and, at a depth of 600 meters, radioactive water would probably have to travel at least 100 km to reach the surface. Moreover, water would first have to corrode the glass and steel nuclear waste containers, not to mention the rock or salt in which they are embedded. The process could take a million years, and radioactive leaks are easily discovered.

Cohen's conclusion: The chances of leakage, of leakage reaching the earth's surface, and of leakage being inhaled or ingested, are remote.