

momentum

Institute on the Environment • University of Minnesota

{ the energy issue }

LIFE *after* OIL

Six steps toward
the new energy era

Q&A

with **MAJORA CARTER**
Equal Opportunity Environment

NUCLEAR REACTIONS
from science and industry

PLUS

*Words to the wise from BILL MCKIBBEN, JEFF GOODELL, ANN VILEISIS,
ALEX STEFFEN, DON SHELBY and other energy experts*



More and more, the public is gaining awareness of the energy and environmental problems facing the planet. Unfortunately, our efforts to find solutions, so far, have been inadequate, fragmented and short-sighted.

We're still mired in the old argument of "jobs versus the environment." We've failed to connect science and policy to practical problem solving or to engage people with anything more than shallow sound bites.

As you'll see throughout this issue of *Momentum*, the energy problem is complicated, to say the least: Food, fresh water and energy are becoming increasingly interconnected as we rely on irrigation and petroleum-based chemicals to boost food production, and as we consider large-scale production of agriculturally-based biofuels. We must solve these problems simultaneously.

Without question, our world desperately needs a transformative approach to the environmental, social and economic challenges of building a secure energy system. But finding sustainable and equitable ways to provide energy, water and food to billions of people will be the greatest challenge humanity has ever faced.

So, what is the University of Minnesota's Institute on the Environment doing to tackle this global challenge?

Since I arrived at the Institute in August 2008, we've been very busy developing some ambitious new programs, including a new cohort of resident fellows and a new cadre of research initiatives. We'll announce these fellows and initiatives early this spring, so stay tuned for exciting news.

The Institute's new research initiatives will greatly increase our understanding of human activities, changing natural resources and the global environment. At the same time, they will apply innovative technical, economic and policy solutions to complex sustainability issues.

Of course, science and technology alone are not enough. We also need to engage with businesses, non-governmental organizations, media outlets and policymakers to convert new knowledge into real-world solutions.

That's why the Institute is designing programs to train the next generation of sustainability leaders. These leaders will learn to extend the latest science and technology developments to emerging opportunities in business, social entrepreneurship, public policy and mass communications. We are also creating international collaborative networks, which will broaden our reach to the entire world.

As we begin to launch these new programs, I would like to invite you to get involved. We can't develop long-term solutions in a vacuum. We need your input and ideas. Working together, we can make a real difference in the world—both today and for future generations.

Jonathan Foley

Director, Institute on the Environment
jfoley@umn.edu

momentum

WINTER 09 – 1.2

director JONATHAN FOLEY

communications director TODD REUBOLD

managing editor EVE DANIELS

art director SARAH KARNAS

communications assistant AMANDA OBERG

webmaster MICHELLE BEAMAN

video producer BETH M. ANDERSON

contributors

SIMON DONNER

TIM GIHRING

JOSEPH HART

JOSH KOHANEK

JAKE KULJU

MARK NEUZIL

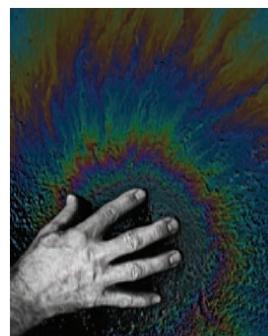
SUBHAS RAI

printing SHAPCO PRINTING, INC.

The Institute on the Environment is committed to sustainability. This magazine is printed on FSC-certified paper with a 20 percent soy-based ink.

Momentum is published three times per year by the University of Minnesota's Institute on the Environment. To change your address or to request an alternative format, contact Eve Daniels, momentum@umn.edu, 612-626-2670.

The opinions expressed in *Momentum* are those of the authors and not necessarily of the Institute on the Environment/University of Minnesota.



