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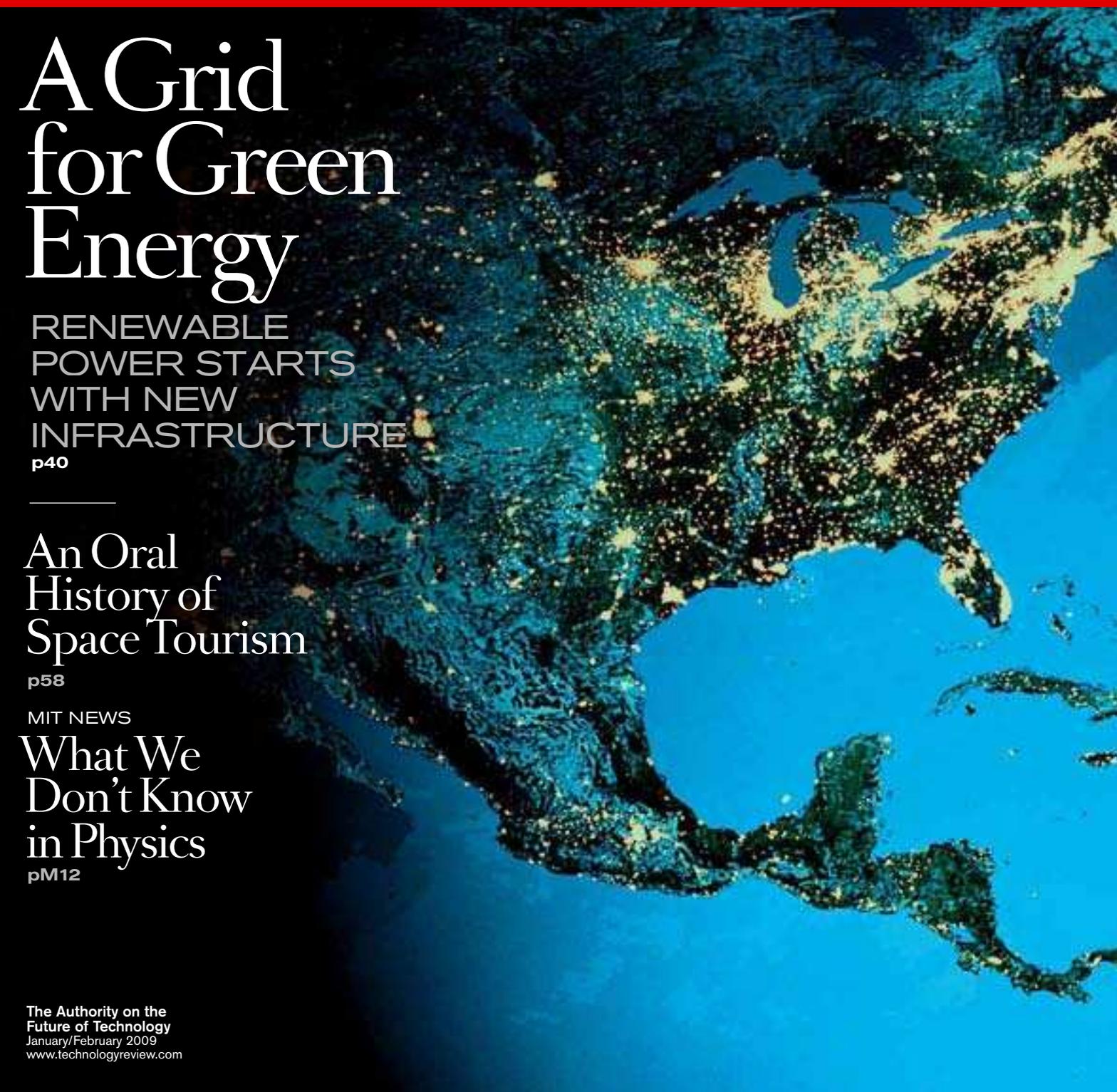
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Without a radically expanded and smarter electric grid, wind and solar will remain niche power sources.

