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The business of COLLABORATION

ENERGY CENTER OF WISCONSIN

We share your future

ANNUAL REPORT ISSUE
WINTER 2001 VOL 6 NO 1

MASKS ARE USED IN CULTURES THE WORLD OVER TO SYMBOLIZE CHANGE. REPRESENTING FORCES OF NATURE, ANCESTORS, OR SPIRITS, MASKS WERE OFTEN USED WHEN THE COMMUNITY GATHERED FOR RITES OF PASSAGE. COLLABORATIVES ARE ALL ABOUT CHANGE TOO. REPRESENTING VARIOUS INDUSTRIES AND CAUSES, THE MEMBERS OF ENERGY COLLABORATIVES WORK TOGETHER TO HELP OUR ECONOMY BECOME MORE ENERGY EFFICIENT, PRODUCTIVE, AND ENVIRONMENTALLY RESPONSIBLE. IT'S A TASK THAT NEEDS MANY FACES GATHERED, AND THE ENERGY CENTER OF WISCONSIN IS LEADING THE WAY, BRINGING PEOPLE TOGETHER TO TRANSFORM OUR ENERGY ECONOMY.

MISSION STATEMENT

To sponsor and conduct research in efficient use
and management of energy, and to develop, demonstrate,
and transfer the results of that research to Wisconsin's
energy service consumers and providers.

ENERGY CENTER
OF WISCONSIN
We share your future

energy efficiency

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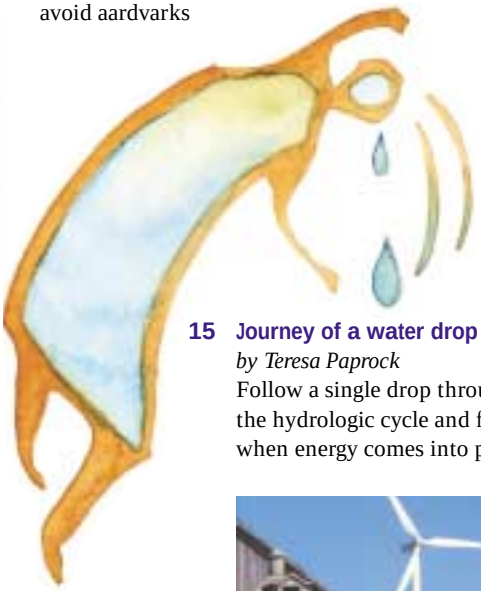


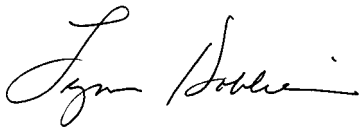
FROM THE PRESIDENT

When we chose "we show you how" as the Energy Center of Wisconsin's slogan, we knew ECW would be in for some changes in the years ahead. Utility restructuring, Wisconsin's developing public benefits program, and changing energy markets have and will affect how ECW pursues its mission. Still, we thought the phrase had staying power. Because whatever the future brings, there will always be value in taking energy information and showing people how to apply it.

Take ECW's residential characterization study. This study of the energy use patterns and attitudes of 300 Wisconsin households found that the best way to save energy in Wisconsin's homes is also the simplest—put in more insulation. ECW also found that programmable thermostats aren't saving the energy that we thought they would, pinpointing the need to understand the role of attitudes in energy efficiency. In addition, ECW has produced a data book that will help policy makers decide which measures to target in the marketplace. This study literally shows Wisconsin how to best save energy in its homes.

On the industrial side, ECW has recently spearheaded an important meeting of Wisconsin metalcasters to develop a strategic "roadmap" for that industry. The metalcasting industry is one of the most energy intensive in Wisconsin, and is one of nine industries targeted by the U.S. Department of Energy in their Industries of the Future program. This innovative program works with the industry to develop a plan that benefits their bottom line, while also reducing energy costs. ECW is helping the metalcasters develop and implement a roadmap for Wisconsin, showing them how saving energy can go hand in hand with productivity gains and increased competitiveness.

These two examples are just the tip of the iceberg. All of ECW's projects are aimed at developing or applying information that helps Wisconsin make its homes and businesses more efficient. A decade after its founding, ECW continues to show our state how to save energy and better use its renewable energy resources. It's a tradition we're proud of, and one we will continue in the years ahead.



Lynn Hobbie, *Board President*

Library reaches out to Wisconsin... and world

Librarian Andrea Minniear sits in front of a one-foot stack of paper. In it are over 300 information requests the Energy Center of Wisconsin library has received in the last year. But she's not in the least overwhelmed. That stack is evidence that people need information about energy, which is exactly what the ECW library provides.

She thumbs through the requests. One person wants information about daylighting he can pass on to the architects and school boards of two elementary schools being planned in his community. Another is looking for unbiased information about outdoor wood stoves after being flooded with information from vendors.

Even people from Thailand are contacting ECW. The Thai Environmental and Community Development Association was proposing an energy and environmental center and needed information showing that energy education results in energy savings. With the help of evaluation reports collected from the 1980s and a few websites, the library provided background information for their grant.

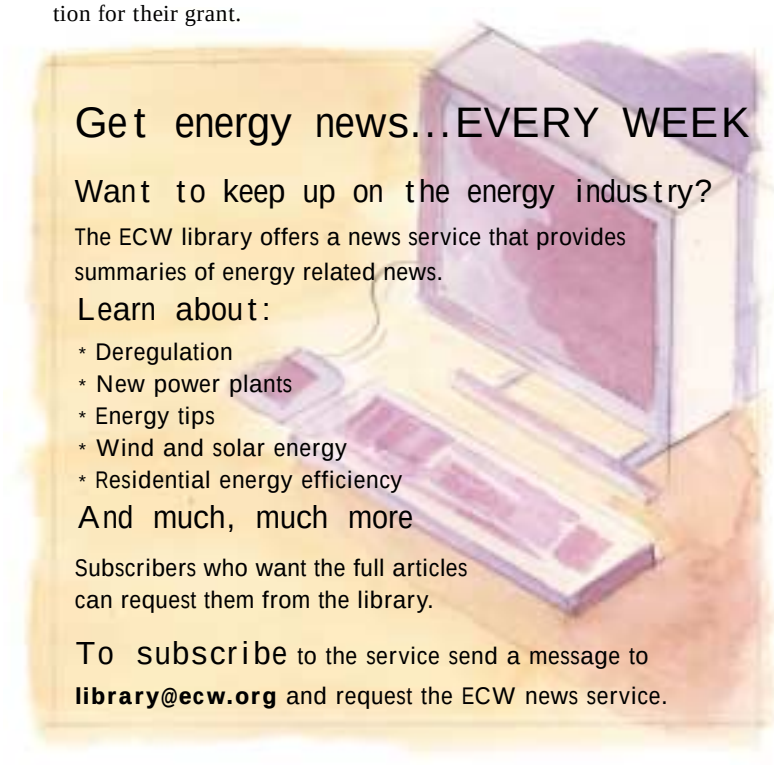
But sometimes, rather than needing information, people have the opposite problem, especially when it comes to the Internet. "Some people may not know where to start, while others are overwhelmed with the sheer volume of information," says Minniear, "We can act as data miners to help these users sift through the information." For instance, ECW library staff prepares "webliographies" of reliable internet sources on request.

To give researchers and others a starting point, the ECW library has an internet presence at www.ecw.org/library. There's an online catalog, bibliographies on popular energy topics, and recent acquisitions.

Minniear envisions a vast expansion of these resources in the years ahead. "We want to be a virtual information clearinghouse, in addition to having a print collection," she says.

FOR ASSISTANCE WITH your energy-related questions, contact the library, 608.238.8276 x134, library@ecw.org.

—Eric Nelson



Get energy news...EVERY WEEK

Want to keep up on the energy industry?

The ECW library offers a news service that provides summaries of energy related news.

Learn about:

* Deregulation
* New power plants
* Energy tips
* Wind and solar energy
* Residential energy efficiency

And much, much more

Subscribers who want the full articles can request them from the library.

To subscribe to the service send a message to **library@ecw.org** and request the ECW news service.

NEWS BRIEFS

ECW helps "make sense" of energy and environmental programs for industry

Did you know there is a plethora of free energy and environmental programs available? Which is the best one for your particular industry? Which programs are best for your business—and your bottom line?

The Energy Center of Wisconsin's Lifelong Learning Group is sponsoring a program entitled "Making Sense of Energy and Environmental Programs to Assist Wisconsin Industry." ECW will host the program four times in February 2001, all around the state of Wisconsin.

Participants will be able to meet with program representatives in person to discover which programs will help them to receive technical assistance, boost productivity, and improve profit margins. They'll be able to tell the difference between various energy and environmental programs so they know which ones are best for their business.

Speakers may include representatives from ECW, the Department of Natural Resources, the Department of Commerce, the Wisconsin Manufacturing Extension Partnership, local utilities, the Energy Efficiency Performance Program, Wisconsin Focus on Energy for Industry, and the Wisconsin Division of Energy.

The program will be of special interest to plant energy and environmental mangers and to senior managers. There is no cost to attend.

Past participants have given the program high ratings according to evaluation results. All said that they would attend again—and would recommend the program to a colleague. Participants said the program provided useful reference information.

Check with ECW for specific dates and places.

FOR MORE INFORMATION contact Brenda Jessen, 608.238.8276 x128, bjessen@ecw.org, or visit our website at www.ecw.org/training.

—Teresa Paprock

FROM THE DIRECTOR

Remember that report card you weren't happy with? It probably upset you, and made you wonder why and what could be done about it before the next report card. Wisconsin received a disturbing report card in September and it made me ask these questions. The report card was a report called "National and State Energy Use and Carbon Emission Trends" by Howard Geller and Toru Kudo at the American Council for an Energy-Efficient Economy (ACEEE).

The grade that Wisconsin earned was a ranking of 33rd of the 50 states—which did not seem very satisfactory. As I tore into the grading scheme, I found some things that reduced my annoyance, but other things that were disturbing.

On the positive side, Wisconsin ranked 26th in terms of energy use per capita. This was about what I expected given our climate, heavy presence of papermaking, and metal industries. Another happy note: our per capita *residential* energy use has declined over the past 30 years, even as home size increased and household size dropped.

The study also pointed out that states with high energy prices tended to use less energy. In looking at what's behind this pattern, the more energy intensive industries have been leaving the high energy cost states. Not surprisingly, these states (including California and New York) were scoring the highest, while states with lower energy costs such as Wisconsin were scoring lower. Losing industry to lower energy cost states (or countries) is not necessarily a sign of progress.

Now for the bad news. Wisconsin's per capita energy use in the rapidly growing commercial sector grew 75 percent between 1970 and 1997, while transportation energy consumption increased 28 percent, and industrial, 19 percent.