The University of Minnesota is an equal opportunity educator and employer.

on the cover

"Male hand in spilt petrol on asphalt"
Tate Michael Davidson/Photonical/
Getty Images

DEPARTMENTS

2 Web Extras

3 Noteworthy

6 Voices

New deal or no deal

8 Standout

Q&A with Majora Carter

9 In Focus

Greening the ghetto

22 Scientist's Soapbox

A diet for fueling the future

24 Connections

Making waves in Duluth

26 Community

Piper Jaffray's next big thing

28 Viewpoints

Two positions on nuclear power

FEATURES

12 Out With the Old, In With the New

While plenty of cash and ingenuity will be required, the foundation for "life after oil" is already in place. National experts offer six steps we can take to usher in the new era. Plus, a look inside the Initiative for Renewable Energy and the Environment. by JOSEPH HART

20 Meet the Press

Minnesota media veterans from print, television, radio and the Web discuss the role the press plays (or doesn't play) in influencing society's views on environmental issues. by EVE DANIELS

12



24



environment.umn.edu

Cool, new and curious features at IonE online



WATCH

EXPLORE the future of renewable energy; discover the effects of climate change on large lakes from northern Minnesota to East Africa; and get the scoop from veteran journalists on the state of environmental reporting.

LISTEN

TUNE IN to our in-depth interviews with environmental justice advocate Majora Carter and nuclear energy experts John Rowe, Alan Nogee and Paul Wilson.

SOUND OFF

SEND US your thoughts on the articles featured in *Momentum*. We'll review them for potential inclusion in the next issue.

SIGN UP

STAY CURRENT on environmental research, events and funding opportunities at the University of Minnesota by way of our monthly e-newsletter.

NETWORK **JOIN** the IonE group on LinkedIn and become a fan on Facebook.



Watch for this symbol throughout the magazine, and visit us online for special features.

PICKED TO CLICK WEB SITES WE LOVE



100places.com

A visually stunning tour of 100 places across the globe that are being impacted by climate change.



ecogeek.org

From landfill-safe batteries to car parts from coconut husks, ecogeek publishes up to 10 stories a day on innovations that are saving the planet.



gcbl.org

A highly interactive and detailed picture of the programs and projects pushing the Cleveland area toward greater sustainability.



pruned.blogspot.org

A gathering place where landscape architects and designers discuss offbeat topics ranging from "hydro-anarchy" to "deep-sea living in the underground tunnels of New York City."



ted.com

One of the best places in the world to see and hear insightful new ideas from world leaders in technology, entertainment and design.

At the IonE...

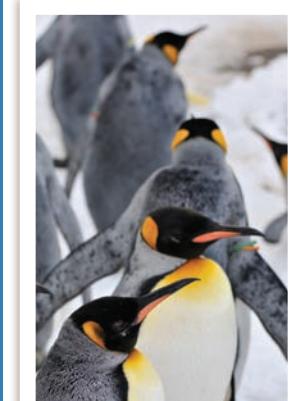
Conducive Climate

The Institute on the Environment recently launched a unique partnership with **Climate Central**, a new nongovernmental organization that serves as a link between the science community and the public on issues related to climate change. Based in Princeton, N.J., with an office in Palo Alto, Calif., Climate Central provides clear and objective information about climate change impacts and solutions—communicating complex topics through a series of video reports that are already showing on PBS's *The NewsHour with Jim Lehrer* and will soon appear on network television.

The Institute will house Climate Central's newest regional "node," a satellite office that creates a bridge into the University of Minnesota's scientific community and the Upper Midwest. The two organizations will work together to build a world-class research and public outreach program that includes innovative fellowships and media internships.

"The Minnesota region plays a key role in the area of biofuels and other renewable energy technologies, and the University has research strengths in so many areas connected with climate change," says Berrien Moore III, executive director of Climate Central. "This is really a win-win from our perspective."

environment.umn.edu/climatecentral.org



Biofuels Guru Now on Board

Noted biofuels expert **John Sheehan** has joined the Institute on the Environment. As the scientific program coordinator for biofuels and the global environment, he'll pay special attention to the direct and indirect consequences of biofuels production on land use around the world. Sheehan will work closely with two of the Institute's signature programs: the Initiative for Renewable Energy and the Environment and the Global Landscapes Initiative.



Most recently, Sheehan served as vice president of strategy and sustainable development at LiveFuels Inc., a venture capital-funded startup that focuses on algal fuels technology. Prior to that, he spent nearly two decades with the National Renewable Energy Laboratory, where he conducted pioneering research on system dynamic models for policy-related decision making.