By DAVID TALBOT

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De Technologia non multum scimus. Scimus autem, quid nobis placeat.



The Geological Strata of Things

OLD TECHNOLOGIES SELDOM DIE; THEY GET UPGRADED.

Mark Shuttleworth, a South African Internet tycoon who paid tens of millions of dollars to go to the International Space Station aboard a Russian Soyuz craft, recounts his arrival in space—blinking, wondering, and weightless after the fire, shaking, and acceleration of liftoff—in Adam Fisher’s oral history of space tourism (“*Very Stunning, Very Space, and Very Cool*,” p. 58):

The thing I remember as being quite striking was this collection of very domestic sounds that kicks in after the main-engine cutoff. Mechanical sounds, like the air circulation and the conditioning, and then bits and pieces are kind of kicking in. You’ve got alarm clocks and fans, and you’ve got a big device called the “globus.” It’s a ball—your map, basically—that turns, and it starts going *tick, tick, tick*, like a cuckoo clock. You’ve just gone through this extraordinary experience of getting into space, and then suddenly it’s like waking up inside the workshop of an old Swiss clockmaker or something. So it’s this amazing contrast between what you might expect—which should involve special effects and background music—and the very mechanical physical reality of it.

Thus, even the most transcendental of real, human experiences (which Saul Bellow, in *Mr. Sammler’s Planet*, evoked, wonderfully: “To blow this great blue, white, green planet or to be blown from it”) occurs amid the most mundane technology.

That technology can be very old. The space tourist Charles Simonyi, a former Microsoft executive responsible for Word and Excel, whom we profiled two years ago (“*Anything You Can Do, I Can Do Meta*,” *January/February 2007*), describes the optical sight on the Soyuz: “It’s like a very old-fashioned—I don’t know what it is. There is nothing, no items like that any more. ... That instrument could have been constructed in the 19th century.”

Famously, the Russian space program employs a brutalist approach: its engineers use the crudest, oldest technology that works. (Since the first Soyuz flew in 1966, only those parts that have failed or are obviously obsolete have been redesigned.) But the technology aboard the space station, much of which was constructed by the U.S. and European space agencies as well as the Russian, is only a little shinier. Simonyi says, “The space station is so messy. Words don’t do justice. It’s like going into the messiest hardware store you have ever seen.”

Because they are professional futurists, technologists like to contemplate new, bright, and disruptive technologies. Often, by a process of substitution, they talk about the newest iterations of things as if they were the only things people actually use. But our spaceships disclose a universal truth: old technologies are

seldom abandoned, and only when they are intolerably inconvenient. (The former financial analyst Pip Coburn calls the moment when a “perceived crisis” is worse than the “perceived pain of adoption” of a new technology the “Change Function”: see “Who’s Sorry Now?,” *May/June 2006*). Mainly, however, old technologies accumulate like geological strata, changing under the pressure of new circumstances.

The writer Robert X. Cringely has succinctly expressed this idea in one of his “laws of computing”: “Old software never dies; it just gets upgraded.” In “Parallel Universe” (p. 54), Cringely explains how multicore computing—the use of many microprocessors on a microchip—can multiply processing power without increasing the heat associated with ever-greater miniaturization. Cringely writes that in order to solve some of the problems of parallelism (or how software is torn apart so that a process can be run in parallel on hundreds of processors), Intel has recalled to service “some graybeards of 1980s supercomputing.” For these graybeards, parallelism never disappeared. Now, in order to preserve Moore’s Law, we will use technologies first developed to build nuclear bombs during the Cold War.

Or consider the U.S. electrical grid. In our cover story, “Life-line for Renewable Power” (p. 40), our chief correspondent, David Talbot, writes, “A patchwork system has developed. ... But while its size and complexity have grown immensely, the grid’s basic structure has changed little since Thomas Edison switched on a distribution system serving 59 customers in lower Manhattan in 1882.” Talbot shows that the old grid, constructed to transmit the predictable flow of electricity from the burning of fossil fuels, must be upgraded if it is to accommodate more-variable, renewable energy sources like wind and solar power.

