
The high-performance glass used at DHMC lets in lots of natural light—but not at the expense of energy-efficiency.

ALL: JON GILBERT FOX

# Ever Green

By Sharon Tregaskis

**Dartmouth-Hitchcock Medical Center was one of the earliest health-care organizations in the country to go "green," more than 15 years ago. DHMC's commitment to environmentally conscious operations hasn't wavered since, and it's now poised to be the first hospital in the nation to calculate its carbon footprint.**

Dr. Diane Riley grew up steeped in good, old-fashioned New England parsimony—the kind that extends from saving leftovers in the kitchen to preserving the region's natural resources. Now married to a conservationist and living in the Upper Connecticut River Valley, Riley, a 1989 graduate of Dartmouth Medical School, still lives by the precepts of her childhood: if some-

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2,000,000

**Tons of garbage generated annually by U.S. hospitals**

33%

**Percentage of the total waste stream at DHMC that is recycled**


**Part of Alan Brown's job as a waste management technician at DHMC involves sorting bins of plastic bottles and other containers so that they can be recycled instead of sent to a landfill. Such care nets Dartmouth-Hitchcock $600,000 in savings a year.**

DHMC got in on the act early, setting ambitious energy-conservation and site-preservation standards for its 220-acre Lebanon campus, which opened in 1991. The design of the complex incorporated an innovative cooling system that substantially reduced peak demand for summer air conditioning.

4

**Number of years DHMC has been honored for environmental leadership by Hospitals for a Healthy Environment**

thing breaks, for example, you fix it and keep using it as long as possible. The couple's laundry room boasts super-efficient appliances; they buy local, organic produce to reduce their impact on the environment; and they reuse their shopping bags.

But Riley found applying ecological principles at work a good deal harder. She is a hand surgeon who practices at two hospitals near DHMC—Alice Peck Day (APD) Memorial Hospital in Lebanon, N.H., and Mt. Ascutney Hospital, a member of the Dartmouth-Hitchcock Alliance in Windsor, Vt. For quite a while, she lived "an almost split existence," as she puts it, tolerating copious amounts of waste on the job while she industriously reduced, reused, and recycled at home.

That disconnect came into sharp relief one morning several years ago, as Riley watched three full bags of trash being hauled out of an APD operating room where she'd just completed a procedure that she does about 150 times a year—a simple, 10-minute operation under local anesthesia to improve the mobility of a finger with an inflamed tendon. Among the discards was a stack of unused plastic drapes, an untouched gown several sizes too big for Riley, and reusable towels that would never be laundered. Riley reached what she calls her "cracking point" when she saw those three bags. "For all I do at home," she says, "it's not going to [amount to] anything if I open thousands of pieces of plastic and throw it all out in the garbage."

The United States generated nearly 250 million tons of garbage in 2005, and hospitals alone accounted for over 2 million tons of it—enough to bury the 10 square miles of Washington, D.C., in a pile of trash nine feet deep. Every year. Health care currently represents 16% of the gross national product, a number expected to blossom to 20% by 2016. And the industry is about to embark, analysts say, on a $200-billion building campaign in preparation for the expected tsunami of demand from aging baby boomers.

Combine those trends with growing concern about climate change, environmental degradation, and energy independence, and it's no surprise that environmentally friendly health care has found its way into the national dialogue. The *Wall Street Journal* has made the business case, *Time* magazine has profiled the architects and activists leading the charge, and *National Geographic*'s electronic "Green

Guide" has ranked the nation's most ecologically friendly hospitals. Health Care Without Harm, a global pollution-reduction nonprofit, boasts more than 460 member organizations worldwide. Closer to home, nearly 200 American health-care organizations have embarked on—or completed—construction of facilities that incorporate a host of green features, from low-toxicity building materials to mercury elimination programs to on-site composting of kitchen scraps.

DHMC got in on the act early, setting ambitious energy-conservation and site-preservation standards for its 220-acre, 1.2-million-square-foot Lebanon campus, which opened in 1991. The design of the complex incorporated an innovative cooling system that substantially reduced peak demand for air-conditioning, plus environmentally friendly materials and a spacious loading dock to accommodate trash removal and recycling. And even before the building was done, a new staff position for a waste and recycling coordinator was filled—a role that many hospitals have yet to institutionalize. (For a WEB EXTRA on DHMC's waste management operation, see **dartmed.dartmouth.edu/summer07/html/green_we.php**.)

