

A Computer Scientist Looks at the Energy Problem

Randy H. Katz

Professor, University of California Berkeley

We describe LoCal, a research project at Berkeley that applies the lessons of the Internet, for building distributed and robust communications infrastructures, to a radical new architecture for energy generation, distribution and sharing. We introduce the concept of packetized energy, stored and forwarded to where it is locally needed, exploiting technology for more efficient energy storage. Like the Internet, quality is achieved end-to-end via protocols over a best-effort, resilient and scalable infrastructure. Distributed management and storage enables dramatic reductions in peak-to-average energy consumption, influencing infrastructure provisioning and investment, and enabling a virtuous cycle of power-limited design. Our architectural building block, intelligent power switching, permits use of diverse, even non-traditional energy storage. Rather than replacing the grid, we overlay it, providing independence from existing generation and transmission systems. Our approach is suited to environments where it is desirable to add incremental generation and distribution, where a centralized infrastructure is prohibitively expensive to deploy as in third world or remote regions (e.g., military or humanitarian operations), or where continued operation in the face of natural disasters is highly desirable (e.g., post-Katrina or post-earthquake disruption of the wide-area energy grid). Management of local demand is also important to dynamically reduce load to remain independent of the grid for as long as possible.