As Wisconsin embarks on public benefits energy efficiency and renewable energy programs, our challenge is to pick up where past utility programs have left off. If Wisconsin is to score better five years from now, we need to keep making progress in the residential sector, and also mount more effective efforts in the commercial and industrial areas. With the participation of Wisconsin's energy users and providers, the Energy Center of Wisconsin and its members are ready to do their part.

Mark Hanson, *Executive Director*

The business of COLLABORATION

Seeking success by sharing the burdens

by Jeremy Kohler

Take a single African termite and it can't do very much—maybe it'll chew on some wood but that's about it. But put it with a bunch of other termites—workers, soldiers, a king, and a queen—and together they create an engineering marvel: a 20-foot concrete tower complete with indoor temperature and humidity control, defense against marauding ants, a chemical communication network, and fungus agriculture to feed a million termites.

Infusing business and industry with new paradigms—like marrying energy efficiency to profitability—takes multiple talents, pooled resources, and a diversity of approaches. You might say it takes a collaborative, a partnership, or a coalition to bring permanent changes to the landscape just as the termites do when they get together to build their durable structures.

To begin, you need a rock-hard foundation.

Getting grounded

"To set up a collaborative you need to find a focus within a small initial group and then get other partners to make a commitment to that vision," explains ECW Executive Director Mark Hanson. Much of ECW's work in the business world involves collaborative efforts among groups with very different priorities.

"People don't often put energy efficiency at the top of their list," Hanson says. "So we work with metalcasters to reduce waste and we talk to compressed air users about reducing maintenance costs—but these things also save energy."

Take the Compressed Air Challenge. The vision of this ECW collaborative is to help industries use compressed air more efficiently. Its members include not only energy organizations like utilities, but also manufacturers, distributors, and engineering consultants, each of

which has a stake in the vision.

"We had developed a training curriculum for compressed air users," says ECW Associate Director Karen Meadows, "but this caught the attention of the equipment distributors who also wanted training for themselves."

Now more than 600 trained distributors are able to offer more comprehensive expertise to their customers, which also helps the collaborative fulfill its vision of energy efficiency.

Using the castes

"Collaboratives bring information, shared wisdom, access to marketing channels, and funding," Hanson says. "For example, distributors and manufacturers do lots of marketing, more than we could ever do ourselves. Having them as partners allows us to reach a lot of people."

And it allows a lot of people to reach the collaborative.

"Collaboratives bring information, shared wisdom, access to marketing channels, and funding."

Mark Hanson,
Executive Director,
Energy Center of Wisconsin

"We serve a broad constituency so we need to collaborate to get broad input to what we do," says project manager Dan York, who participates in an ECW collaborative on Building Commissioning—ensuring that a building operates as intended and that its various systems work together and not in isolation. With participants from across the country, the commissioning group was able to develop a training package applicable in any state—and it has reached more than 800 professionals to date.

"There are different perspectives on what commissioning is and how it should be practiced," York explains. "The collaborative members provided the market research we needed to come up with a single package that everyone could use."

The potential for broad constituent backing is part of what makes collaboration so

Watching for aardvarks

Aardvarks have termites for dinner and excavate chunks out of termite mounds at odd hours of the night. Repairing the damage is costly, and human-built collaboratives are just as susceptible to common pitfalls. If you're participating in a collaborative, keep watch for these damaging aardvarks:

Weak visions

Without a clear vision collaborative members will have difficulty finding consensus. A clear vision with well-defined goals will help members focus on their mutually beneficial outcomes and make the compromises necessary to reach them.

Concrete visions

Visions should be clear, but also flexible. As new information is gathered and as members learn from each other's diverse perspectives, often the vision will need to change to accommodate new insights. If issues seem to defy resolution, you should consider revisiting the vision.

Uninterested members

Sometimes a collaborative will recruit members who don't have a clear stake in the vision, and therefore will not commit the time and energy necessary to fulfill their roles. Invite participants, don't assign them.

Unbalanced decision authority

Collaboration thrives on each member's ownership and responsibility in the shared vision, and on the individual talents, knowledge, and experience they bring to the table. Only when each member has autonomy and respect can the collaborative take full advantage of these resources.

Cultural miscommunication

Collaboratives frequently bring together groups with little or no prior contact. Competing businesses, special-interest groups, minority groups, etc., may have ways of working and communicating that are completely foreign to other members of the collaborative. Be aware of and accommodate these differences when approaching unfamiliar groups.

Broken promises

No program can be all things to all people, as much as it may want to be. Time, money, personnel, and other resources are always limited, so be careful not to promise more than you can deliver or you will risk losing credibility.

Preferential marketing

Frequently, members of a collaborative will need to share marketing space, such as on a collaborative-sponsored website. No individual participant should stand to gain an advantage, especially from information distributed by the collaborative as a whole. To maintain fairness you may even have to keep some potentially useful information under wraps.

attractive. “The collaborative brings with it a powerful message,” Meadows explains, “because you have all these different groups standing behind it—it gives legitimacy to your product, ensures the quality of your product, and increases your chances of getting cofunding.”

Water utilities, for example, are facing new water quality concerns and new regulations, but with very limited funds and resources.

“They need technical expertise and funding to deal with these issues,” says Meadows, who is heading ECW’s participation in the Water Alliance for Technology and Energy Research (WATER). Through ECW, the WATER collaborative is bringing together resources from water utilities, water quality experts from the University of Wisconsin, engineering firms, and private industries like breweries that have an interest in high-quality water. And of course energy efficient purification processes are part of the discussion.

All things to all termites

A growing termite mound is a highly effective termite factory, a home to millions of individuals. Often guests will arrive—other species attracted to the food and shelter that the large, prominent structure offers. But only so many guests can be accommodated.

Because collaboratives tend to offer extremely attractive products and services and reach relatively large numbers of people, they can sometimes get “too much” attention.

“Once you have something people really need you get lots of interest, which can overwhelm your resources,” says program manager Abby Vogen of ECW’s Daylighting Collaborative. “In the beginning we underestimated the speed at which we generated interest.”

The program helps architects and engineers incorporate daylighting into their designs to lower a building’s energy costs. Having started out as a state mandate, daylighting is now attracting nationwide attention.

“When you intersect with the private sector on a functional level they will want to move fast, sometimes faster than you can. If you can’t respond immediately, you will lose them,” Vogen says. “These kinds of programs can’t always move at the speed of business, so you have to pick out what’s most important and concentrate on meeting those expectations.”

For example, ECW keeps trained design contractors on call in the private sector, ready to work with people quickly. And even that is unusual.

“Our structure leaves us especially well-suited to do collaborative work,” Hanson explains. “As an independent, nongovernment, nonprofit company we can be more responsive and adapt better to changing situations.”

Solidly built, yet flexible

Termite mounds take on irregular and unpredictable shapes as they grow. Workers are always constructing new chambers and repairing damage from frequent visits by hungry aardvarks.

Collaboratives also must adapt, not just to changing situations but to new opportunities that arise as a result of a collaborative’s success.

ECW’s MetalCasting Collaborative, for example, works closely with industry groups to improve competitiveness through energy efficiency. But when the Wisconsin Department of Natural Resources embarked on developing new rules for metalcasters, the collaborative—thanks to the industry relationship it had built—was ready to take on a new and needed function.

“Now,” says Meadows, “we are helping DNR communicate with metalcasters through us—a neutral player—to discuss appropriate industry regulation.”

Grain by grain

Building a 20-foot tower by gluing grains of sand together takes time. Termites work at it for many years before their mounds become large enough to entice scientists to climb on them.

Likewise human collaboratives aren’t often sources of instant gratification—they require planning, perseverance, and above all, patience.

“You don’t form a collaborative for a year,” Hanson says. “You need to have a long-term vision and understand that these things take a long time. And you need to work with all the players and resolve the challenges that arise. But the end results can be impressive. You can really change and improve the marketplace.”

The house that Joe built

Joe Nagan discovers joy in helping to build high-performance homes

Teresa Paprock

"Don't tell anyone," Joe Nagan says with a smile, "but I have the best job in the state of Wisconsin."

The secret's out. Nagan, a regional coordinator of Wisconsin ENERGY STAR® Homes, started his day at 6 a.m. today, by dropping by a house construction site. He'll visit several more before the day is done, while taking e-mails and phone calls from people asking questions about high performance home construction. His work will continue until late this evening, as it does on many days. "I *live* this job," he says. "But it's fun."

ENERGY STAR Homes is a U.S. Department of Energy program that promotes the building of dwellings that use at least 25 percent less energy than conventional dwellings. Wisconsin ENERGY STAR homes have even more stringent guidelines than the national program, because of Wisconsin's extreme weather. The Energy Center of Wisconsin provides education and training for the program, in partnership with the Wisconsin Energy Conservation Corporation. The Department of Administration's Division of Energy is the primary funder of the program.

To Nagan, the prospect of combining good science with environmental protection and helping people build homes that are healthy and comfortable is the perfect mix. He discovered his life's mission after working in the paper machine-manufacturing field for 13 years. He had built a small home for himself and his family in Kaukauna. "I did most of the work myself," he said. "I had friends in the homebuilding business so they could keep an eye on me."

After about a year, Nagan was concerned that the home wasn't performing as well as it should. While waiting in an office to talk to an expert, he saw an advertisement about the Energy Efficient Building Association. He left without talking to the expert, and made arrangements to attend a meeting of the organization. That was in 1990; today, Nagan ***is*** the expert.

In his youth, Nagan enjoyed tinkering with cars. The more he learned about homes, the more he discovered that a house is not that different from an automobile. "I was really thrilled that this turned out to be a proven science," he said. "I like to find out why things work and why they don't. I found out homes were actually a complicated system. Everything we do in buildings affects everything else."

Joe Nagan inspects a fireplace in a home under construction. He's checking for proper installation, proper ventilation, and compatibility with other equipment in the house.

After joining the EEBA "I had a pretty good handle on some of this information, and some friends asked me to help them, so I did consulting work. I got pretty good at it." Nagan began consulting on a handful of home projects ever year, and became a full-time consultant in 1995. That year, he consulted on a home that turned out so well the EEBA suggested he enter it in an international design competition.

"I was a little embarrassed about the whole thing—I wasn't even a professional," he says. "But I won first place!" The contest took 18 categories into account, including energy efficiency, renewable materials, and cost. "That kind of gave me a little credibility and it was like my report card for all the years I'd been studying," he said

Today, Nagan assists builders and homeowners in working together to build the highest-quality home possible, while making the house affordable to build and maintain. Nagan says, "The crux of what we're doing is helping people view the house as a system—as it really is. We have to see the interconnection or interaction between all components in a building."

For instance, he says, the basement walls are really connected to the upper walls; the mechanical equipment is connected to combustion equipment. "We have to look at the performance of each component with respect to all the other components," he says. "That's really the key to building in good performance, building in cost-effectiveness, reducing potential for callbacks."