## Local wood, lots of light

By 2006, when DHMC's $220-million Project for Progress expansion was completed, additional green features included the use of locally harvested red oak for interior trim, the latest in high-performance glass to incorporate lots of daylight without compromising energy efficiency, and a six-level garage that provides ample parking while keeping vast swaths of adjacent woodland from being paved over. "Dartmouth is committed to figuring out how to make our buildings as green as possible," says Charles Mannix, associate dean and chief operating officer of the Medical School. "Located where we are, that's part of our responsibility."

DHMC's maintenance and operations have long been green as well. By the late 1990s, DHMC was virtually mercury-free, and since January 2002, ethylene oxide—a substance used to sterilize medical supplies but associated with an increased risk of liver cancer and miscarriage—has been on the Medical Center's list of banned chemicals. Housekeeping uses green cleaning supplies. An environmentally conscious purchasing committee oversees the hospital's supply chain. And additional energy-saving features have been incorporated during scheduled upgrades.

Meanwhile, the waste-management department has moved far beyond simply separating paper and plastic. For example, DHMC recycles waste ethylene glycol from the chillers in its on-site energy plant and installed an autoclave to reduce the amount of waste slated for incineration. "The principles of trying to minimize the effect that we have on our environment, on our natural resources, are broadly understood in this organization," says Gail Dahlstrom, DHMC's vice president for facilities. "When I think about our responsibility as an industry, a producer, a workplace, I think one of the key aspects is how we affect the public health. And that includes things like what kind of toxic materials do we ask our employees to use and what kind of effluent do we put into the air?"

This spring, DHMC garnered its fourth environmental leadership award from Hospitals for a Healthy Environment (H2E), a nonprofit dedicated to promoting and recognizing environmental sustainability in health care—for the benefit not only of patients, but also of workers, their communities, and the global environment. "There are so many opportunities to do better in health care," says Laura Brannen, H2E's executive director and


**Laura Brannen—who was DHMC's first waste and recycling coordinator, back in 1990—is now the executive director of Hospitals for a Healthy Environment, a national nonprofit.**

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109%

**Increase in the number of prescriptions written in the U.S. between 2000 and 2004**

40%

**Percentage of medication prescribed in the U.S. but not consumed**

1990

**Year DHMC established the position of waste and recycling coordinator (making it one of the first hospitals in the country to do so)**

## 2002

**Year DHMC banned ethylene oxide (a chemical often used in sterilizers but associated with an increased risk of liver cancer and miscarriage)**

## 2006

**Year DHMC switched to intravenous bags that contain no polyvinyl chloride**

**John Leigh, DHMC's current waste and recycling manager, points here to a stack of boxes headed for a specialized incinerator that handles medical waste. Dartmouth-Hitchcock has dramatically reduced the amount of waste that must be incinerated.**

"Everyone thinks energy efficiency is important, because you can save money doing [it]," says Charles Mannix, Dartmouth Medical School's associate dean and chief operating officer. "We're going one step further and saying, if we're an educational institution, let's use our buildings as a learning opportunity."

## 5,000

**Number of medical waste incinerators nationwide shut down since 1996**

DHMC's first environmental programs coordinator back in 1990. "From the materials that we use, to purchasing less stuff, to purchasing safer materials, to building green buildings, energy, water. Health care is so big." At DHMC, she says, everyone "gets it"—environmental responsibility is featured in orientation and training for all employees, recycling and waste reduction are part of every employee's job description, and the administration made a solid commitment to environmental programs long before such investments were common.

Planning is now under way on the Koop Complex, which will add new teaching and research space for the Medical School to the Lebanon campus. Groundbreaking is slated for 2008, and planners hope to incorporate a number of ecological features in the project. It's too early to know precisely which features will make it into the final design, but among the options being considered are strategic landscaping to minimize heating and cooling costs, low-flow plumbing to reduce water consumption, and bike racks and showers for employees who commute to work on two rather than four wheels. "Everyone thinks energy efficiency is important, because you can save money doing [it]," says DMS's Mannix. "We're going one step further and saying, if we're an educational institution, let's use our buildings as a learning opportunity."