As much as they are a deepening coastal shelf beneath our technological civilization, old technologies also live in each of us. Biologically, we are their creatures. Explaining how archaeogenetics, the application of genetic analysis to the study of prehistory, might explain the puzzle of how we came to be highly civilized creatures (see “*Our Past Within Us*,” p. 74), Mark Williams argues that we evolved through our technology. “Humankind invented agriculture, started eating different foods, and began dwelling in cities; populations expanded, allowing large numbers of mutations. Natural selection promoted the spread of beneficial variations.” Among those traits selected, Williams suggests, were those that allowed us, eventually, to build spacecraft and space stations. But write to me and tell me what you think at jason.pontin@technologyreview.com. —Jason Pontin



ADAM FISHER spent months compiling an “oral history” of a rarefied experience: private spaceflight (“*Very Stunning, Very Space, and Very Cool,*” p. 58). Since 2001, when former NASA engineer turned financier Dennis Tito flew to the International Space Station aboard a Russian Soyuz spacecraft, five more people—at a price of around \$30 million apiece—have made similar journeys. “I waited for six months to interview some of them,” says Fisher. “They are all smart, charismatic, and well spoken—the kind of people you want to be seated next to at a dinner party. It was only later, when I played back the tape of my interviews, that I realized that they were talking about pretty personal stuff: their preflight enema, for example, or what happens when you vomit in zero G!” Fisher was a features editor for *Wired* and *New York*. He now writes about travel, food, science, and technology from a houseboat in Sausalito, CA.

EMILY SINGER reports on the trend of personal genomics, which is being made possible by rapid advances in DNA sequencing technology (“*Interpreting the Genome,*” p. 48). “The capacity to sequence thousands of human genomes is revolutionizing our understanding of the genetic basis of common diseases,” says Singer. In the course of her reporting, she visited the century-old Cold Spring Harbor Laboratory on Long Island for the first “Personal Genomes” conference. “The newness of the topic was palpable, as presentation after presentation raised



more questions than it answered,” says Singer. “How will scientists analyze the huge volumes of data they are producing, and what does it all mean?” The event may indeed prove historic for the field of genomics; attendees likened discussions there to previous pivotal debates in the field, including those over the Human

Genome Project. Singer is *Technology Review*’s senior editor for biomedicine.



ROBERT X. CRINGELY reports on the central challenge facing Intel and the rest of the semiconductor industry: silicon-based microprocessors have reached such complexity that they risk overheating if they pack any more transistors into a single-core design. One solution to the overheating problem is multicore computing, whereby multiple processors within a chip are made to work with each other in parallel. But this hardware solution presents software problems that are difficult to solve (“*Parallel Universe,*” p. 54). “Many years ago, a very smart boss of mine explained to me, ‘If making computer hardware is like building a house, then making good software is like building a city,’” says Cringely. “My experience writing this piece shows that to be true. The challenge of

making parallel software easy to write is huge, and the penalty for failure is a stalled trillion-dollar industry. My brain still aches from trying to explain the issues involved.” Cringely went to Silicon Valley in the 1970s and fell into writing about and working in the computer industry. His work has appeared in such publications as the *New York Times*, *Forbes*, and *Newsweek*. His PBS documentaries have been shown in more than 60 countries.



EWAN BURNS took photographs for chief correspondent David Talbot’s feature on the tremendous importance of a revitalized electrical grid (“*Lifeline for Renewable Power,*” p. 40). “It was a fun assignment, involving hundreds of miles of California desert highway,” says Burns. “Where I was shooting, it was desolate—a kind of no-man’s-land.” Burns’s work has appeared in *Portfolio*, *Audubon*, *Men’s Health*, and other publications.