The end result is that a Wisconsin ENERGY STAR home is not just efficient, but healthy, comfortable, and affordable. Actually, the efficiency is the result of the attention paid to the other factors.

According to Nagan, the top four areas of concern in homebuilding are combustion safety, indoor air and moisture control, building durability, and occupant comfort. If you address each of those factors, you automatically wind up with a high-performance, energy efficient building. "If you go after those four, energy efficiency slides right in," says Nagan. "Energy efficiency is the icing on the cake."

Joe Nagan visits a home under construction in the Town of Osborn. If you spot him in his decorated van (license plate: NRG STAR), you can probably flag him down for some advice on energy efficiency.

Much of Nagan's job is to be a teacher—helping builders to learn new concepts, and also to unlearn incorrect assumptions. One big incorrect assumption: the concept of the "too tight" home. That issue came about after the 1970s, when homebuilders started building "tight" to save energy, only to get complaints from residents experiencing mold and other consequences.

"We're talking about air movement—it's invisible, intangible. It takes a bit of studying," he says. "There's a lot of talk about 'too tight.' In reality, tight is good, but someone needs to follow up with a user-friendly mechanical ventilation system."

Nagan pointed out that because they are tighter than they used to be, houses can experience pressure differentials relative to the outside. Pressures can affect the drafting of combustion equipment like fireplaces or water heaters. "This is a big issue with the state code," he said.

Before ground is even broken Nagan helps builders and homeowners predict future costs of practically every detail in the house. A computer program "crunches" all the information together—the materials to be used, size and structure, the number and ages of people to live in the house, the type and brand of appliances, and a myriad of other details—and spits out, say, the monthly energy costs for the water heater.

When Nagan visits a building site, he checks for potential problems. On this day, he points out open space around a bathtub enclosure that could result in a cold draft over the winter. Homebuilders using conventional methods would probably leave it there; Nagan will make sure it gets insulated.

If you're a homeowner who's thinking of building a home for yourself, Nagan can't wait to share all of his information with you—and lots more. You'll find his enthusiasm infectious. Nagan takes glee in the simple fact that these concepts exist. "All of this is basic science," he says. "We're not inventing airflow. We're not inventing the concept of moisture transfer. Nature's got all this stuff figured out! We just have to apply it to the process of building homes."

If you're a professional builder who wants to get connected to the ENERGY STAR Homes program, just call 800.677.8423; you'll be mailed a reference manual and an agreement to sign.


During the construction of a home, Joe Nagan goes over plans with Andy Parker of Turek's Plumbing Inc.

NEWS BRIEFS

Initiative provides energy services to inner city Milwaukee

One of the ways the Energy Center of Wisconsin helps communities is to provide energy services to community-based organizations. CBOs are nonprofit groups that help with community development, providing services like housing rehabilitation, weatherization, and job training to low-income people.

Often these groups would like to make energy related improvements to their construction projects but can't because the resources aren't available. But with the help of ECW's Milwaukee Energy Initiative, this is changing.

The Opportunities Industrial Center of Greater Milwaukee, which provides social services to inner city Milwaukee, bought an old theater and converted it into offices, a job training center, and daycare. They also ended up with high energy bills. ECW arranged a design intent workshop and provided them with options to improve their building.

At the United Community Center, an apartment building for the elderly in Milwaukee, ECW sponsored an energy analysis of the building before it was constructed. As a result of the audit, the organization was assured that the building's elderly tenants would have low energy bills.

ECW is also analyzing blue prints for La Causa, a CBO that works with the Latino community in Milwaukee, to help them find ways to make their new administration building safe, healthy, and energy efficient.

All told, ECW has helped half a dozen organizations in the greater Milwaukee area take the first steps toward reducing energy use and monthly costs. Project manager Craig Schepp says the emphasis is often on the related goals of improving safety and comfort. Another goal is to build the local community.

"Our hope is to work side by side with local contractors and consultants so they see what we're doing and build these services into their offerings," says Schepp. "We want to nurture the existing infrastructure and keep money in the local economy."

FOR MORE INFORMATION on the Milwaukee Energy Initiative, contact Craig Schepp at 608.238.8276 x116, cschepp@ecw.org.

—Eric Nelson

DOE grant opens door for ECW efforts in daylighting schools

Daylit schools lead to brighter students.

Thanks to a major U.S. Department of Energy grant, the Energy Center of Wisconsin will be using its expertise in daylighting over the next two years to help develop national daylighting design guidelines for schools. Studies have shown that daylit schools—illuminated with natural light—produce better learners who miss school less often. And then there's the matter of energy savings and peak cooling load reductions in the area of 40 percent.

"It really expands on our current efforts," says ECW program manager Abby Vogen. "There will be more demonstration sites, and more research. We can build on things we're already doing, making what we're doing bigger and better."

ECW received a matching grant of $450,000 (for a total effort of more than $800,000). Along with the National Association of State Energy Offices and the Association of State Energy Research and Technology Transfer Institutions, Lawrence Berkeley National Laboratory, the Lighting Research Center, and the Iowa Energy Center, ECW will work on a project entitled "Energy Smart Schools—Applied Research, Field Testing, and Technology Integration." Schools in Florida, New York, California, and Wisconsin will be involved in the effort.

"This is a sizable award to ECW, and puts us in a very advantageous position to push ahead nationally with daylighting," says ECW Executive Director Mark Hanson.

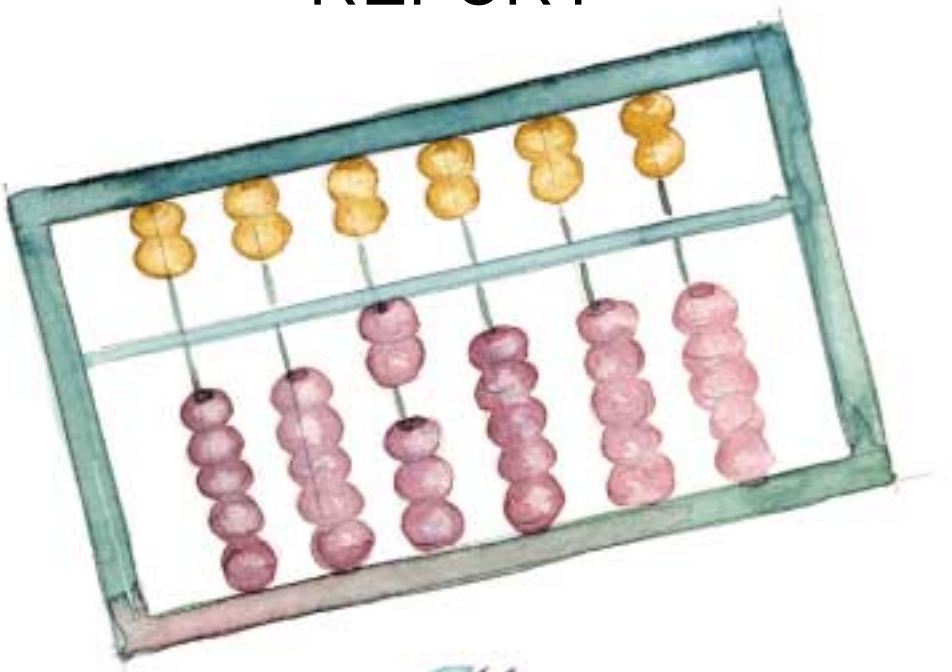
ECW administers the Daylighting Collaborative, which promotes the use of daylighting. With this technique, buildings are illuminated with natural light, but without excess glare and heat buildup, and without driving up the cost of construction. The project includes a national technical review, and controlled experiments at the Iowa Energy Center on how daylighting affects heating, ventilation, and air conditioning system loads.

FOR MORE INFORMATION about daylighting schools contact Abby Vogen at 608.238.8276 x122, avogen@ecw.org.

—Teresa Paprock

Studies have shown that students in daylit schools are better learners with better attendance.

FINANCIAL REPORT



ENERGY CENTER
OF WISCONSIN
We show you how

Membership

The Energy Center of Wisconsin is a private nonprofit organization funded through voluntary contributions from Wisconsin's utilities and grant revenue. ECW's Board of Directors oversees the selection of projects and programs. The Advisory Committee—along with multiple standing committees—work with ECW staff to guide our activities.

Representatives from both member and participant organizations serve on committees and on the Board of Directors.

We invite participation, collaboration, and support from any organization that shares our mission. Contact ECW for information on how to participate or become a member.

Supporting our mission

Members

Alliant Energy*

Consolidated Water Power Company

Madison Gas & Electric Company*

Manitowoc Public Utilities

Marshfield Electric and Water Department

Rice Lake Utilities

Superior Water, Light and Power

Wisconsin Electric Power Company*

Wisconsin Public Power Incorporated

Wisconsin Public Service Corporation*

Xcel Energy*

Participants

Badger Safe Energy Alliance

Citizens' Utility Board*

Community Builders

Conserv Products, Inc.

Cooperative Educational Service Agency 5

Department of Administration's Division of Energy

Earth Energy Syhstems

Kohler Company

L & S Associates

Midwest Renewable Energy Association

Municipal Electric Utilities of Wisconsin*

National Association for the Advancement of Colored People

National Center for Appropriate Technology*

Opportunities Industrialization Center of Greater Milwaukee

Plumbing & Mechanical Contractors Association*

PRO-TEL, Inc.

Public Service Commission of Wisconsin*

RENEW Wisconsin

University of Wisconsin Extension

University of Wisconsin-Madison*

Western Dairyland Community Action Agency

Wisconsin Community Action Program Association

Wisconsin's Environmental Decade

Wisconsin Manufacturers & Commerce

Xexoxial Endarchy, Ltd.

