POWER SHORTAGE

The Information Age is rendering the nation's ag electricity grid obsolete and dangerously crisis-prone—with risks to IT potentially more serious any Y2K bug would have been. Trouble is, there i leadership focused on a fix this time, and compa and CIOs are starting to get nervous.

Dr. Roger Anderson
Director, Energy Research Center, Columbia University

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Vice President, Systems Architecture and Technology, Unisys Corp.

Stephen Gehl
Director, Strategic Technology and Alliances, Electric Power Research Institute

California's recent energy woes should be a wake-up call to business leaders and st gists across the nation, says a recently convened *CIO Insight* Roundtable of energy a technology experts. While the rest of the country, they say, appears to be in better s than California, some ominous clouds are already gathering. Supplies in several reg including New York City, are tight. Prices remain stubbornly high in some areas, aff businesses and consumers. In certain Marriott and Hilton hotels, for example, gues being slapped with energy surcharges of between $3 and $10 per night on top of the ular room rates. Some businesses, meanwhile, are facing sharp price hikes over last severe heat wave in the Midwest or along the Eastern Seaboard this summer could those parts of the country into their own power crunch. The breakdown of a few bi plants in one region could cause the lights to flicker in nearly a dozen states.

Whole chunks of the country, in other words, are "walking a tightrope" between sufficiency and outright shortages, says Professor Roger Anderson of Columbia Un sity's Energy Research Center. It's time, experts say, for business and government t to grips with the gap between the growing power demands of the Digital Econom the limits of the nation's decades-old energy grid. But no single player in the chaot world of energy industry deregulation has either the financial incentive or the pol clout to upgrade the lines alone.

Developments in networking technology will help fix things, says energy expert Stephen Gehl—but not for years. Gehl envisions a day when the grid is fully autom and tied to Net-based systems that automatically regulate consumption and pricin

more lights go out and more computers crash.

To discuss the current state of the nation's energy system and the lessons learned from the California crisis, *CIO Insight*'s Executive Editor Marcia Stepanek convened a panel of eight IT and energy scholars, CIOs and consultants. The panelists exchanged views on June 15 in a meeting at the magazine's Manhattan office. For the full text of the discussion, go to *CIO Insight*'s Web site at WWW.CIOINSIGHT.COM. Following are excerpts from the conversation.

CIO INSIGHT: ***Dr. Anderson, you recently wrote that in 1995, there were just 20,000 servers in the world. Today, there are 6 million. Just one new server farm proposed for the economic development zone of the south Bronx, for example, would draw more than twice as much power as the entire World Trade Center complex. Forty-six such developments are proposed for New York City and neighboring Westchester County alone over the next four years, increasing the total electricity demand on Con Edison by 4 percent. Are the electricity demands of the Information Age starting to push the nation's power grid to its limits?***

ANDERSON: The system is crashing. The energy demands of the computer age represent the extra load on the nation's electricity system that wasn't there 10 years ago.

Is this the straw that breaks the camel's back?

ANDERSON: Yes. But the funny part about it? It's not really a power generation problem. There are seven new generators going up here in New York City alone. The big problem is that the nation's transmission grid itself is all messed up. The camel's back in this case is the transmission system that gets the fuel into the power plants and then the electrons out to the consumer. You can argue all day about what causes it, but brownouts are bad, brownouts are happening, brownouts are headed for New York City, and that's the fact. We should all go out and buy batteries.

HURLE: And the scary part of it is that we're not sure what's causing the outages. It's really not the increased demand for electricity that's been causing the problems in California, and I think you can extrapolate that to the rest of the country. It's more the organization and the topology of where the power generation is and how we get that generation out to the consumer.

GEHL: In Silicon Valley, we're at the end of a long distribution line. So we are pretty much at the mercy of everyone upstream of us. Combine that with the fact that we are highly reliant on power imported from other parts of California and other parts of the U.S.

How do we rethink the future of electricity generation, transmission and delivery? If it's not just a question of needing more power, what other issues do we need to address?

