

SINUS



RADIO SPIKES: Neighbors of these high-power radio transmission towers outside Rome complain that they represent a hazard.

Sins Of Transmission?

Vatican Radio's high-power antennas stand accused of causing cancer

The view is impressive, if strange. A forest of about two dozen huge towers supports an intricate web of antenna wires that together pump many hundreds of kilowatts into the atmosphere from a site 25 kilometers north of Rome. The antennas are the Vatican's portal to the world: signals from two medium-wave transmitters reach all of Italy at all times, while those from 27 shortwave antennas are beamed at selected parts of the world in different languages at varying times.

(Only two of the shortwave antennas transmit at any given time.) Thus, papal speeches, news programs, and religious events are dispatched in 40 languages to all the corners of the world, making this complex as important to the Vatican as the Voice of America and Radio Free Europe were to the United States at the height of the Cold War.

But to the inhabitants of Cesano and neighboring communities, the antennas, some transmitting at an

effective 600 kilowatts, represent not only a blight on the landscape and something of a nuisance—hearing the Pope’s voice picked up by your front-door intercom is not always appreciated—but also a possible health threat [see photo, “Radio Spikes”].

When the antennas were erected in 1951 on a 3.9-square-kilometer plot, the surrounding area, known as Santa Maria di Galeria, was still largely rural. But during the last few decades the area has been built up, and now an estimated 60 000 people live within a radius of 10 km of the transmitters. In 2000, a small number of cases of

On the one hand, leukemia incidence was higher close to radio towers; on the other hand, the difference was STATISTICALLY INSIGNIFICANT

childhood leukemia, first reported by a local physician, were blamed by residents on the strong radio-frequency fields generated by the Vatican antennas.

This past May, an Italian court imposed suspended 10-day prison sentences on two Vatican officials responsible for operating the transmitters, a cardinal and a priest, for the “dangerous showering of objects”—meaning the antennas’ electromagnetic waves. (The term “electromagnetic radiation” has not made it yet into Italy’s legal vocabulary.) In addition, environmental groups and committees representing the local population will be awarded damages in a separate civil action, though the figures have yet to be determined.

LOCAL RESIDENTS and environmentalists have sought to have the Vatican close down the complex since 2000. Several years ago, an Italian environmental minister, Willer Bordon, organized field strength measurements and found that the Vatican’s radio transmitters violated Italy’s radiation standards, which are much stricter than those in other parts of the world. He threatened to cut off electric power to the site; in response, Vatican Radio reduced the time it was on the air and transferred some radio transmission to other sites.

The Vatican’s situation improved in 2002, when courts ruled that the Italian government had no jurisdiction over the trans-

UNITED STATES ESTABLISHES “LEVEL PLAYING FIELD” IN BROADBAND—OR DOES IT?

THE U.S. FEDERAL COMMUNICATIONS COMMISSION unanimously decided in August to eliminate a rule that required the regional Bell operating companies to make their still-developing broadband networks available to rivals at discounted prices. Reversing a longtime stance, the FCC no longer maintains that offering consumers broadband services on attractive terms requires there to be competing providers of digital subscriber line, or DSL, service.

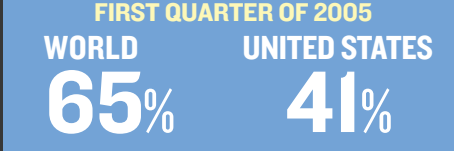
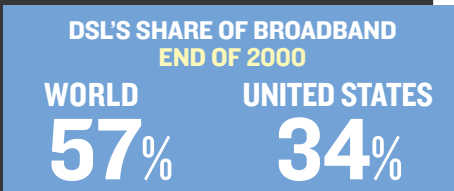
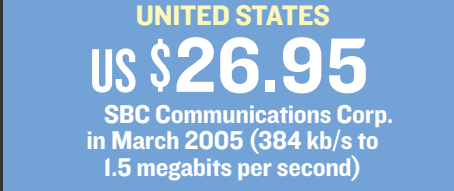
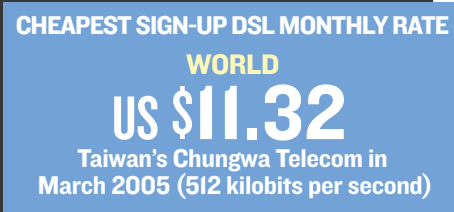
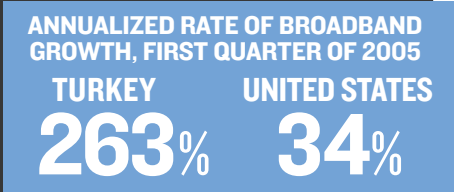
The Baby Bells had complained that having to open their networks to DSL rivals at prices set to guarantee the commercial viability of the competitors, while at the same time maintaining the networks themselves, discouraged them from investing in system upgrades that would allow them to compete effectively against cable companies. The Bells also complained that cable companies were exempt from the common carrier rules that the FCC enforces. A U.S. Supreme Court decision in June, called the Brand X ruling, affirmed the agency’s classification of cable companies’ broadband offerings as data services, meaning that the cable companies do not have to open their networks to competitors.