*Representative serves on the Board of Directors

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Plumbing & Mechanical Contractors Association

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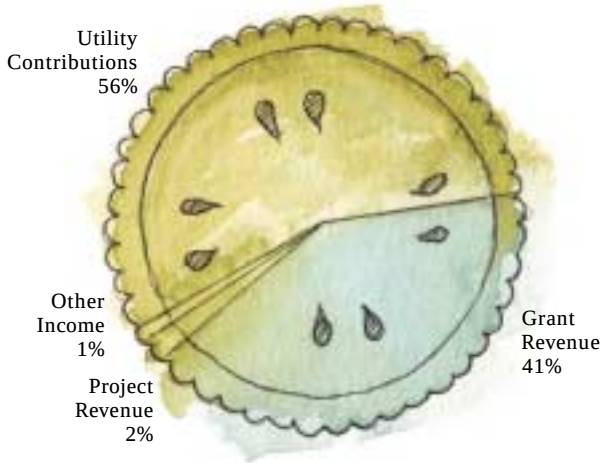
Wisconsin Electric Power Company

Financial summary for FY 2000

SOURCES OF INCOME



Total revenue: $5,635,289

Jack Huddleston
Secretary
University of Wisconsin-Madison

Paul Liegeois
Treasurer
Wisconsin Public Service Corporation

Scott Smith
Executive Committee
Member at Large
Public Service Commission of Wisconsin

David Benforado
Municipal Electric Utilities of Wisconsin

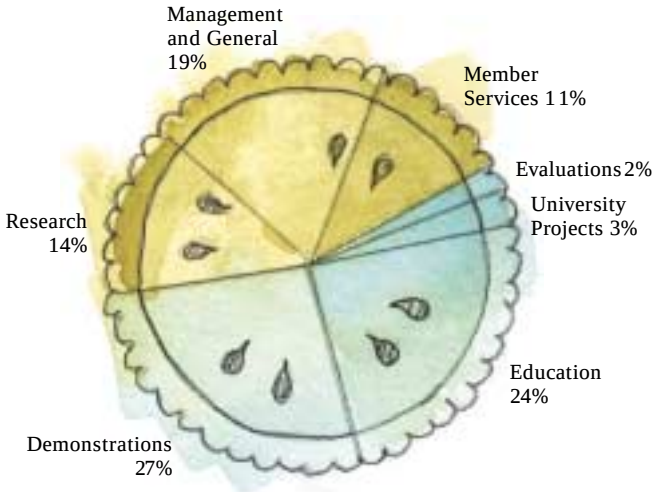
Steve Hiniker
Citizens' Utility Board

Terry Nicolai
Alliant Energy

John Wilson
Xcel Energy

Seat currently vacant
University of Wisconsin-Madison

APPLICATION OF FUNDS



Total expenditures: $5,085,621

Public energy
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At the Energy Center of Wisconsin we've been helping provide the public benefits of energy efficiency and renewable energy for years. Whether it's helping industry keep their energy costs low, providing public information on wind energy, or researching the market to find better ways to sell energy efficiency, ECW has been committed to providing Wisconsin with top quality research, demonstrations, and education on using energy wisely.

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The Energy Center of Wisconsin helps people to save energy and protect the environment. They practice what they preach; 100% of their electricity comes from MGE wind power. "Everyday decisions can make a difference," says Mark Hanson. "For us, wind power was an easy choice."

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WSJ 11/19/2000

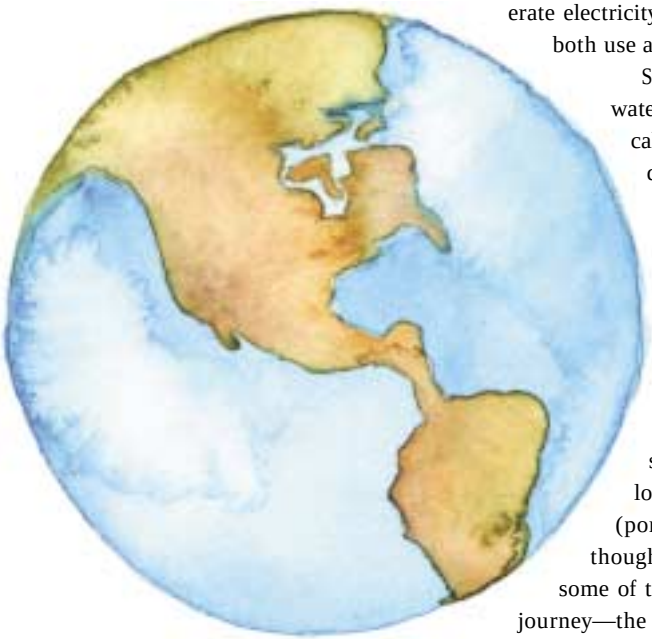
Journey of a water drop

From the clouds to the underground water tables, water is a source and a consumer of energy

by Teresa Paprock

At the beginning of time, according to the oral tradition of the Ho-Chunk Indians, there was nothing in space but Earthmaker. When Earthmaker became conscious of the fact that he was all alone, surrounded by nothingness, he began to cry. He cried so many tears that it formed all the oceans, lakes, and rivers on Earth.

Billions of years later, the Earthmaker's tears are still flowing around in our water supply. They water our crops, clean our floors, and make our lemonade. They are used to generate electricity, cool nuclear reactors, and fill our swimming pools. They both use and provide all kinds of energy for the planet.



Science tells us that the Earth has about the same amount of water now as it did in the very beginning. Because of something called the hydrologic cycle—often visually portrayed in children's textbooks as a circle from the clouds to the oceans and back—the same water is always recycling, an estimated 100 million billion gallons year after year. This means that today's water is a tangible connection to the past. The water that was consumed by a Cro-Magnon man, and that was sailed over by Christopher Columbus, and that fell as sloppy rain during Woodstock, may well be the water in your coffee mug right now.

A single drop of water has an unlimited number of possible directions it can take on its journey through the hydrologic cycle. If we follow the journey of a particular drop (portrayed on these pages as the traditional "tear" shape, even though real waterdrops look more like pill-shaped blobs), we'll see some of those possibilities. Energy is a constant factor on the drop's journey—the drop will either be using energy, or helping to provide energy, depending on where it falls and how it is used. The Energy Center of Wisconsin may become involved with the drop at a few stops along its way.

Let's start (and end, since this is a circle) with the water in the clouds. When the drop becomes heavy enough, it falls (a form of kinetic energy) toward the ground in the form of precipitation. It could be snow or sleet, but for the sake of this particular journey, let's say the precipitation is in the form of rain.

The rain may ruin your parade. Or it might fall into the 70 percent of the earth's surface that is the ocean. Once in the ocean, it becomes part of the largest solar energy storage system on the face of the earth. According to figures from the National Renewable Energy Laboratory, 23 million square miles of ocean absorb solar radiation in a single day equal in energy to 250 billion barrels of oil. (The United States consumes somewhere around 18 million barrels of oil per day.)

Or the drop may fall onto your crops, providing a crucial step in the photosynthesis process that converts sunshine to other energy forms. With the aid of sunlight, your plants will turn the water and carbon dioxide into simple sugars—their food. It's the first step in the food chain that sustains every living being on earth.

The drop may fall in an area where it just winds up being evaporated right back into the clouds, using solar energy—so its journey is short this time around. Or it could wind up in the Arctic, where it could be part of a glacier for hundreds of years—lying in wait as potential energy until the glacier melts a bit and releases the drop. From here the drop may evaporate, trickle into the ocean, or be lapped up by a polar bear.

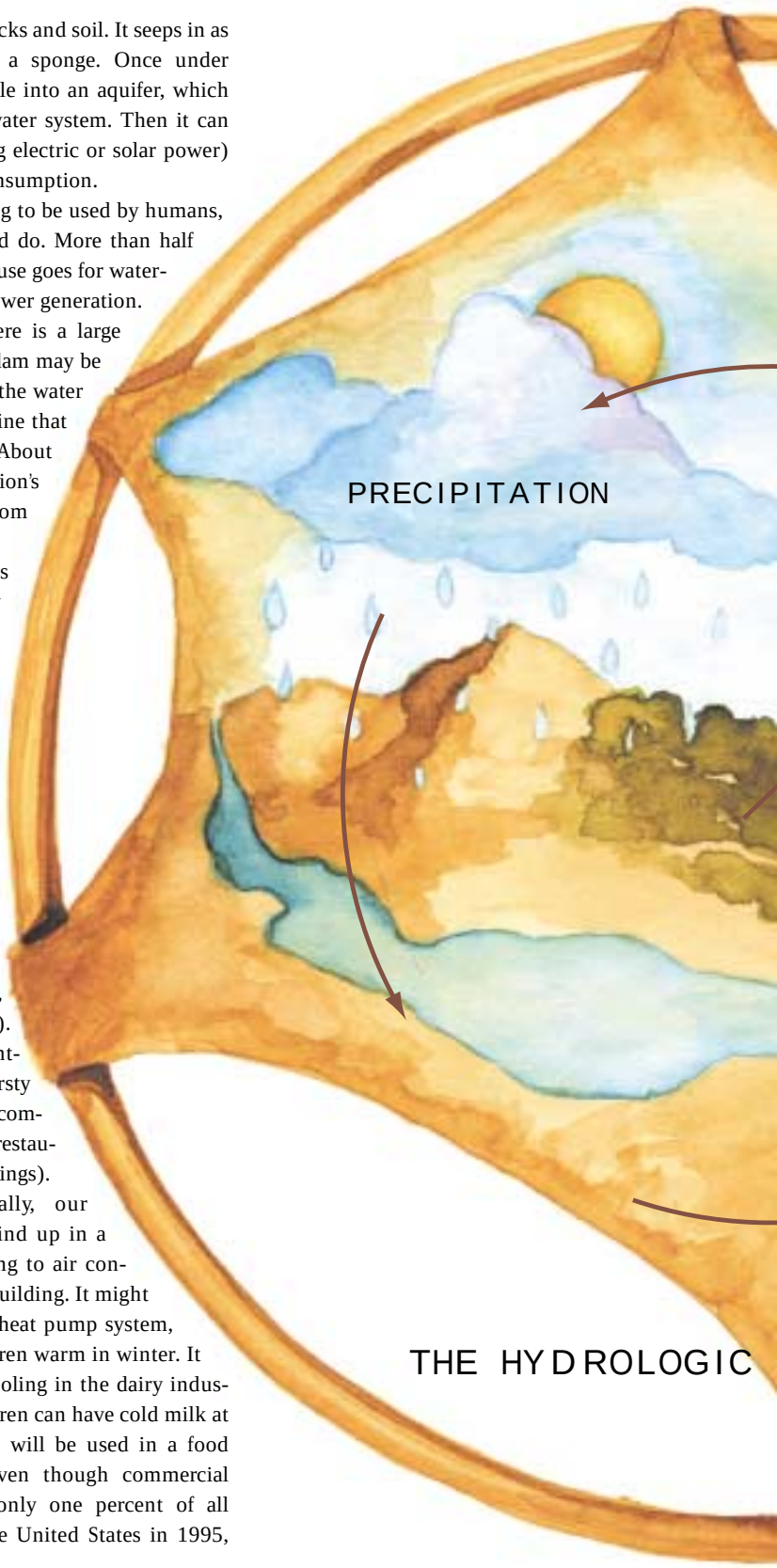
The water drop might fall onto the ground and become surface water. If it winds up being part of the only three percent of surface water on the globe that's fresh rather than salty, it has an important job to do. People, animals, and most plants depend on freshwater. Folks swim, boat, and fish in freshwater. Freshwater is also used in industrial processes. At this point in its journey, the drop may wind up being used in irrigation or in the generation of electricity, or could be consumed by humans after it's been cleaned (more on all these uses later).