ANDERSON: Well, there's nobody in charge of the transmission system. You've got this tremendous increase in complexity with all of the new generator companies throwing power onto the grid and no software or hardware to redistribute it and handle it. It's like an air traffic control system without the Federal Aviation Administration up there running things. Of course, you can put planes in a holding pattern. You can't do that with electricity on a grid. You get these waves of chaos sweeping through the system, and as it gets more and more connected, it's going to get more and more chaotic.

HANDFIELD: In one of the studies we did, we looked specifically at this issue of developing a supply management strategy for sourcing electricity. In fact, there is a process you can use to effectively look at the market, the contingencies [and] the risk factors. There are things you can do in terms of long-term contracts, hedging contracts—agreements that specifically set levels of reliability that you establish in key relationships with providers. And I think the most important thing is to know thyself, to know what your usage pattern is, what things are going to look like in the future. Once you have a baseline of that kind of information, you can set an appropriate strategy to be able to deal with the possi-

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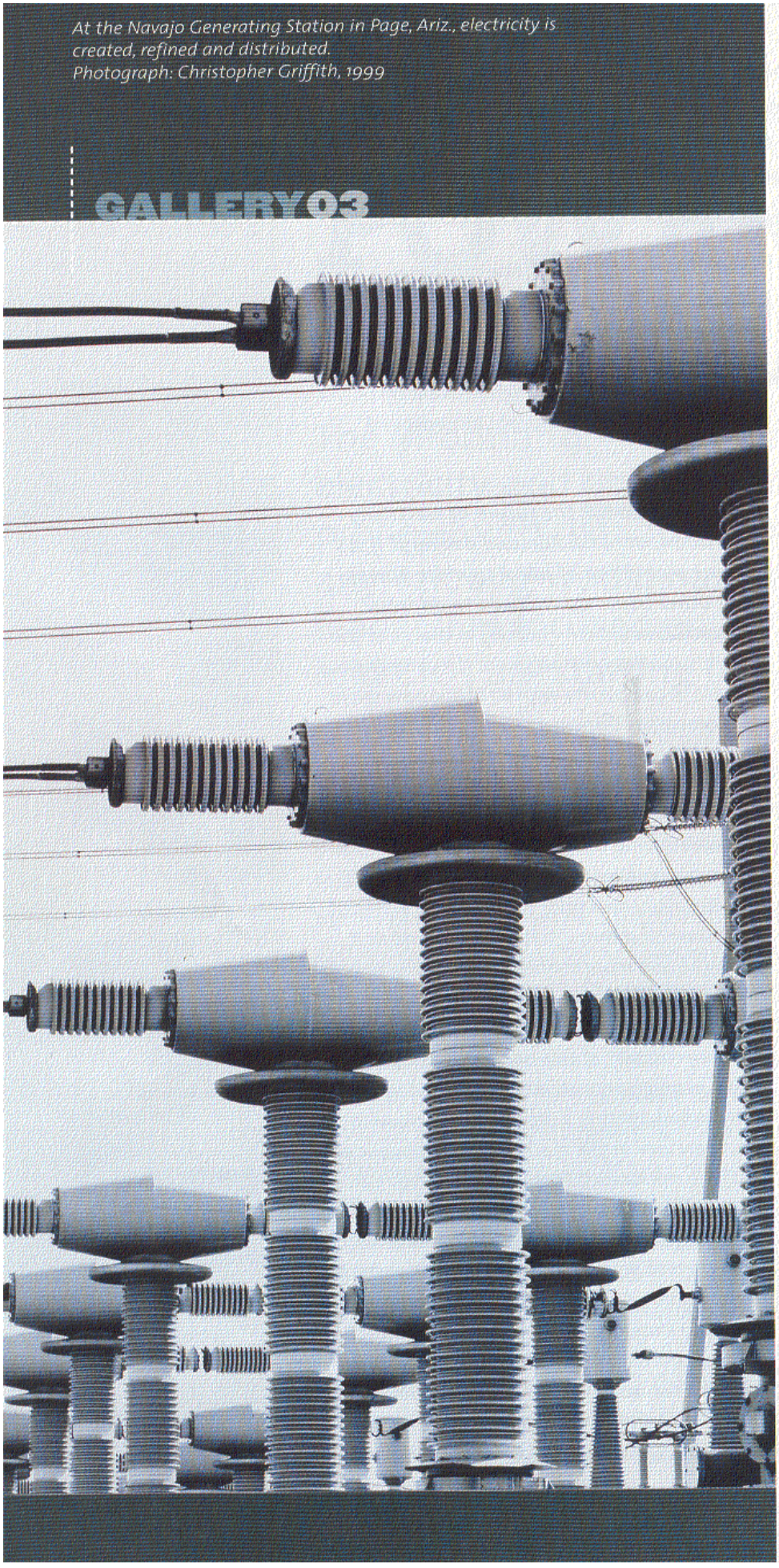