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POWER OF THE SUN

Regarding Kevin Bullis's article on MIT professor Daniel Nocera's method of deriving hydrogen from water using sunlight ("Sun + Water = Fuel," November/December 2008), I suggest going further: tap the power of the sun. Had the plug not been pulled on funding of fusion-related research, we'd be closer to having that technology. Solar, wind, and even "conventional" nuclear power are all diversions from fusion. Like Nocera, let's take a hint from nature. Stellar fusion is the universe's choice for power. Let's get smart and use it here on Earth.

*Gerald Schroeder
Jerusalem, Israel*

Your article on Nocera's work suggests that he has solved the energy problem with his implied—but only vaguely explained, and completely unquantified—improvement upon the existing commercial electrolysis of water. But the article ignores two other huge and inextricably linked problems: the high cost of generating electricity from sunlight, and the difficulty of storing uncondensable hydrogen fuel. Please restore more balanced reporting to *TR*.

*Don Smith
Bolin, CA*

THE INTERNET'S VULNERABILITY

It has been months since security researcher Dan Kaminsky announced the fundamental vulnerability in the domain name system

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(DNS), which serves as a kind of phone book for the Internet ("The Flaw at the Heart of the Internet," November/December 2008). Unfortunately, we've still got millions of



November/December '08

name servers—which use DNS to connect users to Web pages—that are in active use and unpatched against the vulnerability. With an effective script, a hacker can insert arbitrary data into the cache of one of these servers in about 10 seconds. I urge anyone responsible for recursive name servers that look up Internet domain names, whether directly or

through a forwarder, to test them for the Kaminsky vulnerability.

*Cricket Liu
Vice president of architecture, Infoblox
Santa Clara, CA*

BORN ORIGINALS

In a recent editor's letter about how social technologies such as Facebook are changing our notions of who we are ("Authenticity in the Age of Its Technological Reproducibility," September/October 2008), Jason Pontin begins with a quotation from 18th-century English poet Edward Young: "Born Originals, how comes it to Pass that we die Copies?" I was stunned when I read this and delighted when people I trusted were also affected. Here in one sentence we have the mission of education: to preserve and develop that individuality we all have initially and lose so quickly. I've since used this sentence as a litmus test and have been surprised by those who've reacted casually, saying, "Yes, interesting," and then changing the subject! What a mirror this provides into one's inner mind!

*Herman Jacobowitz
Philadelphia, PA*

In his editor's letter on social technologies, Jason Pontin writes, of himself, "Social-media Jason Pontin, in short, is a function

of my business life. I know that this identity is inauthentic." I wonder: if your business-life exchanges are inauthentic because they are incomplete, wouldn't dinner with a friend also be inauthentic because it leaves out your business life? Is a jog in the park inauthentic because it's unrelated to your other pursuits? I think that our selves are created in what we do, but that none of the things we do in themselves constitute our entire, "authentic" self. We can conceive of ourselves as becoming evident in interactions, but we have many aspects to our identity; different aspects arise in different interactions, so your Twittering involves your business self, while a dinner evokes another aspect, and so on. Even subatomic particles have more than one aspect, as do the gods in some religions.

*John Branch
New York, NY*

NUCLEAR TERRORISM

In his essay on the threat of nuclear terrorism ("Nuclear Deterrence in the Age of Nuclear Terrorism," November/December 2008), Harvard University's Graham Allison writes that "no nation must develop new capabilities to enrich uranium," and that there must be no new nuclear-weapons states. At the same time, he assumes that it's not possible to force the present nuclear powers to eliminate their nuclear weapons. What's missing in his analysis is the consideration of a basic question: on what basis may the international community prohibit or impose limitations on the possession or acquisition of nuclear weapons? And more generally, it's worth noting that the heart of Allison's proposal is deterrence: a military measure supported by technology and international agreements. But has he considered alternative actions? It may be beneficial to analyze the socioeconomic situations and cultures of the communities from which terrorists come, and to intervene in whatever nonmilitary ways make sense.

*Michele Muscettola
Milan, Italy*