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Is *MOON*'s sci-fi vision of lunar helium 3 mining based in reality?

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What if we found a clean, abundant resource that could provide the lion's share of the world's energy needs? How far would we be willing to go to get it?

That's the question posed—in both a moral and a logistic sense—by the new sci-fi film MOON, directed by Duncan Jones (the son of musician David Bowie), which opens in New York City and Los Angeles this week.

The movie's protagonist—and essentially the only character who ever appears on camera—is Sam Bell (played by Sam Rockwell), a man nearing the end of a three-year contract staffing a moon base devoted to mining helium 3 for use back home. In this not-too-distant future, nuclear fusion of helium 3, a light isotope of the familiar element, supplies 70 percent of the world's energy, and bases such as Sarang, on the far side of the moon, keep the reactors fueled. (In reality, productive fusion of any kind for energy generation has proved elusive, with the international ITER project recently experiencing setbacks.)
His only companion at the Lunar Industries base is a HAL-esque machine, an intelligent but distinctly non-humanoid robot called Gerty (voiced by Kevin Spacey). Bell's lonely predicament aside, the prospect of a relatively nearby source of clean fuel would be awfully appealing, were it real.

As it turns out, the film depicts a vision quite close to what some researchers describe as a powerful—if extremely difficult—solution to our energy woes.

Gerald Kulcinski, a nuclear engineer and director of the Fusion Technology Institute at the University of Wisconsin–Madison, has been researching the possibility of mining the moon's helium 3 for decades. He is, along with Apollo 17 astronaut Harrison Schmitt, one of the concept's most prominent advocates. (Schmitt wrote an article for Popular Mechanics in 2004 that describes a harvesting operation much like the one Bell manages at Sarang.)

The lunar surface, Kulcinski says, should indeed be loaded with the isotope, which is in the solar wind, the stream of charged particles from the sun. It is scarce on Earth because the planet's atmosphere and magnetic field largely deflect the brunt of the solar wind, but the moon is far less protected. "The only thing that's close to the sun that has neither an atmosphere nor a magnetic field is the moon," Kulcinski says. And samples from the Apollo program show elevated levels of helium 3 compared to the puny amounts available on Earth. Kulcinski estimates that there are a million metric tons of helium 3 embedded in the outermost layer of the moon's crust.

What is more, it could prove very valuable as a nuclear fuel—just 40 metric tons would power the U.S. for an entire year if the fusion process could be perfected, Kulcinski says. Perhaps more important, the isotope itself is not radioactive, and the products of its fusion would be much cleaner than the nuclear waste generated by today's fission plants.

But the holy grail of such clean energy research, fusing helium 3 atoms together to produce ordinary helium 4 and energetic protons, is no easy task. "Nature being as it is," Kulcinski says, "it made that reaction very difficult." The Wisconsin campus has a small-scale reactor that consumes helium 3, but Kulcinski notes it is a long way from breaking even on the energetic balance sheet—that is, the reactor consumes far more energy than it produces.

The disparity is enough to lead some skeptics to swear off the proposal entirely. In a 2007 article for Physics World, theoretical physicist Frank Close of the University of Oxford dismissed the "clean" fusion of helium 3 with helium 3 as slow and requiring prohibitively high temperatures. On top of that, he said, estimates of the moon's reserves of the isotope are purely hypothetical. "The lunar helium 3 story," Close wrote, "is, to my mind, moonshine."