At the Navajo Generating Station in Page, Ariz., electricity is created, refined and distributed.
Photograph: Christopher Griffith, 1999

GALLERY 03

they use today, how much they will be usi
the future. Those metrics simply aren't av

John Keast, the former CIO and Chief Technology Officer of California's Pacifi and Electric, says that government age and utilities should use the California s tion as a wake-up call to build an impr e-business infrastructure to manage th nation's energy needs. He says an e-ma place for electricity would have better tioned many companies in California f crisis just past there. Are Web-based el ty markets part of the solution?

ANDERSON: Well, the first problem is the i gent part of the intelligent grid. There's n that you can do by trading lots of anythin will give the grid any intelligence for man systems. Systems integration requires the to move electrons from one place to anot you can't do it with the current outmode mal mechanical switch-throwing grid. Yo to put the grid into the modern world, wi solid-state switches, and then you have t age that grid with computers that optim flow and distribution.

GEHL: There are also advances on the hori aluminum composite materials, with hig ductivity, higher strength and lower weig would allow you to really maximize the t put on a given transmission right-of-way. Ultimately, we're looking at superconduc transmission lines as well. So there's a wh series of technologies that are at comme near commercial stage that are sort of si the shelf right now. What we need to do come up with the appropriate incentives we can actually implement these things them off the shelf and into service. There tremendous task ahead of us to do this s thing and create the sort of incentives th induce people to do the necessary develo to cooperate, to make sure that all the va interchanges are working properly. It's so thing that I think we are just beginning t to grips with.

ASMUS: Some interesting experiments ar already under way, chiefly in the area of

collaborative effort with CMS Viron Energy Services, has linked up via the Web to solar panels. They have energy management software where if a cloud cover comes over it, let's say at a 5 o'clock peak, the place will automatically ramp down power consumption on site so that no extra electricity has to be bought from the grid at high peak prices. The cloud cover passes, the solar generation comes up to a maximum, and the software manages it. And what's interesting is that the county used no general funds.

How does the CIO fit into the picture?

HANDFIELD: I think the CIO should definitely be a major player on the team that develops energy strategy. I think it should be led by supply management and operations, and it should be a cross-functional undertaking, really, because it is of critical importance.

GARDINER: I agree. What we see emerging is a need for IT organizations along with their facilities counterparts inside companies to be working very closely with power companies to talk about their strategies for the future, what kinds of [technology] needs they have, and how they can work together to anticipate what that's going to mean to the group.

HURLE: The CIO's role in an organization is twofold: First, to be responsible for integrating technology into the business strategy of the organization; and second, from an operational standpoint, to deal with issues on a day-to-day basis—provide technology, anticipate technology change. I don't think it's fair to expect the CIO or even any single organization to be responsible for redesigning the nation's power grid, and I think Dr. Anderson's point is well on. There really isn't anyone in charge, and it's not necessarily fair to hold any one organization responsible. The CIO's job, a company's job, is to maximize shareholder value, and that's what they'll do. That's what they get measured on, that's what their performance is based upon.