"The high points of my career have been when I've been able to tackle some of the thorniest questions about the sustainability of biofuels—and I love the interdisciplinary nature of these questions," says Sheehan. "Coming to Minnesota is the ultimate opportunity for me to work with a talented and interdisciplinary team on the most urgent questions facing biofuels."

Visit environment.umn.edu/about and click on "People" for more on Sheehan's background.

The Lay of the Land

The need to provide food, fiber, water and shelter for more than 6 billion people is driving changes to the world's forests, farmlands, waterways and atmosphere. Such changes have enabled humans to utilize a greater share of the planet's resources, but they have the potential to weaken the capacity of ecosystems needed to sustain a healthy environment.

In response, the Institute on the Environment's new **Global Landscapes Initiative** is utilizing satellite-based remote sensing, combined with sophisticated computer models and ground-based observations, to document and understand the changing nature of Earth's landscapes from local to global scales. Working with colleagues at McGill University and the University of Wisconsin, with support from NASA and the National Science Foundation, the GLI researchers are addressing the challenges of land use, agricultural practices and food production worldwide.

Along with distinguished scientists from across the University of Minnesota, a group of graduate students and postdoctoral scholars will lend their expertise to the initiative. The GLI team is currently looking for students, postdocs and partners who are interested in the connections among land use, agricultural systems and the environment. To learn more, contact Jonathan Foley, director of the Institute and head of the GLI, at jfoley@umn.edu.



Noteeworthy continues on page 4...

NOTEWORTHY

Across Campus...

Polar Quest

In early January, researchers from the University of Minnesota's **Antarctic Geospatial Information Center** and the Science Museum of Minnesota headed to our southernmost continent to participate in a landmark mapping survey. The six-person team is collecting GPS measurements to create three-dimensional maps of the Dry Valleys, an area of desert-like terrain within the Transantarctic Mountains. Scientists have always been intrigued by Antarctica, but there's a lot more urgency behind their research these days—and for good reason: Antarctica has about 90 percent of the world's ice, which amounts to about 70 percent of the world's fresh water. If all of this ice melted, sea levels would rise roughly 200 feet. Through ambitious treks like the AGIC's, scientists will better understand how Antarctica and its vast ice fields are responding to climate change. www.agic.umn.edu



PHOTO: PETER WEST, NSF

Critical Biomass

It's been another cold winter in the Gopher State, but homegrown heat is keeping the University of Minnesota, Morris community warm and cozy. In October, the Morris campus unveiled its new **biomass gasification plant**—a model, community-based energy system that will use some 9,000 tons of biomass per year to offset about 80 percent of the campus' fossil fuel consumption. Energy sources like corn stover and prairie grasses, purchased from area farmers and producers, will bring in hundreds of thousands of dollars for the region's economy, creating new employment opportunities for west central Minnesota. The biomass facility will move the campus one step closer to energy self-sufficiency and carbon neutrality by 2010. Visit morris.umn.edu/greencampus to learn more about the campus' sustainability initiatives.

Sound Research, Sound Advice

The University of Minnesota's **Deborah Swackhamer**, a world-renowned expert on toxic chemicals in fresh water lakes and rivers, was appointed chair of the Environmental Protection Agency's Science Advisory Board

this past fall. A professor of environmental health sciences and co-director of the Water Resources Center, Swackhamer's research focuses on chemical and biological processes affecting the behavior and fate of toxic organic contaminants such as PCBs, dioxins and pesticides in the aquatic environment.

The Science Advisory Board is an independently chartered, federal committee of external scientists and engineers. The board's mission includes reviewing the quality and relevance of the scientific and technical information used or proposed as the basis for EPA regulations.

Now five months into her two-year term, Swackhamer says it's an exciting time to be heading the board. "The new administration has expressed a strong commitment to reinvigorating the use of science in decision and policymaking at the EPA, so our advice will be used more than it has been in the last several years. In particular, it will be important to consider climate change in all aspects of agency policy, something that hasn't been done under the Bush administration."



PHOTO: MARK LUIJENBURG

Around the World...