Brand X upheld the agency’s drawing of a line between broadband services provided via cable versus broadband via telephone wires. Ironically, the FCC now is relying on the ruling for authority to erase that line. The agency is betting that consumers will benefit from allowing the telephone companies to slug it out with the cable companies on equal footing—and that this rivalry will be enough to protect consumers from dramatic price increases and anticompetitive business practices, such as network operators’ blocking access to competitors’ content.

Will the Supreme Court and FCC decisions give broadband adoption a boost? The proof will be in the pudding. Though broadband continues to spread in the United States, and the country still leads the world in the number of broadband connections, it has fallen far behind nations like South Korea and even Turkey in terms of market penetration and broadband growth.

—WILLIE D. JONES & ANNA BASANSKAYA

ACCELERATING BROADBAND PENETRATION



Sources: <http://www.Point-Topic.com>; <http://www.cabledatamnews.com>

ZAP ART/GETTY IMAGES

mitters because of the Vatican's status as an independent state. But in 2003, Italy's Supreme Court overturned those rulings, which resulted in the two Vatican officials' having to stand trial [see photo, "Divine Right of Way?"]

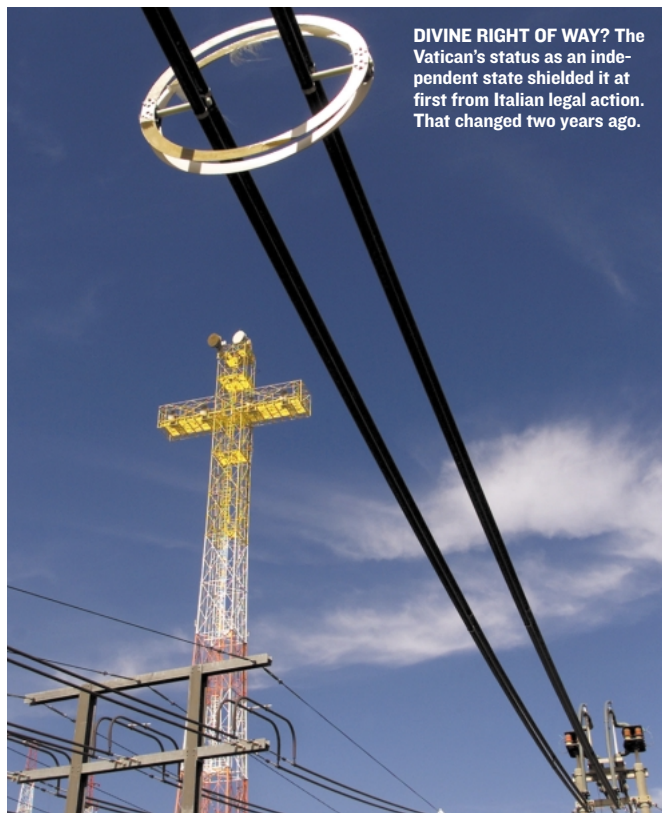
What does science say? While the complaints against Vatican Radio were bouncing back and forth in the Italian courts, the regional government commissioned an epidemiological study of leukemia incidence in the area around the disputed antennas. A team of researchers led by Paola Michelozzi of the Local Health Authority, in Rome, reported in 2002 that the incidence of childhood leukemia from 1987 to 1998 was twice the expected rate, but the actual numbers were very small. The results, published in the *American Journal of Epidemiology*, indicated that instead of the expected 3.7 cases in the population of 60 000, there had been eight. Because of the small number, Michelozzi considers the result statistically insignificant. But a somewhat more disconcerting finding in her study made a stronger impression on critics of the Vatican, members of the press, and even some experts.

Michelozzi's survey determined that if leukemia incidence was measured in concentric circles around the radio complex, rates dropped off with increasing distance from the transmitters. Based on that finding, a court-appointed expert science panel in the legal proceeding against the Vatican concluded, questionably, that "the weight of evidence...is much more in favor of the existence of a [cancer] risk" and that it "is in favor of a causal relationship." That assessment, together with the Vatican's violation of Italian power limits, is what prompted the guilty verdict last May against the Vatican officials.

