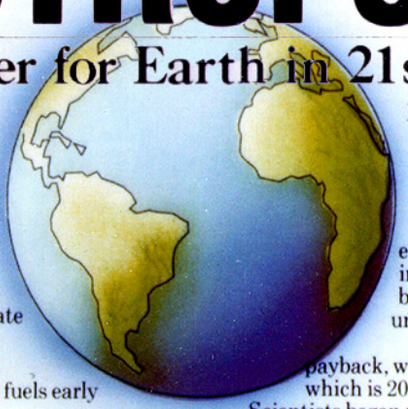
MAGIC OF ASTROFUEL

Moon-mined atoms may provide power for Earth in 21st century



A new form of fuel

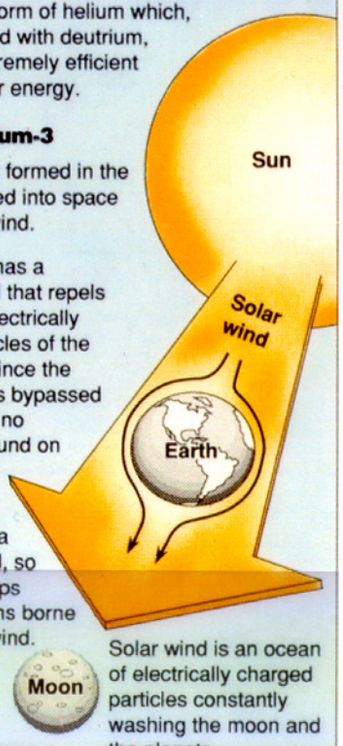
When American astronauts brought back the first samples of moon soil and rock, geologists discovered helium-3 locked inside them. Helium-3 is a very rare form of helium which, when combined with deutrium, creates an extremely efficient form of nuclear energy.

Finding helium-3

1 Helium-3 is formed in the sun and carried into space by the solar wind.

2 The Earth has a magnetic field that repels most of the electrically charged particles of the solar wind. Since the solar wind has bypassed Earth, almost no helium-3 is found on our planet.

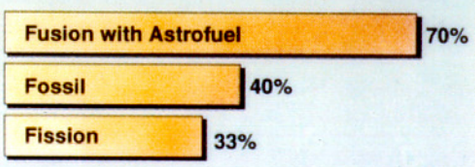
3 The moon doesn't have a magnetic field, so its surface traps helium-3 atoms borne by the solar wind.



Solar wind is an ocean of electrically charged particles constantly washing the moon and the planets.

Fuel efficiency of power sources:

The amount of energy for conversion into electricity from fusion with astrofuel is approximately twice the amount available from coal and oil plants (fossil) or from atomic reactors (fission).



■ It is estimated that the moon contains 1 million metric tons of helium-3 -- more than 10 times the energy contained in economically recoverable fossil fuels on Earth.

Source: NASA, University of Michigan

By Hugh McCann
News Staff Writer

Capturing a piece of the sun is an ancient dream of man. Modern scientists think bringing it back to terra firma is the ultimate solution to the energy problems of an Earth scheduled to run out of nonnuclear fuels early next century.

The idea is sound in principle but not in practice. So, the next best thing is to conjure a miniature sun in the laboratory, which is what nuclear-fusion researchers around the world have been trying to do for 37 years.

Fusion energy is the reverse of fission energy, the current method of generating atomic power. While fission energy comes from splitting atoms, fusion energy comes from crowding, or fusing, atoms together under immense heat. It is the process at work in the sun and the stars.

Despite the expenditure of $20 billion on experimentation, the world is still an estimated 30 to 40 years away from bringing commercial nuclear-fusion power plants on line.

Gerald Kulcinski, a University of Wisconsin nuclear engineer, is convinced that success can come in half the time if scientists turn to helium-3. An extremely rare gas on Earth, it would have to be mined on the moon.

"Astrofuel," Kulcinski calls it.

Helium-3 is a very rare form of helium.

Kulcinski proposes a colony of astronauts and robot miners dig for helium-3 atoms in the lunar surface.

Nations could afford to pay as much as $1 billion a ton for moon-mined helium-3 in exchange for commercial fusion power 20 years sooner, he says.

The National Aeronautics and Space Administration "is very, very interested in this," he says, "mainly because it gives them a reason to go back to the moon."

When American astronauts brought back the first samples of moon soil and rock, geologists discovered helium-3 locked inside them. Unfortunately, Kulcinski says, in 1970, they couldn't think of a single practical use for it.

But fusion scientists have long been aware of the boost that helium-3 could give their investigations.

For almost four decades, fusion researchers have concentrated on reacting two rare forms of hydrogen deuterium and tritium. Kulcinski would react deuterium with helium-3.

"One of the great advantages," he says, "is that once it can be ignited, the development path to a commercial unit should be much easier."

He estimates that the moon contains 1 million metric tons of helium-3. "This is over 10 times more energy than that contained in economically recoverable fossil fuels on Earth," he says. "For every unit of energy you spend going to the moon, mining it and bringing it back down, you get 250 units back."

Compare that, he says, to coal's payback, which is 16 to 1, and to uranium, which is 20 to 1.

Scientists began mimicking the sun's immensely hot, gaseous interior in 1951, when they started fusing atoms of hydrogen. The goal of fusion experiments is to create in a laboratory the conditions that exist in the continuous, controlled explosion of a mini-hydrogen bomb.

Atomic theory suggests fusion reactors would be safer and less objectionable environmentally than the 370 fission reactors operating worldwide. Also, there is the potential for immensely increased power: Fusion is to fission as an H-bomb is to an A-bomb.

Helium-3 dramatically escalates fusion potential: Ninety-nine percent of the energy it releases is not radioactive, and the electrified particles it creates can be directly turned into electrical current, Kulcinski says. Without astrofuel, the fission process must generate power in four steps: Reactor heat boils water and turns it to steam. The steam drives turbines that generate electricity.

"The impact of such a lower electricity cost applied to the U.S. alone for 1987 would mean roughly a $30 billion savings to consumers," Kulcinski says.

He says researchers could use helium-3 obtained from the byproducts of hydrogen-bomb manufacture, which generates enough of the gas to run a demonstration plant for several years. "This could be done without ever having to leave the Earth for fuel."

Ideally, this would occur before the Earth's oil, gas and other fossil-fuel energy sources were exhausted. "The next major question is, 'can we get the helium-3 fuel from the moon on a time scale consistent with our development path?' " he says.

Kulcinski says an analysis of rock samples brought back from the moon by Apollo 11 astronauts in July 1969, confirmed that a region of the moon called the Sea of Tranquility contains more than 8,000 metric tons of helium-3 to a depth of about six feet."

He calculates that 20 metric tons of condensed helium-3 would fit in the cargo bay of one U.S. shuttle craft. When burned with deuterium, he estimates, it would provide as much electrical power as the United States will consume in 1988.

Helium-3 is formed in the sun and carried into space by the solar wind, an ocean of electrically charged particles constantly washing the moon and the planets.

Because of a magnetic field that repels the solar wind, the Earth's crust contains very little helium-3.

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Mining for helium-3 on the moon

It is proposed by scientists that a colony of astronauts and robots dig for helium-3 atoms in the lunar surface. Here's a look at how helium-3 would be mined on the moon.