A new energy source for a fraction of the cost?

The SunCell could transform energy production as we know it — but will it work?

By Bennett Daviss
CONTRIBUTING EDITOR

For 25 years, Randell Mills has been quietly preparing to end the Fossil Fuel Age. Now he's ready.

On Oct. 26, 2016, he gathered his team of scientists, engineers and manufacturing partners at his lab in a suburban smear of industrial and office buildings outside of Princeton, New Jersey. They revealed the latest version of his technology, and plans for its commercialization beginning in 2017, to a select group of colleagues, investors and potential customers.

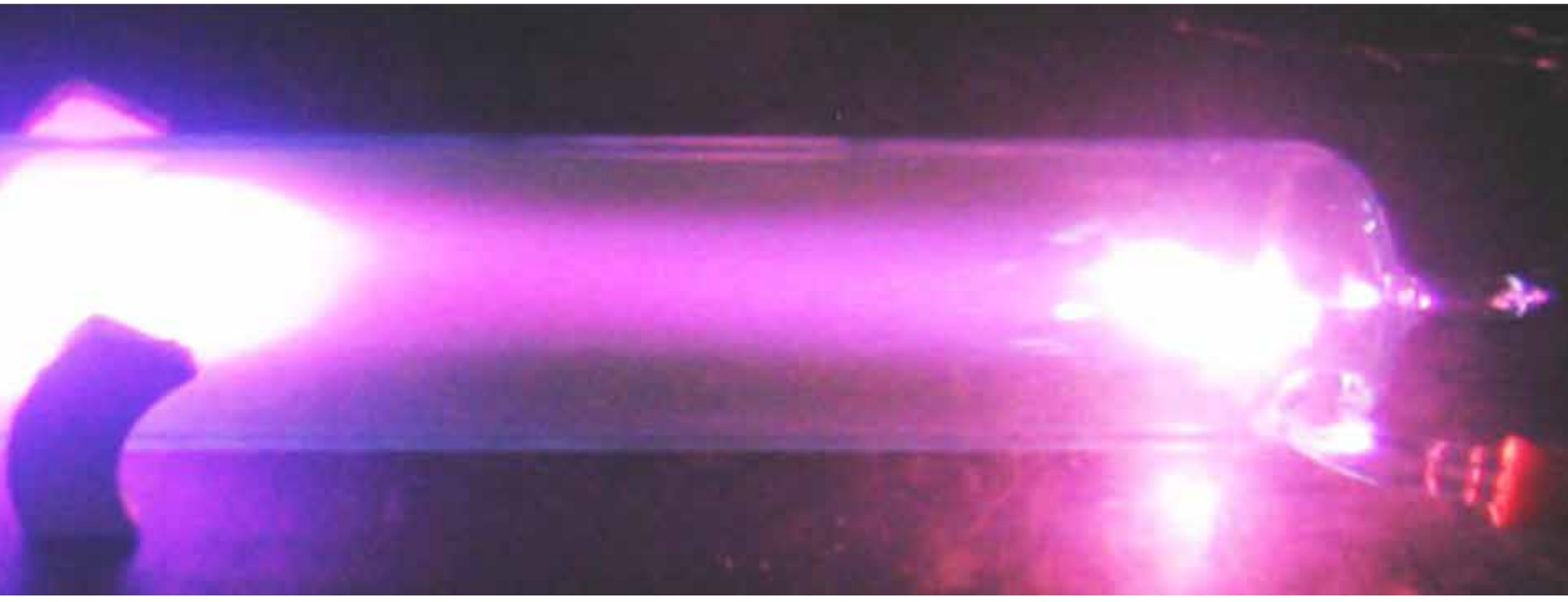
He calls his device the SunCell — because, he claims, it yields the power of a thousand suns contained in a small device. The SunCell uses no exotic or rare elements, consumes only purified water and emits no noxious waste or greenhouse gases.

The result: Electricity generated at a cost of less than a tenth of a cent per kilowatt-hour — literally hundreds of times cheaper than most oil, coal or renewable electricity sources. The SunCell has no moving parts and a projected life of at least 20 years without major maintenance.

Even more exotic, the device will run on water pulled from the atmosphere and, once the energy-yielding reaction has begun, can sustain itself indefinitely.

Mills sees his SunCell powering oil tankers and your family car, making electricity in giant factories or your basement.

As unlikely as all this sounds (or preposterous, as some would say), his process has been validated by



Plasma directed by magnetic force.

Wikipedia

almost a dozen independent chemists, physicists and engineers who trekked to his lab dozens of times over the last 15 years.

INSIDE THE SUNCELL

A SunCell looks like a globe atop two thick, squat pedestals connected by some pipes and hoses to a car's radiator. Hydrogen taken from water is injected into the globe's cup-size interior chamber. Molten silver also is injected as an accelerant, along with a compound that supplies oxygen to form a catalyst.