Smart Tower

In the past few years, LED technology has helped boost energy efficiency in homes and businesses across the globe, but this may be its biggest breakthrough yet. Boston's oldest skyscraper, the **Custom House Tower**, has been revamped with LED fixtures, adding a beautiful lighting element to the

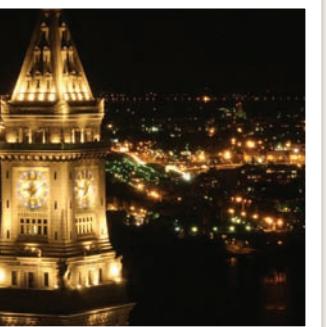


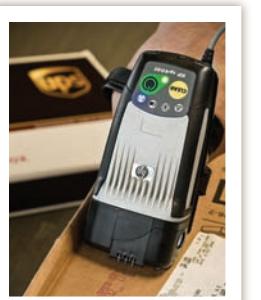
PHOTO: MF3 PHOTOGRAPHY

exterior of the building while using one-third the energy of its former halogen-based spotlights. Illuminating the tower from the 17th floor to the peak, the lights have an estimated lifetime of 20-plus years at six hours of use per day.

H₂O from the Heavens

Drawing water from air has been possible for years, but it has required an enormous amount of energy. Fortunately, the **Israeli startup EWA** has developed a technology that collects humidity naturally present in the air and turns it into clean water—using

very little energy in the process. The secret lies in a unique water absorption process, which employs a drying agent to trap the water, along with a special condenser that reuses more than 85 percent of the energy put into the system. The Beersheba-based company predicts more than \$100 million in sales by the end of 2009, mainly due to the rising demand from Africa, India and Australia.



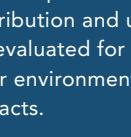
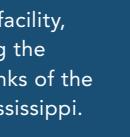
18 months to develop a **scan-and-print solution** that integrates a two-dimensional barcode imager, an inkjet printer and wireless communication. Dubbed the "HP Handheld sp400 All-in-One," the portable device is expected to save 1,338 tons of paper and reduce carbon emissions by 3,807 tons each year.



The Answer, My Friend?

Naysayers of wind power may be blown away by **Spain's recent energy record**. For a brief period on Nov. 24, 2008, wind power provided 43 percent of the country's electricity needs, according to the Spanish Wind Energy Association. Spain is among the top three generators of wind power in the world, with about 16,000 megawatts of installed capacity to date.

2008 IN REVIEW » University of Minnesota environmental news highlights

JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
The U.S. Department of Energy chooses the U of M as one of just 20 international teams to compete in the next solar decathlon . 	U of M researchers co-publish a study in Science urging that all stages of biofuels production, distribution and use be evaluated for their environmental impacts. 	Federal grants of approximately \$2.27 million help boost biomass research and development at the U of M. 	The U of M celebrates sustainability with its 10th-annual Beautiful U Day , giving away 10,000 CFL bulbs to the campus community. 	The Solar Vehicle Project team unveils its new car, Centaurus , in preparation for the North American Solar Challenge. 	The College of Biological Sciences dedicates the new Raymond Lindeman Research and Discovery Center at the Cedar Creek Ecosystem Science Reserve. 	The Statewide Conservation and Preservation Plan team presents a groundbreaking report on the future of Minnesota's environment and natural resources. 	Following an extensive international search, Jonathan Foley is named director of the Institute on the Environment. 	The U of M launches its new Outdoor StreamLab , a state-of-the-art environmental research facility, along the banks of the Mississippi. 	A new biomass gasification plant , a model community-based energy system, opens at the U of M, Morris campus. 	More than 750 energy enthusiasts attend E3 2008 , an annual conference hosted by the Initiative for Renewable Energy and the Environment. 	A Carlson School senior and the Applied Environmental Solutions student group earn " Carbon Buster Awards of Excellence " from U.S. Sen. Amy Klobuchar. 

Deal or No Deal

Interview by TODD REUBOLD

Facing a financial sector in chaos, mounting unemployment and a crumbling economy, a newly-elected Democratic president came to Washington with a plan to significantly change the direction of the country. Sound familiar? That was 1933, but Franklin Delano Roosevelt's New Deal—the largest public works investment the nation had ever seen—is getting a second look as everyone from Gore to Google calls for a "Green New Deal." • Momentum sat down with **STEVE KELLEY**, a former Minnesota senator and director of the Humphrey Institute's Center for Science, Technology and Public Policy, to get his take on what a massive investment in renewables, energy conservation, transit and infrastructure could mean for America's future.

