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The Perfect Fix

Simple and sophisticated solutions for some of our most vexing problems
by **Sean McCourt and Reed McManus**

FOR ALMOST EVERY ENVIRONMENTAL ILL, scientists are working on a technological solution — or three. Some involve simple changes in the products we choose or in the way we use technology in our homes, offices, and industries. Others require replacing entire systems with the latest wizardry. The most comprehensive solutions often combine low-tech smarts and high-tech innovation.

No designer of a cutting-edge office building, for example, would rely on on-site biomass energy generation without exploiting the absolutely free lighting and energy benefits of southern exposure. Here's a sample of responses — ranging from simple to sophisticated — to environmental problems we face every day, along with examples of technology we really could do without.

AUTOMOBILES

➤ Take care of the technology sitting in your driveway. According to the EPA, regular TUNE-UPS can improve your car's gas mileage by an average of 4 percent, and your vehicle will last longer. (If it's got a clogged air filter, that trip to the mechanic can improve the gas mileage by as much as 10 percent; if the problem is a faulty oxygen sensor, it can improve by as much as 40 percent.) And it's your job to keep an eye on the tires: Properly inflated, they'll boost your car's mpg by as much as 3 percent.

➤ Fuel-economy-conscious automakers such as Honda use VARIABLE VALVE TIMING to squeeze power out of efficient engines while offering good gas mileage and less pollution. According to the EPA, Honda's Civic HX Coupe gets 36 mpg in the city and 44 mpg on the highway and is certified as an "ultra-low-emission vehicle."

➤ Fuel-cell-powered cars are a decade or more away, but HYBRID VEHICLES are already on the streets. These cars and SUVs typically combine an efficient gasoline engine with a battery-powered electric motor. At slow speeds, the electric motor is normally the primary power source (and is constantly recharged by the gas engine and braking); at higher speeds and during acceleration, both kick in. The results are impressive: The three vehicles with the highest fuel economy in the most recent EPA tests are all hybrids. (Check out the Sierra Club's [Hybrid Evolution Campaign](#) for more information.)

☐ **TECH DRECK** Consumer interest in hybrids has soared along with gas prices, catching a few automakers off guard. General Motors has cobbled together ME-TOO HYBRIDS: modified Chevy Silverado and GMC Sierra pickup trucks that achieve a mere one or two more miles per gallon than conventional models. The Union of Concerned Scientists takes aim at these "hollow hybrids" — and offers alternatives — on its Web site, hybridcenter.org.

MANUFACTURING

➤ The nearly indestructible epoxy adhesives used to manufacture circuit boards have long been an obstacle to the efficient recycling of electrical components. Researchers have been developing NEW ADHESIVES that are strong but designed to disintegrate when heated to a precise temperature, facilitating disassembly and cleanup.

➤ As microchips are manufactured, they must be continuously washed to remove impurities. Researchers at the University of Arizona have found a straightforward way to reduce the vast amounts of water consumed in the process: SENSORS THAT MEASURE MICROCHIP CLEANLINESS and mete out exact quantities of water as needed.

➤ The chemical solvents and corrosive cleaning agents used in the fabrication of semiconductors and microchips may one day be replaced by SUPERCRITICAL CARBON DIOXIDE. This pressurized form of CO₂ is already present in its basic form in industrial emissions and is easily reused.

☐ **TECH DRECK** With its components bathed in industrial solvents and assembled from materials such as lead, cadmium, barium, and mercury, HIGH-TECH MANUFACTURING leaves a filthy trail. California's Silicon Valley has more than 179 groundwater contamination sites and 23 Superfund sites. For more information, contact the Silicon Valley Toxics Coalition at svtc.org.

HOME ENERGY

➤ Your home may be a drafty Victorian, but you can reduce its energy consumption inexpensively. Start by

WEATHER-STRIPPING doors and windows with self-adhesive foam or metal strips. Complete the job with window treatments such as draperies and roller shades.

➤ According to a study by Lawrence Berkeley National Laboratory, the energy lost through inefficient residential windows accounts for 2 percent of total U.S. energy consumption. To the rescue come a variety of HIGH-PERFORMANCE WINDOWS. You can choose windows with two or even three panes of glass; to increase insulating ability, the spaces between the panes can be filled with argon or krypton gas. Finally, low-emissivity coatings made from tin or silver oxide reduce your home's winter heat loss and block summer heat while allowing light in.

➤ Green goes the neighborhood: PHOTOVOLTAIC POWER is proven but costly. Technologies being readied for the market include photovoltaic roofing material, "thin-film" designs that use as little as one-hundredth the amount of expensive silicon in traditional cells, and cells that use no silicon at all.

☐ **TECH DRECK** You've got vampires in your house: appliances whose STANDBY MODE consumes energy even when they're switched off or not performing their main functions. To plug these leaks, turn off microwaves, televisions, computers, monitors, printers, and copiers at the wall or power strip. You can get more tips from the [U.S. Department of Energy](http://www.energy.gov).