In a proprietary process, a low-voltage electric current passes through the chamber to create a mix of hydrogen atoms and water molecules. That sets off a blinding, brilliant plasma, the intensity of which has been measured at well over 1,000 times the brightness of the sun and can reach a temperature of 6,000 degrees Kelvin.

Brilliant Light Power

An earlier version of the SunCell. A commercial prototype is now being tested.

The plasma's light ultimately is picked up by "concentrator" solar cells capable of operating with light 2,000 times more intense than that of the sun. The solar cells surround the globe's dome and convert it to electricity.

The heat not converted to electricity is drawn off and vented. A recovery system collects the vaporized silver and reconstitutes it for reuse.

For more than 15 years, Mills and his team have doggedly tackled and resolved a steady series of engineering challenges. For example, it took years to fabricate a system that could handle the reaction's heat. They tested various materials from which to make the chamber and electrodes, but each melted or vaporized. Not even tungsten, with the highest melting point of any metal, could withstand the temperatures.

After more than a dozen trials, the group found a carbon material that could contain the reaction. They also eliminated electrodes in favor of an injection system.

PHYSICS PROBLEM

So where does all this energy come from?

It's liberated, Mills says, from hydrogen atoms when hydrogen's single electron is hugged closer than normal to the atom's nucleus. Mills has dubbed these shrunken hydrogen atoms "hydrinos" (hy-DREE-nose).

When an electron's orbit shrinks, startling volumes of energy can be released. And that's the sticking point for most scientists: Mills' claim violates modern physics' fundamental assumption that an atom's electron can't fall below what's called its ground state.

Electrons are envisioned as a cloud of negative charge surrounding the nucleus. An electron cloud can absorb energy, perhaps from heat or light, and physically move farther away from the nucleus the way a balloon expands when more air is put into it. The electron also can lose that extra energy and settle back to its original orbit, known as its ground state.

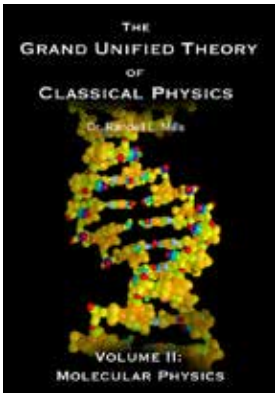
Modern physics, also known as quantum physics, asserts that an electron can never fall below its

By giving the energy industry's centralized old guard a stake in this new, distributed technology, Mills hopes to defuse fossil-fuel forces' impulse to obstruct his advance.

ground state. One physicist said that would be "like walking south from the South Pole" — physically impossible.

But the idea that a ground state is an electron's rock-bottom energy level has never been proven, either mathematically or experimentally. Like other building blocks of quantum theory — which is based as much on mathematical theory as on observation and measurement — it was assumed to be true because that made building the rest of the mathematical and theoretical framework so much easier.

Mills already was dissatisfied with that idea by the time he got to MIT. After graduating from Pennsylvania's Franklin and Marshall College with a straight "A" average (except for one A- in a freshman writing course), he enrolled in Harvard University's medical school. He completed the coursework in three years, but was more interested in inventing than in practicing medicine. He asked Harvard if he could spend his fourth year down the street at MIT, taking courses in electrical engineering. Harvard agreed.



Mills has written a three-volume treatise to explain how classical and quantum physics can be unified.

Brilliant Light Power

NEW MATH

One of his professors at MIT was Hermann Haus, who was working on development of a "free electron" laser for the US military. To build the laser, Haus had to understand how electrons behave and why. But quantum physics was too vague on these points to give him firm answers. So Haus invented a mathematical tool that allowed him to pinpoint electrons' behavior based on physical principles and laws, instead of pure mathematics and conjecture.

Haus showed his work to Mills, who recognized immediately that re-characterizing the electron in terms of its observable physical properties — using the tools of old-school classical physics, not quantum theory — held the power to revolutionize science.

After graduating from medical school in 1986, Mills worked on his ideas for a new form of medical imaging and a novel approach to radiation treatment for cancer. In 1988, Mills' imagination was captured by breakthroughs in superconductivity — methods of transmitting electricity over long wires with no resistance or loss of current.

As Mills tried to apply quantum theory to understand superconductivity, he became more and more frustrated with the theory's imprecision. He decided that quantum theory was "just made-up garbage" and set out to unify the useful, verifiable parts of quantum mechanics with the tools and methods of classical physics.

The result was a three-volume work, the last of which is titled *The Grand Unified Theory of Classical Quantum Physics*. But, partly because Mills' college degree is in medicine and not physics, his ideas largely have been ignored or dismissed by academics.

The book's publisher is BlackLight Power, Inc., the entity that Mills formed to pursue his idea of hydrogen as a new source of energy. The name comes from the fact that expanded research in space science in the 1990s added new observed energy levels to hydrogen's spectrum. Mills' unique theory had predicted the existence of these specific wavelengths outside of the range of the visible spectrum — "black light."