During this economic downturn, should President Obama and Congress really be making a near-trillion dollar public investment in a Green New Deal? Substantially increasing the resources that we're putting into renewable energy is critical to the country's future. There are really two pieces. One is research into developing new forms of energy that will make us more energy efficient. Second, some things we understand reasonably well already, such as mass transit and weatherizing homes, those are all things that will put people to work now and will also put us in a much better situation in the future both economically and environmentally.

Doesn't all of this depend on consumers changing their energy consumption patterns? When gasoline was over \$4 a gallon and oil was at \$125 a barrel, people did change their behaviors. One of the problems was that they had a shortage of alternative strategies

MONEY CHANGES EVERYTHING

How does the proposed "Green New Deal" compare to other major government expenditures* over the past 100 years?



* Note: All expenditures are expressed in 2008 U.S. dollars.

Sources: NASA, The Nation, Wikipedia and The Wall Street Journal



available to them. So I think one of the good things about the proposed investments is that we're going to add to the choices that consumers have in terms of saving energy. But with government policy, we'll also need to pay attention to how we provide information to people. ... There are going to be a lot of claims about what's green or what's energy-efficient. There's a role for the government in making sure those statements are truthful and meaningful to people.

What's the best way to pitch a Green New Deal to the American public? People are nervous enough about the economy overall, their jobs and the jobs of their friends, neighbors and relatives, that seeing an administration committed to putting people back to work is a sufficient argument in the short term for this investment package. The Obama administration may get some political opposition and, at that point, they may have to add some nuance to the message. But keeping the focus on jobs is perfectly fine, and if we get a "twofer" out of these investments—putting people to work and saving energy costs for the future—that's great.

If the deal goes down, who will the winners and losers be? In the long run, everybody will be a winner because we'll hold down the country's energy consumption and put our kids in a much better position from an environmental perspective. In the short run, there is a policy design challenge, though. Let's take retrofitting or weatherizing homes. You can't do everybody's house all at once. So having a long-term strategy of how you're going to ensure that middle-class and low-income homeowners and renters benefit from the program will take some time.

Do you expect climate change legislation to be part of the package? The United States is going to have to adopt a coherent strategy for reducing greenhouse gas emissions. Even John McCain had gotten to the point of recognizing that the current market structure does not recognize the external costs related to greenhouse gas emissions. We've been treating the atmosphere as a global commons without paying the costs of the emissions we're putting into it. So it's perfectly consistent with economic theory to say it's time to recognize the externalities.

President Obama and Congress have a big challenge in front of them, but I'm encouraged by the fact that Rep. Henry Waxman will be chairing the House Committee on Energy and Commerce. I think it's an indication of Congress' willingness to move in the right direction, but it will take sustained leadership...to see real progress. We are long past the point where we should be debating each other over whether or not climate change is a problem.

What's your advice for the new administration? I would encourage the president to move forward with some promises he made during the campaign regarding the telecommunications infrastructure; a portion of Obama's platform was related to building a high-speed broadband infrastructure throughout the country. We currently spend a lot of money moving people from place to place physically, whereas teleconferencing, telework or distance education can, with additional investments, provide real alternatives, be more energy efficient and contribute to economic growth. One of the barriers to having that happen is that—particularly in rural areas, but it's also true to some extent in certain metro neighborhoods—we don't have the high-speed infrastructure yet for people to fully use these new applications.

No matter what investment decisions we make, though, any moves toward a more efficient and responsible energy infrastructure for future generations has to be a bipartisan effort to succeed.

ENERGY EXPERTS FROM THE NONPROFIT SECTOR, BUSINESS INTERESTS AND THE BLOGOSPHERE SUBMIT THEIR LETTERS OF ADVICE TO THE OVAL OFFICE.