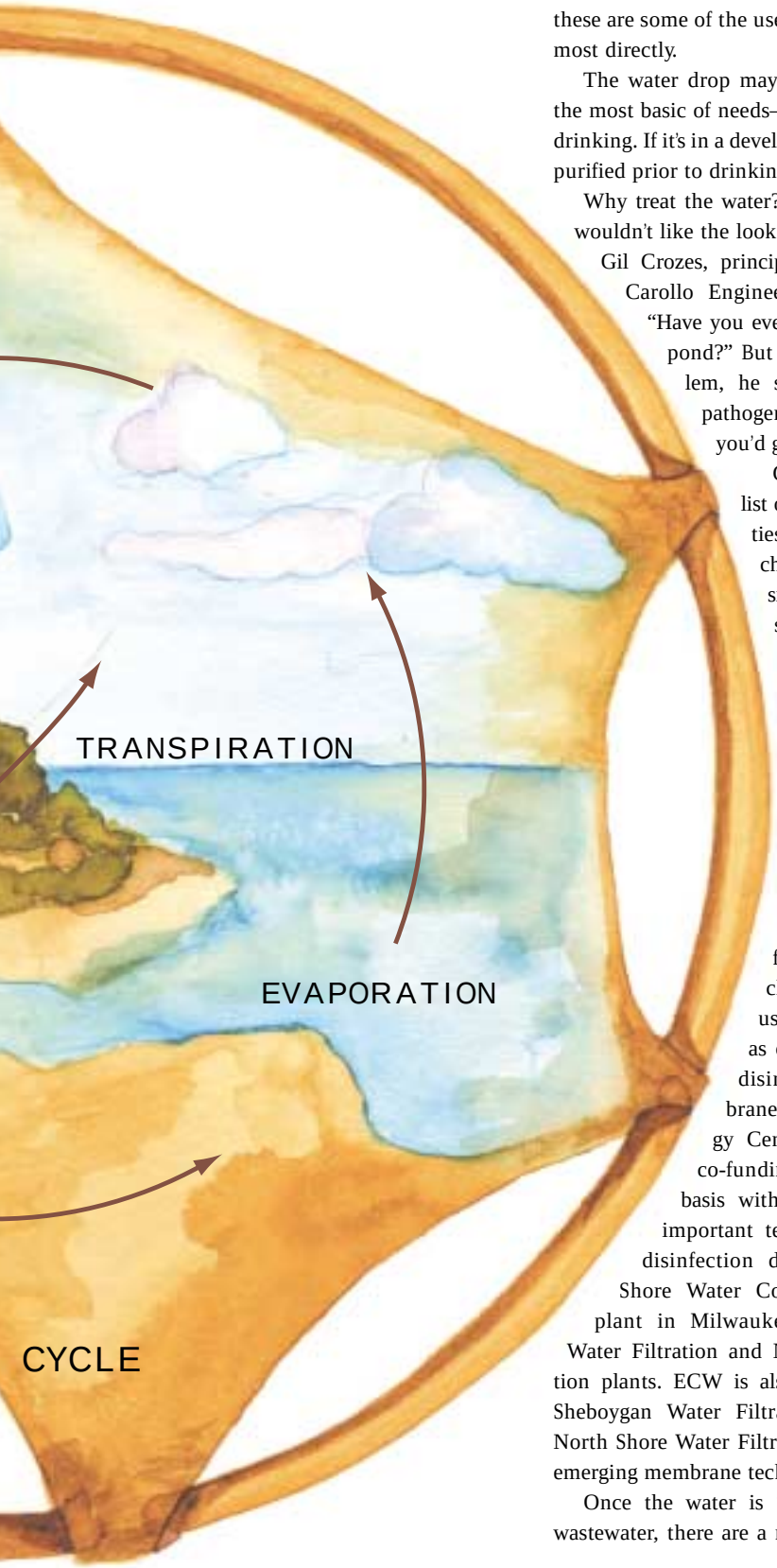
Maybe the water drop sinks into the ground and becomes part of the ground water supply. Groundwater fills porous places under the earth, between rocks and soil. It seeps in as if the ground were a sponge. Once under ground, it might settle into an aquifer, which is an underground water system. Then it can be pumped up (using electric or solar power) for human use or consumption.

If the drop is going to be used by humans, there's plenty it could do. More than half of the freshwater we use goes for watering of crops or for power generation. In a river where there is a large drop in elevation, a dam may be built through which the water flows, turning a turbine that generates electricity. About one-tenth of the nation's electricity comes from hydroelectric power.

Smaller amounts of the water used by humans go into mining and industry (where water can be used for heating, cooling, and transporting of materials), and into the public supply (where it goes to all our familiar household uses—drinking, cooking, laundry, baths, and showers). The smallest percentages go to quench thirsty livestock and into commercial use (such as restaurants and office buildings).

Used commercially, our water drop might wind up in a cooling tower, helping to air condition a large office building. It might be used as part of a heat pump system, keeping school children warm in winter. It might be used for cooling in the dairy industry, so the same children can have cold milk at lunchtime. Maybe it will be used in a food processing plant. Even though commercial use accounted for only one percent of all freshwater use in the United States in 1995,





these are some of the uses that affect our lives most directly.

The water drop may be used for perhaps the most basic of needs—it might be used for drinking. If it's in a developed nation, it will be purified prior to drinking.

Why treat the water? "For one thing, you wouldn't like the look of it otherwise," says Gil Crozes, principal with the firm of Carollo Engineers in Boise, Idaho. "Have you ever seen the water in a pond?" But a much bigger problem, he says, is the microbe pathogens. "If you drink it, you'd get sick in a hurry."

Crozes ticks off a long list of disgusting possibilities: "There's E. coli, cholera, viruses, parasites, protozoa, cryptosporidium—that's a very nasty one—and Legionella bacteria, which causes Legionnaires Disease."

Heard enough? The next question is, how should the water be treated? It depends on what the water will be used for. Drinking water is cleaned and purified using techniques such as ozonation, ultraviolet disinfection, and membrane filtration. The Energy Center of Wisconsin is co-funding, on a collaborative basis with other stakeholders, important tests of an ultraviolet disinfection device at the North Shore Water Commission Filtration plant in Milwaukee and the Cudahy Water Filtration and Neenah Water Filtration plants. ECW is also working with the Sheboygan Water Filtration plant and the North Shore Water Filtration plant on a new, emerging membrane technology.

Once the water is "used" and becomes wastewater, there are a number of other processes used to make the water safe to return to the environment. Conventional wastewater treatments include combinations of coagulation, flocculation, sedimentation, and filtration.

Our drop has several different paths to follow if it's to eventually wind up being treated as wastewater. It can fall into the sewer system at the side of the road. Or it can be used in human consumption before winding up in the sewer, its last stop being your sink or toilet bowl.

Water and wastewater treatment take enormous energy and money, but are absolutely essential to the hydrologic cycle. ECW helped initiate the WATER (Water Alliance for Technology and Energy Research) collaborative and administrates it; WATER was formed to look at technology research and development needs in the water industry.

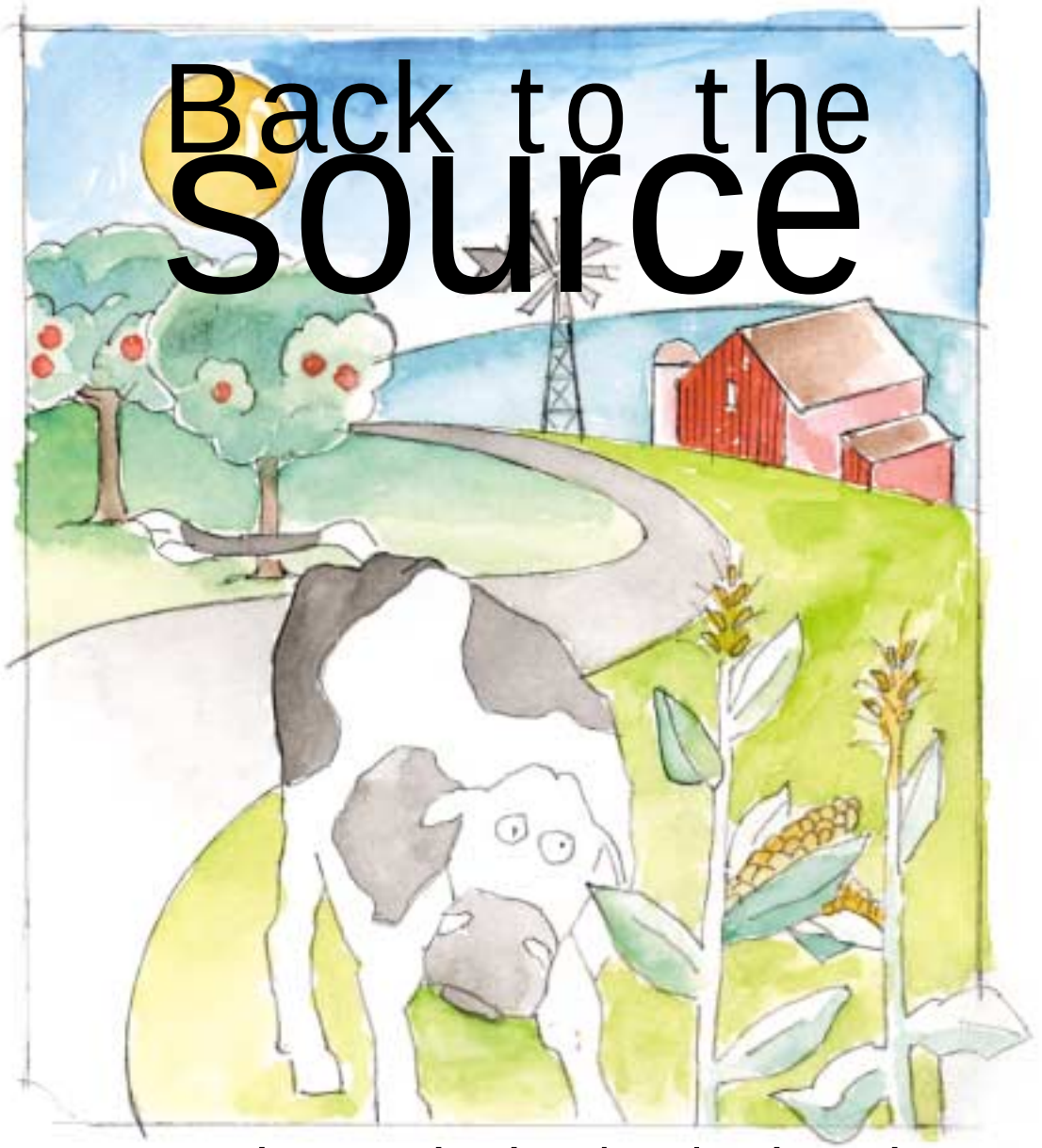
Electricity is used in all steps of the treatment process, from pumping the water into the system to the actual treatment operations themselves. Aeration accounts for a great percentage of the treatment, and is also a large user of electric power.