His engineering results, if not his theoretical ideas, have been confirmed by a range of independent physicists, chemists and technical experts. At the October 26 gathering, Dr. Peter Jansson, a professor of computer and electrical engineering at Bucknell University, summarized the results of his own evaluation and those of three independent reviewers who visited Mills' lab this year. Each was there at different times.

The four applied a range of standard tests in calorimetry — the process of measuring changes in heat — and spectroscopy. In all tests, the evaluators calculated the amount of power the SunCell used and the amount it generated. Jansson noted that each reviewer was allowed to observe every aspect of the SunCell's test runs and given full access to all resulting data.

In one test, Jansson, who holds a Ph.D. from the University of Cambridge and specializes in technologies of electrical power production, measured 8,020 watts of electric power going into the cell and 521,000 watts coming out. That's a 65-fold gain. In a second run that lasted more than 30 minutes, the cell used 10,450 watts and delivered 1,560,000 watts. Jansson refers to it as "a million watts of power deliv-

ered in a space the size of a coffee cup."

If all chemicals used in the reaction were converted to energy in their most powerful forms, Jansson notes, the result would be two one-hundredths of a percent of the power he measured coming from the SunCell. "Clearly, some novel energy transformation is taking place," he says.

Jansson isn't alone in his findings. Dr. Joseph Renick, a specialist in measuring explosive forces for the US military, measured energy gains of 86 times the power used and 271 times.

"Sometimes you worry about calorimetry tests because there are so many ways" for them to go wrong, Renick says. "But, in this case, we're not looking at variations of 1 or 2 percent, but thousands. The results are undeniable and unexplainable according to any conventional understanding of physics or chemistry."

In seven separate tests, Dr. Kandalam Ramanujachary, a chemist at Rowan University, saw power gains ranging from 27 times to 538 times, with highs of 988,000 watts and 1,567,000 watts coming from the device. If all the chemicals used to create the reaction had been converted to energy, he notes, the results would have yielded less than 19 watts.

In his three tests, Dr. Randy Booker, a physicist at the University of North Carolina, found similarly startling results. One of his trials recorded a 637-fold energy gain, delivering 3.2 million watts from barely 5,000 watts used to begin the reaction.

Doesn't the wide variability — some would call it inconsistency — in the amount of power gained indicate some flaw in the measurements? Not at all, says Mills, noting a gasoline engine will vary in its power output depending on weather, quality of the fuel used and other variables. The point, he adds, is that the SunCell consistently delivers far more power than it uses.

These reviewers' findings reflect those of others. In 2010, GEN3 Partners, a Boston-based technology-development firm, contracted with a research team that used equipment at Harvard University's Smithsonian Center For Astrophysics to test Mills' technology. The company reported that it had "identically [and] independently" reproduced Mills' results "and could find no conventional explanation for the emission of... light from hydrogen in this very high energy region" of the spectrum. "We believe that this confirms hydrino emissions."

TO MARKET

To celebrate the shift from development to a commercial business — and the culmination of 25 years of work and $110 million in investment (all from private individuals and unnamed corporations; no government or military money, Mills notes) — Black-Light Power has been rechristened Brilliant Light Power, Inc. The business plan calls for a commercial device to enter the market in late 2017.

To reach that goal, Mills has enlisted two high-powered manufacturing partners. Masimo Semiconductor, with 30 years' experience in solar-power engineering, will design the concentrator photovoltaic system that surrounds the reaction chamber. Columbia Tech, which has worked for major companies in a range of industries, will design the sensor and control systems, manufacturing process, and produce prototypes and up to 100,000 commercial units per year.

Columbia will deliver the first working prototype of a 100,000-kilowatt device in the first half of 2017. By late in that year, it will produce around 10 units that will be beta-tested by commercial partners such as big-box retailers, telecommunications companies and other heavy users of electricity.

Brilliant Light also has an agreement with a truck manufacturer to develop SunCells for buses and heavy-duty freight trucks. Units capable of producing 15,000 kilowatts to power homes should be available in 2019.

Brilliant Light will own the units, leasing them to users directly or through distributors. Wisely, the company has decided to open its network of distributors to all comers, including public utilities and fossil-fuel companies. By giving the energy industry's centralized old guard a stake in this new, distributed technology, Mills hopes to defuse fossil-fuel forces' impulse to obstruct his advance.

The company expects to reveal its SunCell technology to the world in a public announcement later in 2017, possibly followed by a public stock offering — partly to give money abandoning fossil-fuel investments a new place to go. TJ

TREND FORECAST

Even if the SunCell technology and business plan work, ExxonMobil won't be closing up shop any time soon. It likely will take decades to dismantle the fossil-fuel economy. Also, oil and coal industries' lobbyists and hired politicians will scramble to find legal and regulatory ways to protect their patrons' interests.

Still, Mills' SunCell technology has progressed farther and endured longer than any other advanced technology proposed to supersede fossil fuels. It leads the pack of exotic energy technologies vying to create a green economy.