SiliconIndia

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Power Play

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K.R. Sridhar has a vision. In fast-developing nations like India and China, cell-phones have enabled whole regions to leapfrog industrial-era phone technology with its expensive grids of landlines. Thus, remote provinces of these countries have made a first step towards going directly from impoverished agrarianism to the 21st century's information age. Now, Sridhar believes, a similar transition is achievable in the realm of electric-power generation.

And it's not just the developing world, says Sridhar, which needs to move to this new model of distributed generation of electricity. "The model of power generation we currently have in America is one we've inherited from Edison and the Industrial Revolution," he points out. "The socioeconomics of the Depression, when America's rural areas were electrified, reinforced this model of large power plants at the center of a massive grid. We desperately need to move on."

Today, Sridhar explains, 10 percent of America's electricity supply is "premium power." In other words, the burgeoning digital infrastructure of American civilization — its millions of servers, workstations, storage devices,

switches, routers, embedded devices and plain old PCs — requires power uninterrupted by outages and hiccups, with “clean electrons” coming in consistent voltage waveforms. Furthermore, U.S. needs for such premium power are exploding.

“Salamon Smith Barney’s trading floor in Manhattan now uses 8.5 megawatts of premium power daily,” Sridhar says. “That’s the same amount of power as 100,000 homes or a small city. Here in Silicon Valley, Sun Microsystems uses 26 megawatts and would lose $50 million for each hour of downtime from power disruptions.”

Still, given forecasts that premium power will account for 50 percent of U.S. electricity needs in 2010 and warnings that our industrial-era grid can’t supply it, where will this power come from?

“As we did with telecommunications and the Internet, we need to move to a distributed model of generation,” Sridhar says. He does not believe that the old power grid will be junked — after all, it’s still a vast, valuable infrastructure. But he notes that a growing number of offices, plants and businesses are now placing power-generating systems on their premises. This trend will continue, he says. Electrical supply will be reengineered and supplemented from the bottom up, leading to its progressive decentralization as, dragged along by the demands of the Web, it mimics the Web’s architecture. “With energy deregulation over the last few years, there’s anyway a lack of incentive for a business to build a utility since they won’t make their money back by having a monopoly on it,” says Sridhar. “The main driving factor, though, is simply that technology advances.”

The technology Sridhar is betting on as distributed generation unfolds is his design for a solid oxide fuel cell with a proton exchange membrane, capable of generating 100 kilowatts. Each unit will be slightly less than minivan-sized, with customers buying one or many of these modular-type units, as they require.

Sridhar continues to teach at the University of Tucson as associate professor of aerospace and mechanical engineering. That is, of course, when he’s not at his Silicon Valley home, where he lives with his wife and their 4-year-old son while maintaining his relationship with NASA Ames Research Center in Mountain View. For NASA, Sridhar and his research team have created what they call an Oxygen Generator System, or OGS, which can convert the carbon dioxide that predominates in Mars’s atmosphere into oxygen. The generator is

eight inches tall, somewhat resembling a dome-shaped, silver metal hat for a small man. Yet Sridhar sees a big future in this relatively modest-looking object.

“If human beings are going to live in space, we’ll eventually have to survive there on what’s available to us,” he says. “What’s exciting to me about the OGS is that it represents the first time that humans have been able to make something we can use out of what will be available to us beyond Earth. That means that instead of the backpacker mode, as I call it, which we’ve had ’til now, humans will be able to live off the land on Mars. That’s a big step, like the first time human beings made fire.”

Born in 1960, Sridhar was an eight-year-old in Chennai when Apollo 11 landed men on the moon and confirmed his desire to be a scientist. Sridhar’s desire was fed by his teachers at school in Madras, by his professors at the Regional Engineering College in Tiruchirapalli, and in America at the University of Illinois at Urbana-Champaign, where he studied under B.T. Chao and obtained a doctorate in mechanical aerospace engineering.

“I always wanted what I did to have an impact,” Sridhar says. For a long time, his dream was to make that impact by aiding NASA’s advance into space. Having achieved that at 40, he’s now turned his attention back to Earth. “All the technology I’d accomplished with my group for NASA is completely built, waiting for a ride to Mars. The next project we were awarded potentially wouldn’t have flown for another decade. So the fuel-cell project is something totally down to Earth, the opposite of my NASA project.”

Sridhar pauses. “I have aging parents — in fact, my father’s 82 — so I’ve started returning to India at least once every year. Initially, after you’ve been in America and you return, you’re frustrated because you know how things could be. As years go by, though, you start appreciating what Indian culture has — the close-knit families, people’s humaneness despite meager means, and their willingness to help when help is needed. You realize these are great values.

“So I’m proud to have been from there,” Sridhar concludes. “Also, while the frustrations of the developing world still exist, what’s amazing are the advances over the last 15 years. When I go back now, I see how quickly India

is transforming itself.” Indeed, if Sridhar’s new dream works out, he could have a big impact on that transformation.

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