

ENERGY

The nuclear prospect . . .

In the latest energy policy study sponsored by the Ford Foundation, *Nuclear Power Issues and Choices*, a group of experts concludes that as the world moves away from a petroleum-based energy system, nuclear power will continue to be the economic choice over alternatives for at least the remainder of this century. The study was conducted by the MITRE Corp.

Although coal-fired electrical generating plants may be more economical in some parts of the country, the report concludes that generally nuclear plants will maintain a "small economic advantage." Solar energy for heating houses "will be practical in the near future in favorable situations," but the study group sees "little prospect" for competitively priced solar electricity in this century.

If other than economic considerations are taken into account, the group says that coal might eventually prove more attractive than nuclear energy. But the report dismisses fears that developing nuclear power will increase weapons proliferation, since there are other ways to develop them.

The experts are less optimistic about the breeder reactor, however. They believe that uranium resources have been under-estimated and will probably be adequate to fuel conventional reactors well into the next century.

The report directly addresses critics of nuclear power who disapprove of social changes they say are likely to accompany it. Such social changes depend on many factors, the report concludes; all that is certain is that energy will cost more but "this need have relatively little effect on the evolution of the basic style of life of the future."

The solar prospect . . .

A direct contradiction to both the philosophy and conclusions of the Ford study comes in the latest paper from the Worldwatch Institute, *Energy: The Solar Prospect*. Researcher Denis Hayes says that only subsidization of other forms of energy have made solar devices appear relatively expensive, and that if these are removed, solar resources could provide 40 percent of the world's energy needs by the end of this century.

Even so, social, not economic, costs should be considered first, Hayes maintains: "Energy sources are *not* neutral and interchangeable. Some energy sources are necessarily centralized; others are necessarily dispersed. Some are exceedingly vulnerable; others are nearly impossible to disrupt. Some will produce many new jobs; others will reduce the number of people employed. Some will tend to diminish the gap between rich and poor; others will accentuate it."

Once people make such comparisons between nuclear energy and solar resources (including wind, ocean thermal, biogas, hydroelectric, and photoelectric energy), he says, they will see that the latter are more compatible with "social equality, freedom and cultural pluralism." All in all, "solar resources could power a rather attractive world."

And the solar home heating prospect

Another study, prepared for the Joint Economic Committee of Congress by researchers at the University of New Mexico, supports Hayes's claim that solar energy could compete with conventional sources. *The Economics of Solar Home Heating* concludes that by 1990, solar energy to produce hot water and space heating will be competitive with deregulated natural gas. In some northern states, solar space heating systems are already feasible. However, the report states the ultimate feasibility of solar heating will depend on capital costs and interest rates, which if unchecked could deter feasibility.

ASTRONOMY

The fast-flying pulsar(s)

The proper motions of most stars, their movement across the sky over the years, is a slow process. Years and decades of measuring photographs may be necessary to determine it. But in this, as in some other things, pulsars are an exception. The fast-flying pulsar leaves other stars behind the way the Fast-Flying Vestibule, once the C&O Railroad's premier train through the bluegrass country, left the milk train behind.

The first pulsar proper motion was measured by the usual optical techniques for the visible pulsar PSR 0531+21 and indicated a velocity of about 100 kilometers per second. Then radio techniques were developed for measuring proper motions of invisible pulsars, and literature of recent years contains seven measurements between 45 and 500 kilometers per second.

The latest measurement, reported in April 1 *ASTROPHYSICAL JOURNAL LETTERS* by David J. Helfand, J. H. Taylor and R. N. Manchester of the University of Massachusetts, apparently breaks the record. The proper motion of PSR 1508+55 "implies a transverse velocity of over 500 kilometers per second." (These observers also provide improved data and upper limits for the motions of several other pulsars.)

Some of these values exceed the velocity necessary for pulsars to escape from the gravitational field of the galaxy and fly off into intergalactic space. Such velocities can also be taken in support of theories that pulsars are made in supernova explosions. A violent origin is a plausible way to give them the kick that causes such velocities.

An antinucleus in the cosmic rays?

One of the most difficult questions in cosmology is that of antimatter. The laws of physics require an equality of matter and antimatter. But in the universe no positive evidence for any antimatter exists. As Ray Hagstrom of the Lawrence Berkeley Laboratory points out in the March 28 *PHYSICAL REVIEW LETTERS*, "the cosmological consequences of the observation [in the cosmic rays] of a heavy antinucleus would be considerable."

There is on record an unusual cosmic-ray observation, the one that P. B. Price and collaborators first interpreted as a magnetic monopole (SN: 8/23-30/75, p. 118). Much criticism has been heaped on that interpretation, but the alternate suggestions seem a little forced. Hagstrom suggests that the solution to the difficulty is that the object was a heavy antinucleus.

He bases his argument on the large amount of ionization the object caused in the Lexan plastic that served as detector and the ease with which it penetrated the Lexan. High ionization suggests a large amount of electric charge, but penetration suggests the negative charge of an antinucleus. A positively charged ordinary nucleus would have been considerably slowed going through the Lexan. Hagstrom suggests a conscious search for other antinuclei in the cosmic rays.

The manufacture of heavy elements

Theory suggests that the nuclei of heavy elements are made in supernova explosions. If that is so, the nuclei should be floating around in space, and in the April 1 *ASTROPHYSICAL JOURNAL LETTERS* Reuven Ramaty of the NASA Goddard Space Flight Center and R. E. Lingenfelter of the University of California at Los Angeles suggest that their radioactive decay processes may produce observable gamma-ray emissions. A particularly good candidate they say is aluminum 26. Its beta decay to magnesium 26 should yield a line at 1.809 million electron-volts that should be narrow and easy for gamma-ray detectors to record.