Similar studies of populations around radio and television transmitters have been conducted during the past two decades in several countries, including the United States, Switzerland, the Netherlands, and New Zealand. But all these studies are crippled by the very low normal incidence of leukemia, the need to study very large populations, and the technical difficulty of accu-

nications at California State University, in Fullerton. (Overbeck, a ham radio operator, takes precautions to avoid exposing himself and other people to excess RF radiation.)

Local inhabitants, on the other hand, reacted to the Italian court's finding with jubilation. "We are satisfied; we had to suffer the arrogance of the Vatican for years," one resident told the press.



DIVINE RIGHT OF WAY? The Vatican's status as an independent state shielded it at first from Italian legal action. That changed two years ago.

rately determining actual exposure levels. "The situation has not changed that much. If you look at the string of recent epidemiological studies, they are still equivocal," says Keith Florig, a specialist in risk analysis and radiation protection at Carnegie Mellon University, in Pittsburgh. Florig expressed surprise at the court's ruling in the Vatican case.

Others agree that the ruling was premature. "I'm quite concerned about a rush to judgment based on a less-than-adequate understanding of the scientific issues," says Wayne Overbeck, a specialist in the legal aspects of commu-

Representatives of Vatican Radio, maintaining that the radiation levels are safe, said that they found the judgment unjust and plan to appeal it.

THE CASE OF VATICAN RADIO

is but the latest episode in a half-century-long scientific controversy. Last December, a panel of the International Commission on Non-Ionizing Radiation Protection (ICNIRP), headquartered in Oberschleissheim, Germany, published a global review of epidemiological studies dealing with the impact on health of electromagnetic waves. The report covered a range of RF sources, including cellphones and com-

munication towers, and one section reviewed eight epidemiological studies of residents living around radio and television transmitters, including Michelozzi's study.

The panel found the results inconclusive. "For these studies to be informative, there have to be better exposure assessments, and the numbers [of people in the samples] should be larger," says Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden, who led the study. "Even taken together, they don't really suggest any health risks," he says.

RF radiation is nonionizing—that is, it cannot break the bonds in molecules—and no plausible biophysical mechanism has been proposed that would predict biological effects from low-level fields, except as related to heating. Therefore, many scientists in the field have viewed research on the biological effects of radio waves with some skepticism. Radio frequencies do, however, induce currents in parts of the human body, which can resonate as a half-wave antenna: there is a maximum in the fraction of incident energy that is absorbed in the whole body at 100 megahertz and at 800 MHz in the head—the latter is close to the 850 and 900 MHz frequencies used for mobile phones in the United States and Europe. Exposure limits, such as those recommended by the IEEE, take that effect into account.

In addition to epidemiological studies, researchers are looking at what happens to cultures of human cells (and also of other organisms) when they are exposed to radio waves of intensities that do not produce any significant heating in the material in which the radiation is absorbed. Most useful for risk assessment are standardized animal studies, which are being undertaken in a number of labs around the world. But some researchers are pursuing other areas of investigation,

some of which are scientifically controversial.

At CNR-IREA, the Italian National Research Council's Institute for Electromagnetic Sensing of the Environment, in Naples, researchers place petri dishes with cell cultures in beams of radio waves and then compare the cells with control samples that have not been irradiated. DNA damage, cell division, oxidative stresses, and the induction of apoptosis (cell death) are some of the effects the small Naples group investigates.

So far, however, such studies "do not produce a coherent picture," says Maria Rosaria Scarfi, a researcher at CNR-IREA. Fundamentally, the absence of theoretical models explaining the interaction between electromagnetic fields and biological systems complicates the research, she says.

Despite the lack of compelling results, whether the focus is on cellular changes or statistical anomalies found in connection with radio transmitters, high-power lines, or mobile telephony, Ahlbom thinks that research should continue, because RF radiation is so ubiquitous. "So many people are exposed. I think it makes sense to try to investigate as much as possible whether there might be any risks, although the likelihood is against [there being any] risks."

In the meantime, the inhabitants of Cesano can, in principle, rest assured that they are in no great danger. "The exposure from the [Vatican] transmitters is much lower than what you receive from ordinary cell-phones—several orders of magnitude lower," says Ahlbom. This does not mean, however, that Cesano residents actually are relaxing or giving up their struggle to close down the Vatican complex altogether.