BUILDING DESIGN

➤ Some of the most livable structures built today employ low-cost designs perfected in an era before air conditioning: SKYLIGHTS, OPENING WINDOWS, ATRIUMS, OVERHANGS to minimize overheating, and SOUTHERN EXPOSURE to maximize natural winter light.

➤ The thermostat has grown up: To reduce energy use, many green buildings employ COMPUTER-CONTROLLED OCCUPANCY SENSORS to manage light and heat. Some include "daylight-harvesting" sensors that automatically adjust lighting depending on the amount of natural light available and monitors that signal elevated carbon dioxide levels and adjust the flow of outside air.

➤ A BIOMASS-POWERED ENERGY PLANT at a rehabilitated mid-'70s building owned by the Herman Miller furniture company in Zeeland, Michigan, generates two-thirds of the building's energy requirements. It's fueled by wood chips from the firm's furniture-making operation.

☐ **TECH DRECK** Even the most environmentally impressive office building or technology park misses the point if it's DISTANT FROM PUBLIC TRANSIT, forcing employees into their cars and onto clogged highways. Learn more from the Smart Growth Network at smartgrowth.org.

COMPUTERS

➤ Flat-panel LIQUID CRYSTAL DISPLAY (LCD) MONITORS are not just sleeker than bulky cathode-ray-tube models; they're far more energy-efficient. Some consume one-half to two-thirds the energy of traditional monitors. Although they might cost a bit more, LCDs save money in the long run, while reducing heat generation and eyestrain.

➤ Business travelers drive or fly millions of miles every year to attend meetings, wasting massive amounts of energy and adding to severely congested roads. WEB-BASED VIDEOCONFERENCING enables businesspeople to hammer out deals with clients thousands of miles away, without suffering jet lag or missing out on telltale gestures or shifty eyes.

➤ Just as the Internet allows us to tap into the data of remote computers, one day we could routinely rely on GRID COMPUTING to access the power of millions of PCs around the globe. Corporate bottom lines wouldn't be the only winners: IBM's World Community Grid program hopes to connect individual and corporate computers to improve forecasting of natural disasters, analyze the world's food and water supply, and study genetic codes to better understand diseases.


☐ **TECH DRECK** Where did the fix-it shop go? Because of rapidly improving (and hard to repair) gadgetry, E-WASTE now accounts for 2 to 5 percent of the U.S. municipal solid-waste stream. For information on computer recycling and sustainable production methods, contact the Computer TakeBack Campaign at www.computertakeback.com.

AT THE OFFICE

➤ Most traditional paper mills use chlorine compounds to whiten their products. But the process sends carcinogenic chemicals into water supplies, affecting humans and wildlife. One option is virgin paper that's "totally chlorine-free." Recycled paper may have some chlorine in its past, but it can be processed chlorine-free using ALTERNATIVE BLEACHING AGENTS such as oxygen, ozone, and hydrogen peroxide, so that no chlorine is released into the environment.

>> Offices can help boost their energy efficiency and save natural resources by using equipment that has been approved by the EPA's ENERGY STAR program, which rates computers, faxes, printers, copiers, and even water coolers. By turning to such products, Americans saved enough energy in 2004 to power 24 million homes and avoided greenhouse emissions equal to those of 20 million cars — on top of saving \$10 billion in energy costs.

>> To replace woefully inefficient incandescent lightbulbs as well as more-efficient compact fluorescent bulbs, researchers have been experimenting with the next generation of light-producing materials. QUANTUM DOTS, which are nanometer-size (a billionth of a meter) silicon crystals, absorb light near the UV range and reemit it as visible light, a process that could revolutionize lighting. (Still to be answered are questions about what effects nanocrystals might have if released into the environment.)


 **TECH DRECK** The glittering lights of a big city at night are breathtaking — and a shining example of WASTED ENERGY. In many older, unrenovated buildings, an entire floor is illuminated even if only one person is present. Numerous offices are also guilty of "light trespassing": inefficient exterior lights that flood adjacent properties or woodland areas. Contact the [International Dark-Sky](#) Association for more information.

AGRICULTURE

>> Farmers can help themselves and the environment by switching to NO-TILL FARMING, increasing soil fertility and water-holding capacity. And when soil is left undisturbed, there's less opportunity for nitrogen fertilizer and other organic matter to be converted to greenhouse gases.

>> You can't combine age-old wisdom with high-tech wizardry any better than Anson Panzner, who distributes manure from cattle feedlots to Kansas farms using a GLOBAL POSITIONING SYSTEM that tells him exactly what parts of a field he has already covered.

>> Scientists at the U.S. Department of Agriculture are experimenting with ways to make PLASTIC FROM CHICKEN FEATHERS, 4 billion pounds of which are generated each year by the U.S. poultry industry. Once cleaned and separated, the feathers can be spun into strong and biodegradable fibers similar to polyethylene and polypropylene.

 **TECH DRECK** A study in the journal *Food Policy* found that the TRANSPORTATION OF AGRICULTURAL PRODUCTS from the farm to the retailer to the consumer accounts for nearly half of the environmental costs of food. Find out how to "buy local" at localharvest.org.
