ENERGY

The great helium waste

About 13 billion cubic feet (bcf) of helium — a potentially valuable and nonrenewable science- and energy-related resource — is lost to the atmosphere annually. In the present fiscal year alone, the plan is to pump more than $300 million into developing such helium-dependent technologies as fusion, superconducting transmission of power and magnetic energy-storage devices. While some predict a helium requirement of five bcf a year by 2030, the government has stockpiled only 37 bcf. A new report by the General Accounting Office says Congress must revamp its helium-conservation policies if sufficient quantities are to be stockpiled for future needs. Helium reservoirs exist only in the atmosphere and natural-gas fields, GAO says. While producing helium from natural gas is relatively inexpensive, up to $13 per 1,000 cubic feet (mcf), recovering it from the atmosphere could run $2,000 per mcf.

Gassing up

The American Gas Association suggests that one way to survive the high cost, pollution and threatened shortage of gasoline is to switch fuels. Their recommendation? Give it gas.

Powering a car with methane, or natural gas, costs (per mile) 54 percent less than an electric car, 43 percent less than a diesel and 59 percent less than a gasoline-fueled car, according to a report prepared for AGA by J. Winston Porter and Morton Grosser. A methane car pollutes substantially less than any but an electric car (including emissions for the electric-power plant), and its fuel system is much safer than its gasoline equivalent, according to Dual Fuel Systems, a world leader in converting cars for methane. Drawbacks include the cost of converting a car to use dual (methane and gasoline) fuels — about $1,200 — and the limited availability of retail methane outlets. But for fleets of cars the economics look good, and worldwide some 400,000 cars are already giving it gas.

Radiogenic geothermal energy

From New Jersey to North Carolina, some 40 shallow (1,000-foot) test wells have been bored to map the geothermal-energy potential of the Atlantic Coastal Plain. And the results have been encouraging, according to Jack Salisbury, deputy director of the Energy Department's geothermal office. An interesting and somewhat surprising find was that everywhere DOE looked, the ground is warmer than had been expected — roughly 70°F to 83°F at depths of 1,000 feet.

Coupled to a water-source heat pump, this temperature is ideal for heating and cooling buildings, Salisbury told SCIENCE NEWS. In fact, the temperature could double or triple the coefficient of performance (ratio of heat energy delivered to the heat energy equivalent consumed at the site) for an air-source electric heat pump, he says.

Unlike most geothermal sources out West, the Eastern aquifers — water-bearing strata of permeable rock — are heated slowly by radioactive decay of uranium, thorium and potassium in underground granite. Heat emanating from this rock would be almost imperceptible to the touch. But having lain for eons beneath an insulating earthen blanket, the material has built up sufficient heat to practically boil water at depths of 5,500 feet.

Drilling of the first deep hole to experimentally tap this radiogenically heated water should begin at Crisfield, Md., in a week or two, Salisbury says. At 4,700 feet, the temperature is expected to be 175°F to 185°F, hot enough when coupled with heat pumps to replace fossil fuels for industrial process-heat applications. And signs indicate low-grade geothermal reservoirs may extend as far south as Florida.

SPACE SCIENCES

How much lightning on Jupiter?

Although the Voyager 1 spacecraft provided the first direct evidence of lightning in the atmosphere of Jupiter, the discovery had been expected for many years by a number of researchers. In 1975, for example, Akiva Bar-Nun, now with Tel Aviv University in Israel, calculated that there might be as many as 53,000 lightning bolts per year for every square kilometer of the planet. In some just-published research (prepared before the Voyager encounter), Bar-Nun now has drastically lowered his estimate, but Voyager's confirmation of lightning suggests that the bolts may have a real role in Jupiter's atmospheric chemistry.

Bar-Nun's 1975 calculation was based on the earth-based detection of acetylene, whose relatively short lifetime in the hydrogen-rich Jovian atmosphere, he said, would require some replenishment process to generate more. Since then, there have been several subsequent detections, but "with each observation," he reports in ICARUS (38:180), "the mixing ratio of acetylene was reduced," getting as low as one eight-hundredth of the original estimate.

Also, he says, several factors could be combining to reduce the rate at which the acetylene is destroyed, leaving a smaller amount that must be produced by lightning or other processes such as ultraviolet photolysis. An aerosol haze layer in the atmosphere with an optical thickness of about 1.7, he says, would cut down the acetylene destruction rate from about 22 times the production rate to only about 4. From related data and his own laboratory experiments, Bar-Nun now calculates that if lightning indeed has a role in acetylene formation, only about 245 bolts per square kilometer per year would be required instead of 53,000. (In earth's tropics, he says, the number is about 300, "including cloud-to-cloud and cloud-to-ground strokes and taking into account the fact that each lightning flash counted consists of 3 to 4 strokes." At high latitudes, however, he adds, there is a sharp drop both in the conversion efficiency of solar radiation into lightning energy and in the number of lightning bolts.)

While preparing his research before the Voyager encounter, Bar-Nun wrote that "it seems at present to be impossible to decide which of the two sources of acetylene in the Jovian atmosphere [lightning or photolysis] is more important." Voyager data now being refined, however, include acetylene measurements and possibly other relevant factors, such as the depth to which acetylene is found in the atmosphere. Voyager 2's July encounter could help further if its increased photo coverage of Jupiter's night side (SN: 5/5/79, p. 294) can indicate the strength, extent and frequency of the thunderbolts of Jove.

NOAA: Self-financing satellites

Despite repeated statements that applications-oriented earth satellites often more than pay their way in savings to their users, it has often proved difficult to underscore the point with specific dollar figures. Now a report from the National Oceanic and Atmospheric Administration, evaluating actual and potential savings from two NOAA satellite systems (ITOS and GOES) in nine specific cases, has concluded that annual savings in these cases alone could have amounted to nearly twice the 1978 budget of NOAA's entire National Environmental Satellite Service.

The nine examples, selected as those "in which annual savings could be estimated with some degree of accuracy," are primarily in the areas of fishing, agriculture and marine shipping. The cases ranged from an annual $100,000 now being saved in the cost of mapping snow cover in the Sierra Nevada river basins to a potential $48 million fuel-cost savings to Florida citrus growers who must heat their groves on cold nights. Together, the cases cited in the study totaled an annual potential of $172 million, compared to the $94.3 million NESS budget for 1978.