That attitude fits solidly within the environmental commitment made by Dartmouth College. In April 2005, simplicity movement guru James Merkel, author of the 2003 book *Radical Simplicity*, was named Dartmouth's first sustainability coordinator. Since then, Merkel has championed the creation of a waste-free dining facility that opened last September, involved undergraduates in energy conservation in residence halls and Greek houses, and begun assessing which buildings on campus could be fitted with solar hot-water heaters to reduce fossil-fuel consumption. In January 2006, those efforts and others were honored by the Sustainable Endowments Institute, which gave Dartmouth a grade of A-minus. It was the top mark awarded, and only Harvard, Stanford, and Williams joined Dartmouth in earning it.

"Humanity has really serious issues to face," says Merkel. "We could have a runaway climate system. I'm not a fan of fear-mongering, but I think we really have an imperative to act fairly quickly on

these things." Merkel calls himself a "yes . . . and" guy when it comes to making progress. That is, he thinks it's important to combine several strategies to achieve synergistic outcomes.

"Say we want to be carbon neutral by 2027," he posits. To get there, an institution might switch to low-carbon fuels, improve building controls, and change user behaviors—each step a small component of the overall effort. One ambitious strategy alone wouldn't be enough, he says. "But you could get there by doing these things together."

### Smaller pumps, smaller fans

Architects and engineers for an undergraduate life sciences building look to achieve enormous gains with such strategies. Construction on the $92-million office, classroom, and lab building, adjacent to DMS's Hanover campus, is slated to begin later this year. A rigorous set of energy-performance metrics has informed every decision about the facility—from the kind of glass in each window to the mechanical systems that will provide heat, cooling, and ventilation. In the process, preliminary designs have been optimized to drastically reduce peak demand for both steam and chilled water. "That means all the systems in the building get smaller—smaller pumps, smaller fans," says architect Stephen Campbell, who heads the College's planning, design, and construction office. "Each of those reductions saves capital costs."

But that doesn't make designing a high-performance facility any easier than getting a building's occupants to remember to turn down the thermostats at night or to shut off the lights when they leave a room. "It takes a lot of knowledge, more consultants at the front end to supplement the architect," says Campbell, who admits to having been skeptical of green-building claims until he came to Dartmouth two years ago. "What I'm seeing . . . is that we're able to save money not only through the life of the building, but in terms of initial cost of construction. It's not costing more to go green; it's costing less." It turns out the highest savings come from an integrated approach to design and engineering that persists from preliminary design through construction and operation. "The green design isn't a tack-on to the normal building process—it's a cradle-to-cradle philosophy," says Campbell, echoing a phrase that is the title of a best-selling book on sustainability.

DHMC now has almost two decades of experience at optimizing facilities' performance while mitigating their environmental impact, at implementing low-toxicity purchasing agreements, and at cultivating a climate where every employee takes personal responsibility for minimizing waste. At Mt. Ascutney and APD, Diane Riley assumed she'd be starting from scratch. But at the Mt. Ascutney medical staff meeting where she first proposed forming a sustainability committee, a group she now chairs, the idea garnered unanimous support. She found similar enthusiasm on the hospital's board of trustees, on which she also serves. Riley attributes the early support to two key factors: a CEO predisposed to sustainability and her own institutional clout as a surgeon. It took a little longer to get APD on the green bandwagon, she adds, but soon the wheels were in motion there, too.

Along the way, Riley turned to staff in Dartmouth-Hitchcock's recycling and operations arenas, gleaning a host of insights and best practices. DHMC even shared a copy of its environmental policy, which Riley rewrote and adapted "in a way that makes sense for a community hospital."

While the successes have been invigorating, greening an existing operation isn't exactly quick or

Housekeepers like Nellie Perkins regularly compare green cleaning products to their conventional counterparts so they can choose the least toxic, most effective product for the job.