Italy's stricter limits on RF energy exposure, ironically, seem to have made the public more ill at ease rather

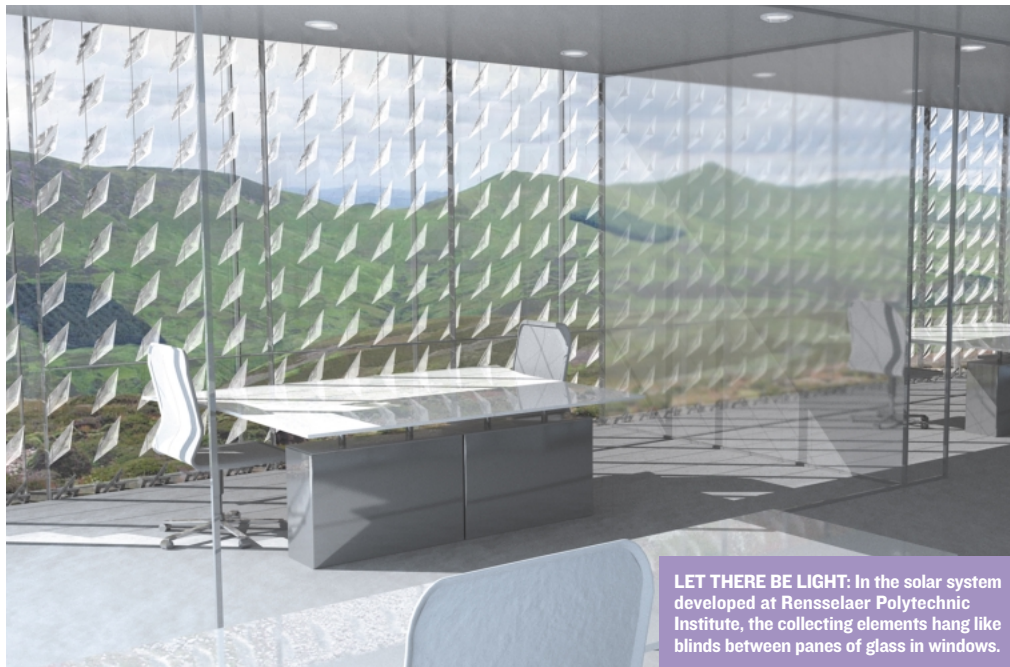
than more confident. Though they were intended to provide an extra measure of safety, the limits "actually increased public fears and controversies," concludes Paolo Vecchia of Italy's National Institute of Health, in Rome, and Kenneth R. Foster, a professor of biophysical engineering at the University of Pennsylvania, in Philadelphia.

Vecchia and Foster believe this is because the public took the stricter Italian limits to be an admission that RF fields really are dangerous in the long run.

For this very reason, Vecchia and Foster note in an article they wrote about the Vatican controversy for *IEEE Technology and Society* in winter 2002, the World Health

Organization in Geneva has advised against adoption of overly cautious exposure limits. The organization warns that the credibility of exposure standards is undermined if limits are lowered to levels "that bear no relationship to the established hazards or have inappropriate arbitrary adjustments."

—ALEXANDER HELLEMANS



LET THERE BE LIGHT: In the solar system developed at Rensselaer Polytechnic Institute, the collecting elements hang like blinds between panes of glass in windows.

Juice From Solar Concentrate

Interdisciplinary team in New York state devises new type of photovoltaic collector

Conventional photovoltaic (PV) panels made from silicon to provide electricity to office buildings and homes are still too expensive. Unless they are heavily subsidized, it rarely makes sense to install them where electricity is available from the grid. Taking a new approach to solar conversion, using advanced materials and solar-concentrator technology, a group based at Rensselaer Polytechnic Institute (RPI) in Troy, N.Y., is developing a system that promises to be cheaper and smarter.

Solar-concentrator technology relies on optical methods to focus light on highly efficient photovoltaic materials. A novel way of using such concentrators has been hatched by an interdisciplinary group that includes architects, materials scientists, and electrical and mechanical engineers at Materialab, a

research firm that grew out of RPI. The key element in their design is a concentrator with a Fresnel lens, whose concentric grooves focus light on a postage stamp-size cell made of gallium arsenide. The lens forms the flat base of a plastic pyramid, 25 centimeters on a side; the photovoltaic material, made by Spectrolab Inc., in Sylmar, Calif., is at the apex of the pyramid. Developed mainly for space applications, Spectrolab's gallium arsenide multi-junction cells have layers of subtly varying PV materials that convert different wavelengths of light into electricity.

In the full system, an array of the modules is hung on wires between glass panels in an office building's facade [see artist's conception, "Let There Be Light"]. A computerized tracking system adjusts the orientation of the