Dear President Obama,

Mr. President, you're absolutely right that the new energy economy is going to be the driver for getting our country back on track—and don't let anybody tell you otherwise. There is a big opportunity for the federal government to make investments that would help prime the pump for the clean energy revolution. Possibilities include incentives for smart grid technology; electrification of the transportation sector; high-speed inner-city rail; renewable energy research and development; advanced biofuels; refueling stations for electric cars; a purchasing program for solar electricity and more. We have to have a new energy economy for national security reasons, for economic prosperity for our children and for protecting the climate. The faster and harder the president drives it, the better off we'll all be in the long run.

MICHAEL NOBLE
Executive Director, Fresh Energy

The federal government shouldn't pick winners and losers. The marketplace should do it. If the federal government is going to make money available, they should make it available in an equal way. Anyone who can develop non-fossil fuel-based technologies should be able to reap the credits or benefits. The Chamber has always supported not only wind and solar, but all technologies. We've been supporting the stimulus packages all along, but our one concern is that you've got to always make sure you understand the unintended consequences. And remember, nobody is going to be as innovative as the private sector, and the private sector will get everything up much quicker than the government ever could. Government has to take the roadblocks out of the way, though, and the biggest roadblock that we have to alternative energy right now is not really funding—it's regulation and a "not in my backyard" approach to new projects.

WILLIAM L. KOVACS
Vice President, Environment,
Technology and Regulatory Affairs
Division, U.S. Chamber of Commerce

First and foremost, I want America to be as energy efficient as possible. That means our buildings, our electricity and our cars should be much more energy efficient. It's the fastest, easiest and cheapest way for us to cut emissions, slow global warming, save money and just make our lives better overall. Next, start building the infrastructure of the future. Our electricity grid is old and obsolete and must be a priority for this administration. The challenge with the electricity sector is that we're going to need so many more transmission lines to move renewable energy from typically more rural areas to urban centers. We need a commitment from the president and state and local officials saying "Yes, we're willing to make this investment and build the needed infrastructure to support it." If we talk about 21st-century energy, we need the foundation first—and that's the grid system.

MARIA SURMA MANKA
Blogger, mariaenergia.com
Senior Account Executive,
Tunheim Partners

Equal Opportunity Environment

Interview by EVE DANIELS

Urban revitalization strategist MAJORA CARTER has dedicated the past decade of her life to confronting poverty, public health and climate change issues simultaneously. In 2001, she founded Sustainable South Bronx, an environmental justice organization working to improve the local environment while providing green-collar job training and placement for residents in need—most of whom relied on public assistance before joining the program. Since then, the community-led nonprofit has done wonders for both the ecological and economic wellbeing of the iconic New York borough. • Now the president of her own consulting firm, Carter is drawing on the lessons she learned in the inner city to help neighborhoods, businesses and nonprofits worldwide unlock their green economic potential to benefit everyone. Here, she offers a free consultation to *Momentum* readers.

With so many people having to move, with so much of the housing stock essentially destroyed, there was an enormous amount of economic disinvestment. I think it sort of set the stage for the environmental degradation that was to come. Suddenly there were lots of waste facilities that set up shop. And it really did take its toll on the public health around issues of asthma and other respiratory problems. ... In a neighborhood that's known for garbage, for high crime, for a sense of hopelessness and poor schools, how could it not reflect on a young person—or an older person?

You founded Sustainable South Bronx in 2001 and the Bronx Environmental Stewardship Training Program came a couple of years later. Why do you think the program has been so successful?

Because we took an approach that was all about adding value. We didn't look at the folks we were attempting to serve...as problems. We recognized that they had some problems, like being formerly incarcerated or not having the benefit of seeing what a working family looks like because they've been in the public welfare system for so long.

But we recognized that, if given the proper care and feeding, anybody can do anything. That's why we made the investment in both the hard skills like wetland restoration or urban forestry management or green roof installation, but we also made the investment in helping people understand that they were a part of something bigger. It wasn't just getting a job, but this was also helping them to see that their lived experience was going to make the world a better place.

You're a lifelong resident of the Hunts Point neighborhood in the South Bronx. What was it like growing up there and how did that experience as a child shape your beliefs today? Before the fires, I felt like this was a really beautiful community. ... My family had a long history here. I felt protected and like there was a lot going on. But when the fires started, when I was about 7, suddenly the Bronx lost nearly 60 percent of its people. Landlords were torching their own buildings in order to collect insurance money because there was no financial investment in the community. So it meant that the people I'd grown up with, literally overnight, were just gone. ...