**900**

**Tons of waste recycled at DHMC in 2006 and thus diverted from landfills**

**$48,000**

**Annual savings at DHMC from recycling laboratory solvents such as xylene and ethyl alcohol**

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**$600,000**

**Net annual savings from DHMC's recycling and reuse programs**

## R30

**Thermal standard being applied to the walls and roof of the Life Sciences Building soon to be constructed on DMS's Hanover campus**

## 75%

**Reduction in peak steam demand by the new Life Sciences Building as a result of its energy-saving design**


**Kim Crosby dons protective gear before making the rounds at DHMC to collect hazardous waste—such as chemicals used in medical and laboratory processes. Some solvents are now cleaned and recycled, however, and many toxins have been eliminated.**

"We have a much more vulnerable population—people here are immune-suppressed," says DHMC's Dahlstrom, who urges staff to seek out benign alternatives to conventional products, from carpet tiles to roofing materials. "We have a . . . moral imperative to maintain a facility that [meets] a higher standard."

## 56%

**Reduction in chilled-water demand by the new Life Sciences Building as a result of its energy-saving design**

easy. There's also the question of cost any time an organization makes changes, complicated by particular concerns associated with health care: round-the-clock operations and patient safety. But if anything, say green-hospital advocates, patients have fewer problems in environmentally friendly surroundings—they're exposed to fewer toxic materials, they breathe cleaner air, and they enjoy more sunlight and increased access to views of natural areas. "The bottom line is to absolutely not impact patient care in any negative way," says H2E's Brannen. Riley points out that she's seen green materials undergo greater scrutiny before being approved for use than do their conventional counterparts. "One might well ask," she observes, "are we placing patients at undue risk with the present chemicals and product selections?"

That's a question that consultant Jan Stensland, who helped Kaiser Permanente forge its green health-care policies, answers in the affirmative. "Formaldehyde is a known carcinogen and a respiratory irritant," says the interior designer and green materials expert. The ubiquitous methanol byproduct also features prominently in the manufacture of carpets, cleaning products, and paint. Polyvinyl chloride, or PVC—one of the cheapest plastics available and a component of everything from building materials and water pipes to clothing, upholstery, and IV bags—has been dubbed the "poison plastic" by the Center for Health, Environment, and Justice and implicated in endocrine disruption, leukemia, and cirrhosis of the liver. "In good conscience, how could a health-care [organization] assemble a facility with known carcinogens?" asks Stensland. "That would be a huge disconnect in a value system."

DHMC switched to PVC-free IV bags in 2006, and staff are currently evaluating rubber and quartz flooring, as well as a PVC-free pseudo-vinyl upholstery fabric, to eliminate PVCs from future additions or renovations. "We have a much more vulnerable population—people here are immune-suppressed," says DHMC's Dahlstrom, who urges staff to seek out benign alternatives to conventional products, from carpet tiles to roofing materials. "We have a higher obligation, a moral imperative, to maintain a facility that [meets] a higher standard than many other industries."

Beyond the moral imperative, advocates say

people-friendly, planet-friendly choices tend to be profitable, as well. In 2006, DHMC diverted more than 900 tons of waste from ending up as landfill and estimates the net benefit from recycling and reuse at nearly $600,000 for the year. And it's not just big and/or rural institutions that can benefit. Even cash-strapped, inner-city Huron Hospital in East Cleveland, Ohio, has seen $50,000 in savings from its 37% reduction in waste since launching a green campaign in 2004. "There's no waste in nature, and there shouldn't be any waste here," says Dr. Gus Kious, the hospital's president. "The people in our community need to know that we're not only high-performance and that we're leaders, but they need to know their hospital environment is safe in all respects."

### A whole different dynamic

Ultimately, greening the health-care industry demands a changed mindset toward the consumption of everything from refrigerants to light bulbs to surgical gowns, as well as toward work process and relationships between employees. Those new attitudes can confer a host of benefits—staff democratization and satisfaction chief among them. "Before a hospital embarks on a broad commitment to waste minimization and waste management," says H2E's Brannen, "waste is just trash. It's out of sight, out of mind, and housekeepers just sling trash all day." When DHMC instituted a training program called "Let's Talk Trash," and made housekeeping staff the experts on how the institution handles waste, suddenly physicians developed a new level of appreciation for maintenance staff. Says Brannen: "It's a whole different dynamic created around a mutual sustainability mission."