Historically, energy efficiency hasn't been at the top of the priority list in water and wastewater treatment, but that's beginning to change as the demand grows, new treatments are required, and new technologies become available. ECW is helping all those concerned to look at the cost of energy, help find ways to minimize energy use, and find the optimal mix of water treatment approaches, by developing a strategic approach to research and development.

Once our drop has been treated, used, and perhaps retreated and reused, it's ready to jump into a riverway or a stream. From there, the water will meander around the water system.

Eventually, it will evaporate into the sky and become part of a cloud. When the drop becomes heavy enough, it falls toward the ground in the form of precipitation. The rain may ruin your parade…

Back to the source



How Wisconsin is developing its native, renewable energy resources

Eric Nelson

If you attend a meeting at the Madison Quaker meetinghouse, you'll find it's a quiet affair. Worshippers meditate in pews arranged in a square. Occasionally, someone will rise to offer a few spiritual words, often on a theme drawn from nature. And if it's a bright day, another silent activity will be taking place on the roof of the white brick meetinghouse—the generation of electricity from the sun.

The top of the building is covered with gray solar panels that double as a roof, silently converting sunlight to energy, and feeding it to the electric grid. Funded and installed by Madison Gas & Electric Company, with cofunding from the Energy Center of Wisconsin's Wisconsin Solar Use Network (WisconSUN), the small rooftop was generating 2400 W on a bright October day when I visited.

The Friends' meetinghouse is a tiny example of the power in the sun. The earth intercepts the equivalent of all known fossil fuel reserves from just 20 days of sunshine. This solar energy has been pouring down on the earth for billions of years. With the exception of nuclear power, it is the source of all the energy we use—all the fossil fuel; all the plants we use as food; and all the wind.

It is only in the last 150 years that we've extensively mined fossil fuels, drawing on vast underground pockets of coal, oil, and natural gas, which are the compressed remains of ancient plants. Today, fossil fuels represent about 85 percent of U.S. energy use but it's unlikely this dependence can last. Coal generated power has become more costly due to environmental concerns, the U.S. is facing higher natural gas prices, and according to many experts oil production will peak within the next 20 years, then decline. These forces, in addition to the threat of global warming, are motivating people to return to the sun and the wind and biomass energy systems powered by the sun.

Solar electricity was discovered by French scientist Edmund Becquerel in 1839, and first put to work in light meters for cameras. Today's silicon-based solar cells date back to the 1950s. Today they power spacecraft, highway road signs, and buildings, and even help disinfect water in remote regions of the world.

Solar energy is also used to heat water or air directly.

Solar energy is only about six percent of Wisconsin's renewable energy mix, but there's a lot of activity in the state. When it comes to smaller systems, the Midwest Renewable Energy Association has been especially active. MREA, which is based in Custer, Wisconsin, was created to promote renewable energy and sustainable living. It has 1,100 members and a mailing list of over 10,000. Tehri Parker, MREA's executive director, and chair of ECW's education and information committee, says that inquiries about solar and wind systems there have doubled in the last four years. Parker also says the installers she's talked to are busier than ever. In addition, she's seeing more solar systems in urban areas.

Back in Madison, ECW leads WisconSUN, which was launched last year to promote solar energy in Wisconsin. Cosponsored by the U.S. Department of Energy and the Wisconsin Department of Administration's Focus on Energy, WisconSUN operates a website (www.wisconsun.org) that provides education and referrals. The program also provides grants for solar energy systems; currently, 13 systems are receiving support. Like MREA's Parker, WisconSUN Director Neils Wolter at MSB Energy Associates sees more growth in urban areas, especially with the use of so-called building integrated photovoltaics, where parts of the building, such as roofs or atriums, also function as solar panels.

(left) Worker installs standing seam solar roofing atop the Friends' Meeting House in Madison, Wisconsin. *(below)* The solar rooftop can generate up to 3600 watts of electricity. Madison Gas & Electric Company, who owns the solar equipment, donates 10 percent of the electricity to the Meeting House.

Windy city

Two hundred miles northeast of Madison, 33 wind turbines sprout like giant trilliums from the farmland of Kewaunee County, Wisconsin. Owned by Madison Gas & Electric Company and Wisconsin Public Service Corporation, these wind machines can generate up to 20 megawatts of electricity, and last year generated enough for 6,500 homes.

Built on a gentle rise of land called the Niagra Escarpment, these turbines are taking advantage of the westerlies, created when sun-warmed air from the equator flows northward and is turned to the east by the rotation of the earth.

In large measure, these turbines are the child of public policy. In 1998, Wisconsin passed Act 204, a law requiring utilities to install 50 megawatts of renewable energy generation by 2001.

But customer service also drove the decision. Utilities have discovered that their customers are willing to pay more for environmentally friendly power. The power generated by the Kewaunee wind farm is being fed to the grid, and MG&E consumers are paying for it through a wind power program. Wisconsin Electric Power Corporation has their Energy for Tomorrow program; two wind turbines based near Byron, Wisconsin help supply power for it. Alliant Energy also has a green energy program in the works.

Wind turbines are often sited on agricultural land, providing farmers with rental income on their land.

Wind has been used for hundreds of years to drive ships, grind grain, and pump water. Spurred by the energy crisis of the 1970s, government-sponsored research led to today's large-scale wind turbines. In the U.S. these turbines were first deployed in mass in California in the 1980s. They now also dot the land in Minnesota, Iowa, Texas, and elsewhere.

Worldwide, wind generation has increased 500 percent in the last 10 years. One reason is that the cost of wind-generated electricity has fallen from 25 cents per kWh in 1981 to four cents today in some areas. This is close to the cost of electricity generated from coal power plants, according to the American Wind Energy Association. Wind power can also be put up quickly, in a matter of months rather than years, giving it an edge when new electricity generation must be constructed quickly.

Michael Vickerman, who directs RENEW Wisconsin, a Madison-based nonprofit that promotes renewable energy development in Wisconsin, says that another advantage of wind power—and other renewable energy—is that most of the costs are up front. He compares the investment to a fixed rate mortgage; once the down payment is made, the monthly costs are the same for the life of the equipment. “The fuel is free and you don't have to worry about price fluctuations,” he says.

To educate people about the benefits and impacts of wind power, ECW created the

Four Vestas wind turbines rise 292 feet above farmland in Kewaunee County, Wisconsin, part of a 33 turbine wind farm shared by Wisconsin Public Service Corporation and Madison Gas & Electric Company.

Wind Awareness Project. Recently, the project distributed fact sheets to educate residents of Iowa County in southwestern Wisconsin, where the Texas-based Enron Corporation is planning to erect 30 MW of wind power next year. The project also hosts the wind awareness website at www.wind.ecw.org.

Although Vickerman has worked hard to promote utility-scale wind farms in Wisconsin, he sees the future of wind power in the state taking a different direction. "There are not that many sites in Wisconsin that can accommodate 20 turbines at a crack," he says. "I think the path to increasing wind generation in Wisconsin lies primarily in small developments."

Waste not

The Madison Metropolitan Sewerage District has been harnessing the power of biomass energy since the 1930s. Sewage is one form of biomass energy, where solar energy is stored chemically in the form of food or waste.

Situated in south Madison near the Nine Springs E-Ways, the District collects and treats 30 million gallons of sewage from Madison and surrounding communities. In the process they generate about 29,000 cubic feet of methane a day—otherwise known as natural gas. The gas is produced with the help of natural bacteria in five large, heated tanks called anaerobic digesters, so called because the bacteria grow without air. MMSD collects the gas and burns it to power equipment, heat and cool their buildings, and to generate electricity that supplies about a third of the facility's needs.

Some other Wisconsin projects are also harnessing the power of waste. Wisconsin Electric Power Company is buying electricity generated from landfill gas, while Alliant Energy is now purchasing electricity from a generator fueled with waste from paper mills. In addition, an ECW-administered project funded by the Wisconsin Department of Administration's Focus on Energy will install a biodigester near Wrightstown to turn excess manure from dairy farms into 300,000 cubic feet of methane per day, which will be used to generate electricity.

Waste is just one source of biomass energy. There's also corn and potatoes, which can be made into alcohol and mixed with gas; native prairie grasses that can be used as fuel in power plants; and trees that are regularly used for heating homes.

Nationwide, biomass energy represents nearly 40 percent of all renewable energy generation, second only to hydropower. In Wisconsin over the last 30 years, biomass energy use has steadily increased. According to Alex DePellis, a renewable energy engineer at the Wisconsin Department of Administration's Division of Energy, the future will see more attention being paid to waste—both plant wastes like straw and corn stalks, and animal wastes. These energy sources promise to improve the biomass renewable energy market.

Future energy

Renewable energy has a promising future in Wisconsin. We have abundant biomass resources, plenty of sun, and wind that can support utility-scale wind farms. In addition, Reliability 2000 legislation passed last year will gradually increase the share of renewable energy in the state's electricity mix, to two percent by 2010. The combination of good natural resources, legislation, and the increasing popularity of green power programs bode well for Wisconsin continuing to tap into the solar powered renewable resources of our planet.

(below) The Madison Metropolitan Sewerage District in Madison, Wisconsin. *(right)* Steel arm sweeps bacteria on its way toward anaerobic digesters, where the bacteria will convert sewage into an energy-rich methane gas that provides a third of the District's electricity needs.

DIVERSIONS

CORNY ENERGY LIMERICKS NEVER BEFORE PUBLISHED

At Walgreens a CFL burned
and cast some cheap light on a fern
but the plant didn't care
bulb sales were only fair
and the good manager grew stern

Efficiency: a very good way
to take little and make it pay
take electricity
or eccentricity
add some cleverness and it may!

BEST ENERGY-EFFICIENCY MOVIES NEVER MADE

PULP FRICTION

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Greenboy's big screen debut is a futuristic sci-fi shocker, revealing the secret and terrifying source of energy in the year 2022!

