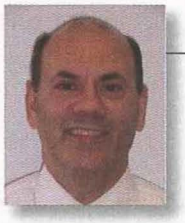

By Peter M. Curtis

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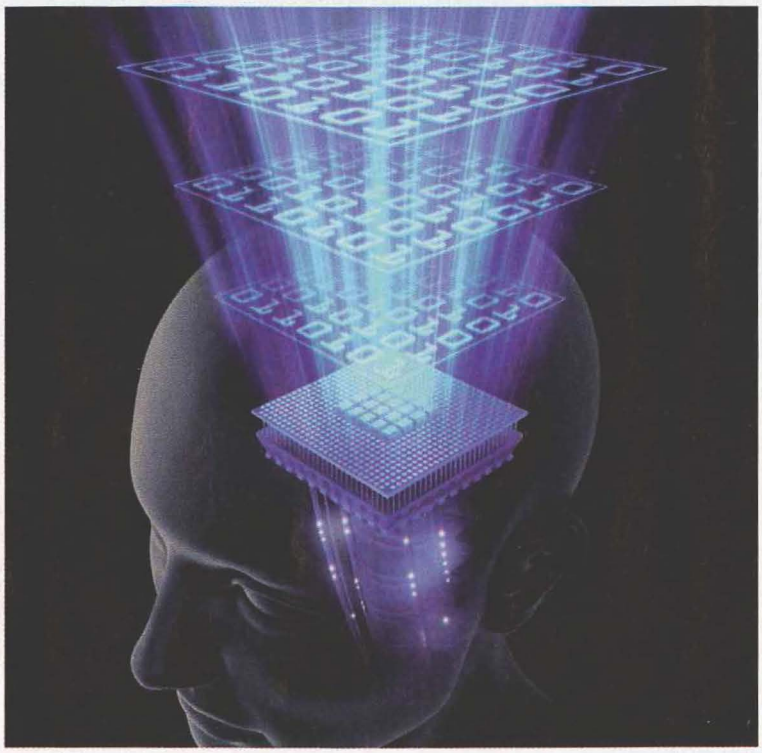
The Demand for Power

Transitioning into the next phase of clean, secure, reliable energy delivery for our digital society

Corporate and global environments have changed vastly over the last couple of decades. The mission-critical industry requires new energy solutions to protect and secure critical infrastructures. To achieve the design intent of more resilience, the industry needs to think outside the box. We must not be confined to yesterday's solutions in addressing today's more diverse and more complex needs. To safeguard our critical infrastructure, while also improving business sustainability and protecting our environment, we need to revisit solutions such as integrating distributed generation into the mission critical energy model.

We must not be confined to yesterday's solutions in addressing today's more diverse and more complex needs.

By incorporating distributed generation at strategic critical locations, we can create independence from aging power infrastructures and sustain critical loads and our digital society indefinitely without stressing the power grid further. In the interim, the power grid can continue to support its original loads: lighting, manufacturing, and convenience power.



The world uses approximately 8000 gigawatts of energy on a peak day. Approximately 10 percent of that energy powers and cools critical infrastructures and other digital loads. Analysts predict significant growth rates in power requirements by 2010, given the increasing power density of processors and servers.

Over the next couple of decades, improving business resiliency will require integrating distributed generation into the mission critical energy model. Microgrids could play an important role in transitioning existing critical infrastructures. If a critical event takes down the national grid, the critical infrastructures would be insulated from these events and national security would be safeguarded.

A microgrid is a collection of generators or alternative energy sources such as microturbines, fuel cells, and photovoltaics, which creates a small stand-alone power network that can run indefinitely, independent of constraints such as fuel oil supplies. Such a microgrid would be immune to outages such as the 2003 Northeast Blackout. These networks are intended to be primary power sources and operate in concert with the grid, thus displacing the high-cost, energy-serving critical load and improving energy delivery efficiency. Taking this concept one step further, point of use generation, when incorporated with high-coefficient absorption chilling, can make large amounts of free cooling, further lowering operating costs. The combined heat and power energy produced from distributed generation also creates far fewer pollutants and greenhouse gases than an equivalent amount of power purchased from the grid.

Incorporating conventional technology with alternative energy solutions will allow the market to test newly integrated microgrids, embarking upon the next phase of distributed generation. Fuel cells or other alternatives

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won't replace conventional systems in the near future but instead will complement existing technology.

As more critical systems come online, microgrids will become a viable alternative in smaller-scale applications ranging from 1 to 20 megawatts. This solution is also ideal for countries having unstable grids or poor infrastructure. In fact, these countries could leap ahead in the technology needed to address today's growing digital power requirements while also addressing their needs for reliable, resilient, clean, and secure power.

Isn't it time to have two types of power: regular and premium, just as we have with gasoline grades for compact and high performance cars?

Incentives may even be available to offset some of the upfront capital and installation costs.

In the rest of the world, Google, Fujitsu, United Technologies, Verizon, Bank of Omaha, and Bank of America, among many others, are currently setting a positive example by incorporating new clean power and alternative power technologies. These companies have instituted environmental stewardship policies and taken leadership and global responsibility in their environmental principles and philosophy.

Incorporating distributed generation in data centers provides a wide range of benefits. Primarily, distributed generation increases reliability bypassing problems associated with the grid. The grid has miles upon miles of exposed transmission lines and transformers that are vulnerable to a wide range of unpredictable elements. Distributed generation's reliability translates directly to more dependable service as long as operations and maintenance are attended to. Furthermore, the use of on-site power generation deceases facility expansion time.

Distributed generation also benefits overall energy efficiency and helps protect the environment. On average, power plants require 2.5 kW of input energy for every 1.0 kW of power produced. There are additional losses as power travels through miles of transmission lines and multiple transformers, leading to power losses of about 67 percent on average. A microgrid with high thermal recovery avoids these inefficiencies, achieving as high as 90 percent efficiency. The building's "carbon footprint" compared to that of equivalent grid supplied power is greatly reduced, as well as are other air pollutants such as nitrogen oxides and sulfur dioxide (SO_2). The end result is clean, reliable, resilient power for the data center and far less drain on society's energy reserves. Microgrids have an excellent opportunity in some cases to take advantage of renewable fuels, further attenuating the consumption of natural resources.

Yes, there's an initial cost, but the cost of energy produced is less than purchased energy. Sure, it takes time to fully amortize such an investment, meaning the burdened cost of power is slightly higher along the way. Yet isn't it time to have two types of power: regular and premium, just as we have with gasoline grades for compact and high performance cars? ■

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www.lbl.gov/Science-Articles/Archive/EETD-microgrids.html