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## Made in Washington: Infinia: Energy technologies that will change the world

by Paul Schlien

Big things are happening at Kennewick's Infinia Corp. Located near Kennewick's Vista Field Airport, this small energy technology company is developing products that could profoundly change our world for the better.

Infinia's roots are in the intellectually fertile world of University of Washington technical research. The company was founded in 1985 by former employees of UW and the Pacific National Laboratory (the precursor to the Pacific Northwest National Laboratory) who developed a power system for an implanted heart assistance device.

The new heart device required a reliable power source that would run for decades with no maintenance. Research led to a 200-year-old technology—the Stirling engine. Invented by Scottish clergyman Robert Stirling in 1816, Stirling engines are closed cylinders that contain a piston fueled by a working fluid—most often helium, nitrogen or hydrogen gas. Heated on one end and cooled on the other, the gas expands as its heated and contracts as it cools, driving the piston back and forth. The movement of the piston drives a generator, producing electricity. The concept was perfect for the heart device.

Later, Infinia continued to refine the Stirling engine technology for other uses. The company also developed the Stirling cryocooler, which reverses the Stirling cycle and can maintain temperatures as low as minus 442 degrees Fahrenheit.

In space and on the ground  
Infinia's work did not go unnoticed. NASA saw potential applications for Infinia's highly reliable, maintenance-free generator. With no wearing parts requiring lubrication, the Stirling engine seemed tailor-made for NASA's next generation of onboard power systems for deep space exploration.

"Infinia worked on a modest sized development program with NASA back in the late 1990s and early 2000s," recounted J.D. Sitton, Infinia's chief executive officer. "NASA wanted to find a generation technology four times as efficient as their existing technology, and got very serious about expanding its deep space exploration budget. We did some initial studies with NASA and did an early prototype build. NASA was sufficiently convinced that the technology was mature enough to turn it into a formal program."

2006 was the planned delivery date for the generator, which utilized radio isotope fuel. Unfortunately, NASA shifted its budget from deep space exploration back to development of the next version of the space shuttle. NASA told Infinia it wouldn't need deep space power systems for about 10 years.

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"Infinia got all the way through the tough parts of the space flight qualification activity, so we look forward to an actual launch of our product," said Sitton.

Although Infinia's ascent into space exploration is on hold, its entrance into the growing national security market is fully under way. National security agencies were also impressed with Infinia's technology.

"It's easy to imagine how national security agencies could use a power source that can be deployed anywhere on the planet, attaching a communications pack to it, and never having to replace batteries or do anything else to it," Sitton said.

Infinia's technology also holds the potential to revolutionize residential power and heating.

Producing electricity creates waste heat. Combined heat and power systems, which are common in Europe and Asia, generate electricity while using waste heat for drying clothes, cooking food, and heating water and interior spaces. CHP systems are significantly more efficient. Lower fuel consumption means decreased energy costs and greenhouse gas emissions.

Infinia's Stirling generators, with their quiet, zero-maintenance operation, ability to operate at partial loads, and extremely efficient heat recovery are perfect for small CHP applications. Infinia is currently working with several technology partners to launch this promising new product.

"Those CHP products will roll out in Europe in the middle of next year," said Jim Clyde, Infinia's vice president of marketing and business development. "Our partners are the German firm Bosch; Rinnai, a Japanese company; and the ENATEC, a Dutch energy consortium."

Infinia is also working with the U.S. Army's Natick Soldier Center to bring the advantages of CHP systems to military field kitchens. Noisy diesel generators will become a thing of the past while operating costs and emissions will be greatly reduced.

**Rays of the sun**

A more dramatic and potentially far-reaching application of Infinia's technology is the marriage of Stirling generator technology with solar power. In 2005, Infinia connected a one-kilowatt Stirling generator to a solar concentrator, using the rays of the sun to power the generator.

This proof-of-concept system demonstrates the feasibility of the next phase of the project—a three-kilowatt design they call the Solar Stirling Product. It will generate electricity with far greater efficiency and economy than the photovoltaic solar energy systems on the market today—double the amount of electricity produced by current equipment.

Since the Solar Stirling Product gets its power from the sun, no greenhouse gases or other pollutants are produced.

"Every megawatt of capacity we install is the equivalent of 1,867 tons of carbon dioxide, seven tons of nitrogen oxide and 11 tons of sulfur dioxide that would have gone into the atmosphere from other generation sources," Clyde said. "This is quite substantial, relative to global warming."

And since there are no harmful chemicals used in the production of the Stirling Solar Product, it can be recycled when it reaches the end of its long life.

While the Solar Stirling Product can be used for on-grid power generation, Infinia primarily envisions it for off-the-grid use in both residences and other buildings.

"We're going to take our solar power system through two rounds of field trials, starting in the late winter or early spring into summer," Sitton said. "I expect to launch the product in November 2008."

Infinia is also taking its technology to developing countries. Working with Iqbal Quadir, the founder of Bangladeshi cellular provider Grameenphone, Infinia is

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preparing to deploy a one-kilowatt Stirling generation system—fueled by cattle manure—to power rural villages that have no other electricity source. Waste heat would be used for drying crops and cooking food. Eliminating the need for expensive power-line connections to an electrical grid, the plan holds great promise for raising the living standards of rural villagers in developing countries.

Looking ahead, the company foresees two primary revenue streams: One from their three-kilowatt solar generation system in a burgeoning \$11-billion-a-year market, expected to increase to \$50 billion within five years; the other derived from European and Asian royalties associated with Infinia's CHP systems.

Infinia's growth is also a success story for the Tri-Cities, which has long worked to attract businesses unrelated to the Department of Energy's Hanford Site cleanup and thus not susceptible to the boom-and-bust cycles seen throughout that facility's history.

Sitton, who came to Infinia from Houston in 2002 after many years of working in energy industry startups, sees the advantages of the Tri-Cities.

"We have access to excellent employees here," Sitton said. "We've got a very educated workforce. We have access to all kinds of talent out of PNNL, which is a wonderful thing for a small company like ours. We have a low cost of living, a moderate climate, and it's a good place to raise kids."

While Sitton is pleased with state policy-makers' support for Infinia, he would like to see them do more to recruit companies that could supply talent for Infinia.

"We expect our first increment of production to be in the Tri-Cities," Sitton said. "We'd like to see the state be able to put some capital into play to help recruit some vendors. The closer we can be located near and integrated more tightly with the people who make pieces and parts for us that we then assemble into systems, the better."

Recently, Sitton traveled to Budapest, Hungary, to speak at the European Energy Roundtable, a prestigious gathering that brings together major technology investors with up-and-coming firms. Infinia is already attracting high-powered venture capital investment from such players as Paul Allen's Vulcan Capital, Khosla Ventures, Idealab, Equus Total Return, and Power Play Energy.

"We're growing rapidly, and that takes capital," said Clyde. "We're very pleased with the breadth and depth of the people who joined us in investing."

Infinia's star is clearly rising. With solid backing, talented people, good ideas and the ability to bring it all together to create marketable products, this is one company to watch as it changes our world.

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