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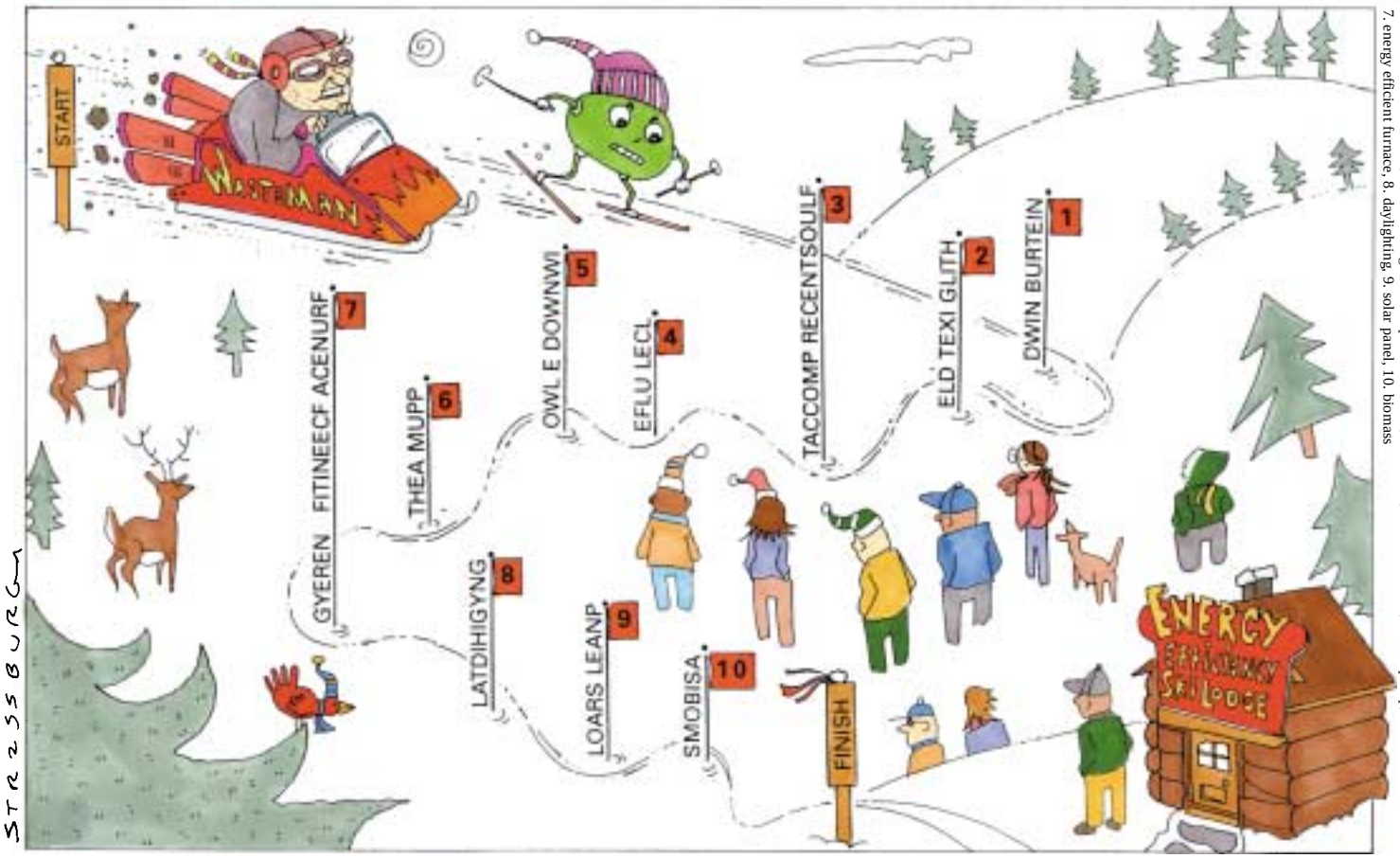
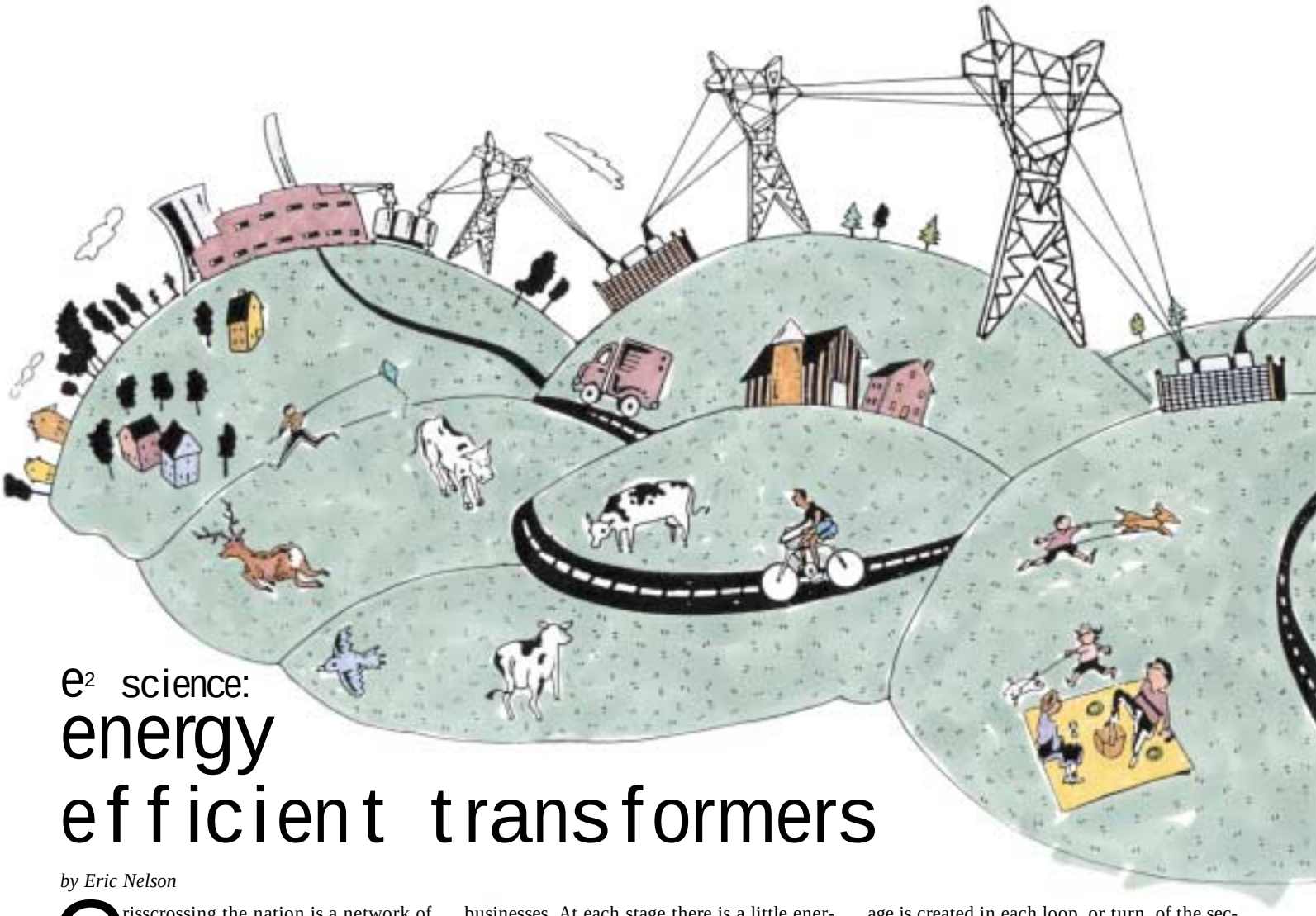
Watch as a troubled Brooklyn neighborhood is completely transformed in a day with the purchase of some Compact Fluorescent Lamps.

GREENBOY



The race is on! Help Greenboy defeat Wasteman in the giant energy slalom! Simply unscramble the slalom pole words (hint...they all refer to energy saving devices) and win yourself an unlimited supply of free hot chocolate and cammaraderie at the ski lodge.

Answers: 1. wind turbine, 2 LED exit light, 3. compact fluorescent, 4. fuel cell, 5. low e window, 6. heat pump, 7. energy efficient furnace, 8. daylighting, 9. solar panel, 10. biomass



e² science: energy efficient transformers

by Eric Nelson

Crisscrossing the nation is a network of wires that carry electricity from power plants to our homes and businesses. They do so with remarkable efficiency, losing less than 10 percent of the electricity they carry in journeys of up to thousands of miles, despite the fact that these wires carry hundreds of megawatts of power. Unlike the coils in an electric stove, transmission wires don't glow red and lose all their energy to heat. They perform this feat with the help of transformers.

Transformers are devices that change the voltage of electricity, and they're used in everything from radios and commercial buildings to factories. They also play an important role in the electrical transmission network.

When electricity leaves the power plant, a huge transformer boosts the voltage to hundreds of thousands of volts. This is done because less power is lost if it's transmitted at high voltage (see sidebar). Down the line, transformers also decrease the voltage to 110V or 220V (or higher for industry) because this is what most equipment and appliances require. This is done in stages, as the electricity is routed off the transmission line through substations to distribution lines to homes and businesses. At each stage there is a little energy lost. But not much.

Transformers are amazingly efficient devices. Utilities use transformers that are 99 percent efficient, and they do so for good reason; they're crucial to cost-effective electricity transmission. If the transformers were only 95 percent efficient, five percent of the power would be lost each time the voltage changed. If there were five voltage changes, nearly a quarter of the power would be lost on route. Efficient transformers reduce this overall loss to just a few percent.