Riley has seen that dynamic play out in staff meetings at Mt. Ascutney and APD. She recalls one especially gloomy meeting, dominated by discussion of declining reimbursement levels and rising on-call responsibilities. Now, she says, there's a sense of optimism. "Instead of physicians saying, 'Why am I practicing?' they were coming up with ideas about how to make the world a better place," she says. "I felt so much more uplifted."

And in an industry that is facing stiff hiring challenges—especially in nursing—the benefits of a healthier, more pleasant work environment can't be underestimated, according to Kaiser Permanente consultant Jan Stensland. "The number-one reason people miss work is respiratory illness," she says, explaining that 16% of the U.S. population is afflicted with asthma alone. "If you know that 16% of your staff has asthma, any time you can make sure you've done your utmost to eliminate asthma triggers in the work environment, you help patients and staff and you help the bottom line."


**DHMC had replaced conventional thermometers with mercury-free models like these by the late 1990s, making it one of the first hospitals in the nation to virtually eliminate mercury.**

In addition to promoting passive health benefits such as improved indoor air quality and increased daylight, DHMC also urges employees to take an active role in boosting their well-being through exercise. This spring, waste and recycling manager John Leigh, who often bikes to work, coordinated DHMC's participation in national Bike-to-Work Day, and two-wheeling staff received a free breakfast upon their arrival at work. Even in inclement weather, the building's design and decor promote physical activity. The risers on the stairways used most often by employees are adorned with whimsical, Burma-shave-style exhortations, such as "Be a Frequent Flier, Frequent these Flights" and "Free Exercise Equipment."

Beyond promoting biking to work and climbing stairs, DHMC heavily supports public transportation to reduce demand for parking and offer alter-

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**$200,000**

**Rebates for energy-saving projects that DHMC has received from Granite State Electric since 2003**

**26,000,000**

**Expected lifetime savings in kilowatt hours of electricity as a result of these projects**

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**$2.5 million**

**Expected monetary savings from that reduction in electricity usage**

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natives to single-occupancy vehicles. "That's driven from three aspects for us," says Dahlstrom. "We don't want to pave more of the world, we don't want to *pay* to pave more of the world, and we don't want more cars driving on the road." A free shuttle connects the DMS, DHMC, and College campuses, while a local public bus system—funded by DHMC, Dartmouth, and the municipalities it serves—offers free rides throughout the Upper Valley. The busiest route, the blue line, includes stops at the College and DHMC, as well as in downtown Hanover and Lebanon. In 2006, more than 146,000 passengers rode the blue line, eliminating an estimated 156,000 auto trips and saving commuters an estimated $341,000.

DHMC's ambulances and grounds equipment are also doing their part to reduce fossil fuel consumption and emissions through the use of sulfur-free biofuel, which yields less carbon monoxide and particulate matter during combustion. "We pay a premium to do so, but we're happy with it," says Leigh. "Our grounds crew reports a very remarkable improvement in the odor of the emissions, which can be an especially important issue among staff members operating such vehicles over long periods of time."

### Carbon footprint

This summer, Leigh will embark on a comprehensive effort to quantify all the natural resources consumed in DHMC's annual operations and maintenance—what's known as a carbon footprint. It's an assessment that's relatively easy to do for one's personal ecological impact, but it's never before been calculated for a hospital. The idea is to come up with a clear measure to serve as a baseline for future improvements, to give administrators and staff the same kind of feedback that a speedometer gives a driver.

"We're going to have an excellent physical environment which is safe, welcoming, healthy, productive, [and] economical," asserts Dahlstrom. "And it's going to, among other things, operate with the smallest possible realistic footprint. Every time we make a decision about a change in the facility, a change in our practice, we ask whether we can make a choice that utilizes all of these resources in the right balance."

