ENERGY

Ammonia power for mini-OTEC

Harnessing the heat stored in warm waters of the ocean's surface was tested by Lockheed Missiles and Space Co. Inc. last year in Hawaii during the initial sea trials for an ocean thermal-energy-conversion project known as mini-OTEC. Beginning a three-and-a-half-month run on Aug. 2, the plant generated up to 52 kilowatts of electricity. Frederick Naef and Delbert Burwell described operation of this — the first OTEC project to operate at sea under real-life conditions — on March 25 at Government Institute's 7th Energy Technology Conference in Washington.

Warm, 80 °F surface water vaporized ammonia in a closed-loop cycle, causing it to expand and drive a turbine to generate power. The vapor then passed into a condenser where 50 °F water pumped from the ocean depths via a 2,170-foot polyethylene pipe (about 23 inches in diameter) turned the ammonia back into a liquid. Anticipated fouling and clogging of screens on water-inlet ports by algae and other biota proved nonexistent, probably owing to antifouling paint used on the sump.

Windfall tax at last

By a more than two-to-one majority, the Senate finally passed "windfall profits" legislation. By an even greater margin exactly two weeks earlier the House passed the same bill, which will capture roughly half the proceeds oil producers will receive from the decontrol of oil prices — an estimated $227.3 billion. The tax, to be applied retroactively to all oil sales from March 1, 1980, will be levied at different rates — between 30 and 70 percent — for different categories of oil. Phaseout of the tax is slated to begin in the latter 1980s.

A rider to the bill, which President Carter has already signed, will expand tax breaks to homeowners and businesses for investments in energy conservation or production, and authorizes $3 billion to help the poor pay their fuel bills.

Dishing out solar power

Cost competitive production of electricity and industrial process heat is the goal of a joint government-industry project to develop a 20 kilowatt solar-powered engine/generator. It is hoped the system will fill the solar-electric niche for small communities, industries, farms and military bases.

Ambient-temperature air delivered at three times' atmospheric pressure to a recuperator by the system's compressor picks up waste heat from the plant's turbine engine. From there the high-pressure air travels to the solar receiver where a dish-shaped parabolic mirror has focused sunbeams. The receiver should heat the air to 1,500 °F. The air drives a turbine to generate electricity and power the compressor. But if the sunshine isn't up to handling the whole job, air leaving the receiver is heated supplementally via a combustor in the turbine's ducts.

The mirror is being developed by NASA's Jet Propulsion Laboratory in Pasadena; the turbine engine will be provided under a NASA contract by Garrett Corp.'s AiResearch Mfg. Co. in Phoenix.

News notes

- A five-member Nuclear Safety Oversight Committee was established by President Carter last month to advise both him and the Secretaries of Energy and Health, Education and Welfare on progress toward upgrading nuclear safety and implementing recommendations of the Kemeny Commission (SN: 12/15/79, p. 405).
- An offshore oil platform in Europe's North Sea collapsed and overturned in near-hurricane winds. Reports list more than half of the estimated 225 men aboard as "lost" in icy waters.

SPACE SCIENCES

Nuclear 'battery' for spacecraft

Because of the weakness of sunlight at the great distances of the outer planets, none of the spacecraft sent from earth to Jupiter and Saturn — Pioneers 10 and 11 and the two Voyagers — have used solar panels as their sources of energy. Instead, they have been powered by devices called Radioisotope Thermoelectric Generators (RTG's), in which the heat produced by radioactive elements is converted directly to electricity by a technique that is essentially that of a thermocouple. Now a scientist at the U.S. Naval Research Laboratory in Washington has designed a different nuclear power source for such applications, which he claims could offer gains of 50 percent or more in efficiency.

The idea for the device (a working model has not yet been built) was developed by NRL's James C. Ritter (who did the work privately and holds the patent rights). Called a Radioisotope PhotoElectric Generator (RPEG), it makes use of alternating layers of "high-Z" and "low-Z" materials (those with high and low atomic numbers, such as lead and aluminum), separated by vacuum or other insulation. When a gamma ray from the nearby radioisotope strikes the high-Z substance, it is likely that an electron — carrying an electric charge — will be kicked loose. When this electron strikes the low-Z substance, however, the chances that one of *its* electrons will be knocked free are very small, and the net effect is the buildup in the low-Z material of an electric charge that can simply be extracted like that of a battery.

The Pioneer and Voyager RTG's (as well as those of the Viking landers) used the isotope plutonium 238, chosen for its combination of high heat output and sufficient half-life. RPEG's, says Ritter, would use isotopes chosen for having a high output of gamma rays at energies of 50 to 100 kilovolts, which is the range over which the high/low-Z "sandwich" works most efficiently. One such isotope is titanium 44, whose 48-year half-life would lend itself to multi-year spacecraft missions to the outer planets.

Did Jovian tides fracture Europa?

The numerous linear features that crisscross Jupiter's satellite Europa may have been caused by a similar but weaker version of the Jovian tidal stresses now favored as the explanation for the active volcanoes on Io, according to E. M. Parmentier, P. Helfenstein and James W. Head of Brown University.

The features, presumably fractures, are so widespread as to suggest a global mechanism, Parmentier told the recent Lunar and Planetary Science Conference in Houston. Given the idea that the energy for Io's volcanoes comes from its being pushed and pulled by Jupiter's gravity as the satellite's elliptical orbit carries it nearer and farther from the planet, Parmentier and colleagues looked for signs that a similar process had affected Europa (though to a lesser degree, since it is farther than Io from Jupiter).

If concentric circles are drawn on a deforming sphere around its axis of deformation (in this case a line from Europa's center to Jupiter's), Parmentier says, fractures resulting from the deformation should intersect the circles at certain characteristic angles — about 35° for those caused when Europa is drawn out by Jupiter and about 60° for those made when the stretched moon flattens out again. Sure enough, the authors report, many of the intersections are at those angles.

The circles that work best are centered about 20° south and 10° east of the present Europa-Jupiter line, suggesting that other forces may have shifted the satellite's orientation slightly since its early history. Also centered there are radial and concentric fractures that could well have accompanied the same deformation. The episode probably happened long ago, the researchers believe, when Europa's still-warm interior would have let it deform more in response to Jupiter's pushing and pulling.