ANDERSON: And they can do a great job and still have brownouts sweep through their company.

HURLE: I think CIOs fall into two groups. There are CIOs of energy companies who have, I guess, a lot more pressure on them to think of pany. Like CIOs at some of the companies that I work for who, for instance, are trying to attract retail customers in more than eight states in the U.S., and for every single state they have a different billing system to be able to deal with attracting customers. That makes for a lot of inefficiency. Then there are a lot of other CIOs who aren't with utility companies but nevertheless have a lot of issues to deal with in terms of the infrastructure, the cost, how they organize themselves, how they procure their energy, involve themselves with base markets and so forth.

MEHRABANI: For us, it's an economic problem. It's an issue of what do we need to do to protect the basic fundamental operations of the business—and what is the source of the energy that will let us do that? I think we CIOs would be supportive of any reasonable economic approach to solving the capacity problem, whether it's an alternative source of energy or something to enhance the capabilities of the grid. But I'm not sure that a CIO, for example, or even an architecture individual like myself, would want to stick his nose into the decision, "Do I want to use my windmill today or do I want to use my biomass?" That's not what I'm being asked to do.

What new technologies have the most promise?

MCCREA: A lot of companies are looking at ensuring their own power supplies by considering building their own generating capacity and bypassing the regional power grid. In the past, CIOs didn't really have to worry about this. But today, energy and pricing is a matter of information—and now they do.

HANDFIELD: I believe smart metering is a very practical application that I think we're going to see a lot of in the future, whereby the electricity meters attached to a house or a building can be read virtually, via sensors that are placed on trucks that literally drive by and check them. I think one important aspect of upgrading the grid and tying it to the Net will be modernizing measurement of power consumption.

GARDINER: I think all vendors, ourselves included, need to focus on the kinds of intelligence built

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SOURCE: THE LAWR
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device's position in the architecture. It's a different issue for a network device than it is for an end-user's laptop or a PC. But all of them can be equipped with enough intelligence to understand how to make power consumption decisions based on the work that they're doing at a moment in time. We are deploying devices that are very power smart at the user end, which is the most ubiquitous piece of technology that we have, and we're teaching our employees how to use that power management capability to reduce our costs. And I think all vendors need to be focused on putting those kinds of products in the marketplace.

ANDERSON: I'm afraid I'm a little more pessimistic. The technology's not the issue. This energy crisis is a gigantic systems integration problem without a leader. And if you look at the three main networks in the world, there's the phone system, there's the Internet, and there's the electricity grid. Now, the phone system was built by AT&T Corp. with the government saying, "Go, take a monopoly and run the phone system," and they successfully got phones cheaply everywhere. That has since bifurcated into all kinds of activity. The Defense Advanced Research Projects Agency, the military, did the Internet. Nobody's doing the electricity grid. Who's going to run this show?

I'd like to ask people like Steve Gehl where he thinks the leadership is going to come from for that to happen? Who's going to pay the bill? Is it going to be the Pentagon when they finally get scared that this is a threat to our survival, or is it going to have to be the companies all banding together and saying we're going to overcome? The problem is the public has little knowledge of how the electricity system works and therefore cannot assert political pressure. Most of my students at Columbia don't know how their hair dryers work, let alone what comes out of the electric plug. So the general public hasn't a clue what's going on here.

Who should take leadership?

ANDERSON: It's going to take somebody like DARPA getting engaged. The military was responsible for the interstate highway system.

"The technology's not the issue. This energy crisis is a gigantic systems integration problem without a leader."

ROGER ANDERSON

whether that comes from the military o
don't know. I think it clearly has got to ir
the federal government, and right now, I
hope it would be aided by voluntary orga
tions. For example, you have the Federal
Regulatory Commission, and the North
American Electric Reliability Council...