## A Green Hospital How-To: Ten Top Tips

**Assess the big picture.** When surgeon Diane Riley, a 1989 DMS alumna, audited her hospital's ecological impact, she discovered numerous isolated efforts, including a lab tech who'd hauled waste to a local recycling center for eight years. When Laura Brannen was environmental coordinator at DHMC, she tracked everything that went through the trash room. Now executive director of Hospitals for a Healthy Environment (H2E), Brannen shares an improved version of her spreadsheet with hospitals nationwide. In 2006, one 12-hospital system used it to save $600,000 in its first year. "You can't manage what you don't know," says Brannen.

**Network with peers.** Share resources and steal ideas. Dominican Hospital in Santa Cruz, Calif., has adapted such DHMC programs as an online bulletin board for redistributing unneeded furniture and a free reuse center for office supplies. "The first step is reach out to people who can tell you what's worked, what hasn't," says H2E's Brannen. "We're all about helping hospitals stretch their limited resources so they don't have to do this in a vacuum."

**Examine your own work processes.** "It's something simple, thinking about how to improve efficiency and decrease waste," says Riley, who worked with Mt. Ascutney Hospital's OR staff to clarify her expectations about supplies and preparations for each procedure. Other strategies: Turn off the water while scrubbing in, and toss only actual biohazards into trash bags slated for incineration.

**Balance sticker shock with long-term payoff.** Vinyl flooring seems cheap and relatively durable until you calculate maintenance costs, not to mention liability for falls on wet vinyl during bad weather. Consultant Jan Stensland recommends rubber. It's attractive and maintenance is quick and easy. In her opinion, the added benefits of reduced toxicity and increased comfort for staff who walk miles on every shift make the choice a no-brainer despite the per-square-foot price. "If you just look at first cost," she says, "you're just doing first-grade economics."

**Set clear expectations.** Dr. Gus Kious, the president of Huron Hospital in East Cleveland, Ohio, eliminated the guesswork. "I said I wanted waste reduced by 50% within three years," he says. He estimates the facility now saves $50,000 a year from recycling and improved supply-chain management. "Our ability to deal with waste," he adds, "is an important part of our ability to be perceived as a high-performance operation."

**Do your homework.** When DHMC considered new cleaning products, staff assessed three for volatile organic compounds—the source of that "new" smell. One marketed as environmentally friendly and containing the fewest chemicals seemed like a great bet—until staff realized the three required applications increased both toxicity and total cleaning time. "You can't just look on the bottle and say, 'Look, it has a green seal,'" says DHMC's vice president of facilities, Gail Dahlstrom. "You have to ask the next question: What does that mean and how are you going to use it and what's the life cycle of it?"

**Take it slow.** Experiment on a small scale before launching a comprehensive overhaul. At DHMC, a few sample chairs have been reupholstered in an antimicrobial, stain-resistant vinyl substitute free of PVCs, plasticizers, bromines, and azo dyes. After users weigh in, administrators will decide how to proceed. Says Dahlstrom: "I might say, 'Let's . . . implement some of these more innovative methods,' then measure results on a variety of metrics—cost, true energy savings, perceptions, satisfaction—and then see if it's growable."

**Make it easy.** Make information accessible, provide adequate training, and keep things simple. Efficient lighting fixtures have proliferated but often require not-quite-interchangeable bulbs. At DHMC, implementation has been limited to a few models to reduce confusion and costly mistakes. "If we have two varieties and they can be easily recognized," says Philip Chaput, DHMC's operations and maintenance manager, "it's much simpler."

**Have fun.** At Dominican Hospital in Santa Cruz, a community-hospital collaboration has yielded an on-site greenhouse populated with bins of earthworms that convert kitchen scraps to compost. It goes on a vegetable garden planted to the hospital chef's specifications and maintained by local vocational students.

**Invest in success.** "If you're not getting a lot of traction with one project, move on to the next," advises H2E's Brannen. Highlight energy savings, waste reductions, improvements in recycling rates, and new program launches. Communicate. Says Brannen: "You're always telling people you're making strides, and they get excited to take on the next thing." ■

3,965

**A conservative count of the number of energy-saving compact fluorescent bulbs now in use at DHMC**

146,000

**Number of passengers in 2006 who rode the free public shuttle that links DHMC, DMS, and Dartmouth College with downtown Hanover and Lebanon**

$341,000

**Estimated amount those riders saved in commuting costs**