How a transformer works

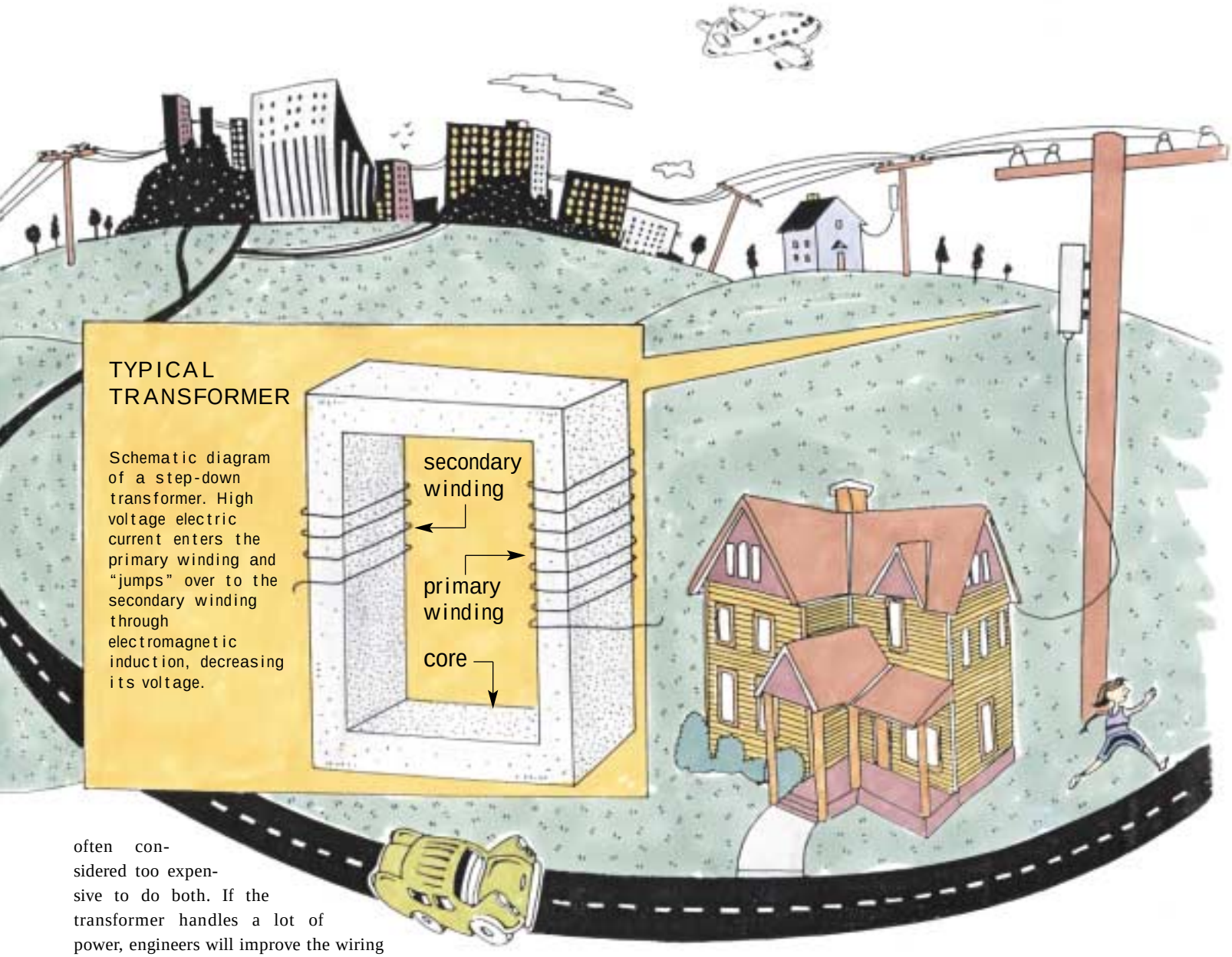
A typical transformer consists of two coils of wire wound around an iron core. When electricity enters the transformer, it flows into the first coil of wire, called the primary winding. Because this current is constantly changing (in the U.S. alternating current changes direction 60 times a second) it creates a fluctuating magnetic field, which in turn produces a voltage in the second coil of wire. In effect, electricity seems to cross between the two windings, even though they're not touching. (Michael Faraday discovered this magic in 1831.)

This is where the voltage changes. A voltage is created in each loop, or turn, of the secondary winding. The turns act like batteries, and since they're all connected, their voltages add up. If the secondary winding has more turns than the primary winding, the voltage will be higher; if it has fewer turns, it will be lower. The input and output power, however, are the same, except for what's lost through inefficiency.

Transformer efficiency

In a transformer, energy can be lost in two ways—through resistance in the transformer wires or through small currents that are created in the steel core by the magnetic field. Either way, energy is lost as heat. To minimize resistance, thick copper wires are used (among other techniques). Engineers minimize magnetic losses by making the core out of thin, high-quality steel plates separated by insulation; this allows a magnetic field to form but prevents heat-forming currents.

Because it's so important that utility transformers be efficient, they're optimized individually, and great attention is paid to both magnetic and resistive losses. With the commercial and industrial transformers used in buildings and factories, on the other hand, it's



Illustrated by Brian Strassburg

often considered too expensive to do both. If the transformer handles a lot of power, engineers will improve the wiring to cut down on resistance, at the expense of higher "core" losses. These are called low temperature rise transformers, because they don't get as hot. On the other hand, if the transformer doesn't handle much power, the biggest gains come from improving the steel core, at the expense of hotter-running wires. High-temperature rise transformers can be more cost-effective in certain circumstances.

Of course, there's no reason you can't do both, which is exactly what is done in high efficiency transformers. High efficiency transformers can save commercial and industrial customers one to three percent off their electricity bill, produce much less heat, and pay for themselves in less than four years. The Energy Center of Wisconsin supports efficient transformers through its new technology fact sheet series and through the Consortium for Energy Efficiency, which runs a High Efficiency Transformer Initiative. ECW is also keeping its eye on superconducting transformers, which boost efficiency still more by letting electricity flow through them without resistance. Wisconsin's Waukesha Electric Systems developed a prototype in 1998.

Why high voltage transmission?

Utilities transmit electricity at high voltage because it flows more efficiently through the wires, cutting down on power losses. The reason is that as voltage increases, less current is required for a given amount of power. Like a water current, electrical current is a flow—in this case, of electric charge. At high voltage, each charge carries more energy, so less current can carry the same amount of power, cutting down on heat loss due to electrical resistance.

You can think of current as cars, voltage as passengers, and transmission wires as the interstate system. High voltage electricity is like carpooling (each car of charge carries more passengers) while low voltage is like everyone driving alone. And just as carpooling means less congestion on the interstate, so high voltage electricity means more effective transmission.

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Contact: Renee Abel-Collinge, 608.238.8276 x143, rabel@ecw.org

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Wisconsin ENERGY STAR® Homes Presents…Training Series
Statewide

February 5–6, 2001, Green Bay, WI
February 7–8, 2001, Madison, WI
Thermal Insulation, Air Barriers, and Drainage Planes

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April, 2001, Green Bay & Madison, WI
Sales Training

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Contact: Brenda Jessen, 608.238.8276 x128, bjessen@ecw.org

February 2001
Making Sense of Energy and Environmental Programs to Assist Wisconsin Industry
Northeastern WI

Four half-day events will connect industry leaders with many different government, utility, and private programs that can help improve industrial efficiency.

Contact: Brenda Jessen, 608.238.8276 x128, bjessen@ecw.org

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Madison, WI & Northeastern WI

Sponsored by the Daylighting Collaborative (www.daylighting.org), this one-day training will teach participants low/no-cost daylighting for schools and offices.

Contact: Marge Anderson, 608.238.8276 x132, manderson@ecw.org

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A two-day conference packed with information about how energy efficiency and high performance buildings go hand in hand. Targeted toward building owners, design professionals, operations and maintenance staff. Includes a trade show.

Contact: Brenda Jessen, 608.238.8276 x128, bjessen@ecw.org

April 30–May 5, 2001
Affordable Comfort 2001
Milwaukee, WI

Affordable Comfort is the home performance industry's largest national conference. Participants will learn how to build with health, safety, durability, comfort, sustainability, resource efficiency, and affordability in mind. This conference features nearly 100 workshops plus advanced technical sessions and a trade show.

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This case study tells how a Wisconsin paper mill improved the performance of one of their boilers, which enabled them to burn more of their wood waste. Optimization training provided by ECW helped pave the way. *321-1* (free download).

Emissions and Economic Analysis of Ground Source Heat Pumps in Wisconsin
This report compares the emissions of carbon dioxide, nitrous oxide, sulfur dioxide, and mercury from ground source heat pumps and conventional heating and air conditioning systems. Comparisons are made for both residential and commercial buildings. Economics are also considered. *201-1* (free download).

Custom-Designed Membrane Filtration for Water Treatment Plants
A Technical and Economic Evaluation
This report evaluates the feasibility of retrofitting a custom designed membrane system as a final separation process in a conventional water treatment plant. The report discusses pilot tests conducted at a water treatment plant in Sheboygan, Wisconsin. *200-1* (free download).

Compressed Air Training Keeps Machining Company on the Cutting Edge
The Compressed Air Challenge workshop provides participants with a step-by-step plan for reducing waste in compressed air systems. In this case study, Chris Lamb of Pioneer Products in Racine implemented the plan, and was able to save his company 35% in energy costs in less than one year. *318-1* (free download).

SELECTED READINGS

The following publications are now available at the Energy Center Library. For more information call 608.238.8276 x126, library@ecw.org.

The Ecology of Architecture: A Complete Guide to Creating the Environmentally Conscious Building (1996) / by L.C. Zeiher. Whitney Library of Design, New York, NY. Access # 7689

Emerging Energy-Efficient Industrial Technologies (2000) / by N. Martin, et al. American Council for an Energy-Efficient Economy (ACEEE), Washington, DC. Access # 7759

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Renewable Resources and Conservation: What Consumers Want (1999) / by E.G. Ferguson. Bonneville Power Administration (BPA), Portland, OR. Access # 7192

Specification of Energy-Efficient Installation and Maintenance Practices for Residential HVAC Systems (2000) / by the Consortium for Energy Efficiency, Boston, MA. Access # 7744

Willingness to Pay for Electricity from Renewable Resources: A Review of Utility Market Research (1999) / by B.C. Farhar. National Renewable Energy Laboratory (NREL), Washington, DC. Access # 7443

World of Water 2000: The Past, Present, and Future (1999) / WaterWorld (a PennWell publication). Access # 7424

COMMENTARY

Wind power: It's about more than the money

What do saving landfills and capturing the wind have in common? Read on and find out.

It was 1977 and I was working my first stint as a graphic designer. I enjoyed reading about new industry trends and often read trade publications in my spare time. I was very interested in the idea of using recycled paper. Being in advertising I often struggled with the lack of social and environmental responsibility in the industry, and this was a way to "Save the Forests." I was hooked. I remember the few recycled stocks that were available at that time. The paper was grainy, there weren't many to choose from, it was tough to print consistently on them, and the cost was at a premium.

Now there are many recycled papers available, and they are wonderful. In most cases the cost is comparable to virgin paper production, and often less. No bleach or much less bleach is used to whiten the paper. The quality is so good that the press people no longer roll their eyes at me when I'm press proofing a project printed on one of these papers. The post-consumer content information is readily available along with all sorts of other information on how the paper was actually produced. While there have been many changes in the availability of recycled stocks, the same can be said for landfills. Between 1978 and 2000 the number of U.S. landfills declined from 14,000 to 1,800. The goal is no longer about saving forests—it's about not filling up more landfills.

Recently I was telling a friend about the Wind Awareness project I was working on. The goal of the program is to provide information to consumer and commercial clients about wind turbines. I found out that wind power costs more than regular electricity. I was curious about what was behind these costs. I also made an assumption there would be some similarities to the recycled paper industry.

Why would anyone consciously pay more for the same product? My research showed that it took a huge capital investment in paper plants so that they could recycle the pulp for repeated use. With time the cost to produce recycled paper dropped dramatically and the technology continued to improve. It is the same for windpower. Equipment cost is dropping but this won't affect the energy prices until the equipment in use is replaced. And as in the paper industry the capital costs are high because of the complicated equipment. In addition, the turbines are often in more remote areas and this means more cost for maintenance and operation. The equipment is getting better all the time (for example, turbines operate at lower wind speed and have taller towers) and is more cost effective than just five years ago. Prices will continue to fall and some analysts expect wind to be the cheapest source of electricity by 2015.

Ultimately, what would the real cost be if we don't invest in these technologies? Will we be spending many times over to correct for the negative impacts on the environment? Recycling paper and alternative, renewable sources of energy are necessary for environmental sustainability. Let's support our future environment by making wise choices now.

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