ANDERSON: You're going to let them run

GEHL: No, but I think they're going to have
involved. But we are going to be hobbled
degree by having locked in on an older te
gy base, and I think what we need to do i
come up with an overall approach for mo
ing the system and recognizing that the
technology is going to have to have a sub
advantage over the existing technology. (
the other problems is that the time const
seems to be a lot larger in the electricity
than it is in the Internet or computer bus
The electricity business tends to go throu
nology cycles at a slower rate, principally
the capital costs are so much higher. You
power plant with the expectation that it'
to be around for 30 years, and if you do th
you're sort of stuck with the performance
tions of what some day will be a 30-year-
technology, the environmental limitation
technology, and so forth.

***Is something being learned now in Ca
that eventually will help other states?***

GEHL: Gosh, I think so. I certainly hope so.
looking at what's wrong with wholesale
kets, what's wrong with retail markets, w
can do to develop technologies that wou
[modernize the grid]. I think there's a tre
dous opportunity to learn from the Calif
situation. We have taken to calling what
pened in California "the perfect storm," b
all of the various variables lined up in the
adverse configuration. But that isn't to s
parts of the California syndrome won't b
rienced in other areas of the country. The
likely will be, and soon.

HURLE: (California Gov.) Gray Davis is no Ge
Clooney. (Laughter.) I think one of the reali
the day, especially one that CIOs have to d
is that they have dysfunctional organizatio

A satellite's-eye view of global power use clearly shows how the distribution of electricity is uneven around the world.

SOURCE: UNITED STATES GEOLOGICAL SURVEY
(Map color digitally enhanced)

FACTS

- **A typical server farm uses 10 to 20 megawatts of power per hour—roughly the equivalent of 10,000 to 20,000 homes with every light and appliance turned on.**

SOURCE: EDISON ELECTRIC INSTITUTE

- **A 20-minute outage at a Hewlett-Packard circuit fabrication plant would cost the company $30 million and an entire day of production to be lost.**

SOURCE: CALIFORNIA PUBLIC UTILITIES COMMISSION

aren't up to the game, just like the experience of the telecommunications companies of 10, 15 years ago when they were deregulated. You're essentially telling bureaucracies to go and be competitive, and they simply can't do that. They have a whole different set of metrics and cultures—the way they organize their data, the way they manage their processes, the sort of processes and technology that they have deployed internally. They just aren't up to the task. And so today's energy CIOs have this unenviable job of trying to integrate a very high level of expectation about what technology can deliver based on what they read [in magazines], telling them that the Holy Grail is just around the corner and if you put in automated meter reading or if you do wireless this or wireless that—or if you connect your palm pilot and manage your washer and dryer from the office—then everything will be fixed. And that's just simply not the case.

GARDINER: I think it simply brings to light the fact that we're probably at the point where policymakers and those who advocate for the individual consumer need to come together to address a very serious national problem that needs to be solved with a sense of urgency.

MCCREA: I guess I would compare this to Y2K. Look at the Y2K issue, when that problem was in front of all of us. There was a lot of hype, there was a lot of change, and a lot of dollars spent. At the end of the day, people realized, with all the changes that were bein
that nothing would work unless po
be delivered. We've done a major re
effort in this industry, and IT, from a
spective, will probably outscale any
we had in numbers associated with
problem. And as an industry, we hav
This is not something that can be d
by state or company by company. It'
a global or at least domestic standa
ensure we've got the power to take
the 21st century.

***Is there a lesson to be learned fron
there a PR effort that's needed her***

ANDERSON: I would love to settle for
that was spent on Y2K. That would b
thing for the transmission grid if we
that much attention. It's remarkable
Y2K got for a non-problem.

HURLE: This is a $300 billion marketp

ANDERSON: How did Y2K happen? Wa
marketing scam or what was it? Wha
still haven't figured...

MCCREA: It was a scare tactic certain

ANDERSON: Started by whom?

MCCREA: ...that got everyone's attenti

ANDERSON: Who did it?

HURLE: The software companies?

ANDERSON: Whoever it was, let's sign
and fix the grid.