Is there a particular success story from one of the graduates that really illustrates the program's impact? I remember there was this one young man who, you know, this guy could quote Martin Luther King. Or Martin Luther. ... He was one of the most adorable people I've met in my entire life and one of the hardest workers. This was after he had gone through the program and we actually hired him to be on staff as a greenway steward, to basically be an ambassador to the coming South Bronx Greenway. And then there was a huge article [in *USA Today*] and he was on the front cover. And it goes on to say, "James Wells, who spent 10 years in jail..." and I was like, "My James? Wait a second. I don't think so!" And I realized that's the power of this program. That he sees himself as vital to the care and feeding of the neighborhood. And this was a kid who spent 10 years locked up on armed robbery. ... Later, in talking to him about it, he was like, "What I needed was someone who believed in me...and who led by example. Thank you. Because of that, look what I can do."

Can you walk me through a recent project of the Majora Carter Group? Our very first project is the Elizabeth City Region Plan: It's the northeast section of North Carolina...and it's actually one of the top three places in the country that's going to be most impacted by sea level rise over the next 25, 30 years. ... And 21 counties in that region have decided they want to work with the Majora Carter Group to help them create a real green economic development and land use plan for their future.

Interview continues on page 10...



Built to Last

"**You don't have to move out of your neighborhood to live in a better one,**" says Majora Carter, who has made it her life's ambition to both practice and teach what she preaches. In the process, she's inspired a new generation of environmental leaders to do the same. ¶ Pictured above, ASHON LEFTENANT applies the skills he learned in the Bronx Environmental Stewardship Training Program to install a green roof on Carter's home in the South Bronx (which, incidentally, is located across the street from her childhood home). Leftenant and his fellow green roofers prepare a wall-to-wall bed of approximately 4 inches of specially mixed soil that doesn't stress the roof when it's wet. After laying down the drainage mats and root barriers, the workers clip succulent plants called sedums into 1-inch pieces and spread them over the roof. The sedums take root independently, covering the entire area within two years. ¶ This project is a shining example of what Carter calls "horticultural infrastructure," or sustainable development efforts with interrelated environmental and economic benefits. Along with extending the roof life by three to five years, green roofs clean the air, manage storm water runoff and counteract the "urban heat island" effect. All this, while creating jobs—and a better quality of life on the whole.

The Meaning of Green

We're all counting on green to help put the U.S. economy back in the black. But there's still some gray area when it comes to what green employment actually means. Looking for answers, we spoke to **KYLE UPHOFF**, an analysis and outreach manager with the Minnesota Department of Employment and Economic Development.

"You can generally lump green jobs into two groups. First, there are traditional jobs that make a green product or provide a green service, but they don't necessarily require green skills. This might include a welder, a machinist or someone who makes wind turbine parts. Second, there are jobs that require some specific green knowledge. This cuts across a broad base of occupations such as environmental engineers, conservation workers, sustainability managers and construction workers who are green-certified.

The current way that we classify workers and industries doesn't really take 'green' into account. If you're an electrician and you work in a coal-burning electrical plant, you're counted the same way as an electrician who's installing solar panels.

At least six other states have initiatives under way to measure green employment. We're all close in our definitions, but there's variability. For instance, some states are counting a thrift store job as green employment because the workers are essentially recycling clothing. But is that really a green job?

By my definition, it's whether a person's predominant job activity revolves around something that's green. The locomotive engineer who occasionally transports ethanol or the concrete worker who builds a wind turbine base from time to time is not something I'd consider to be green employment. However, the employees at a construction firm that predominantly erects wind turbines would certainly be included.

It will be interesting to see if the direction of federal investment [in green manufacturing] is determined by regional strengths or regional needs. The main thing to remember, though, is that tax incentives represent one tool to spur green job growth. Before moving or expanding, green companies will also need to consider workforce quality, education and availability, and whether the state has a strong research presence."

MAJORA CARTER interview continued from page 8.

... So their economy is not going to be based solely in things like mega-hog farms, which foul the water and the air and don't make life a really comfortable place for the people who live nearby. So how do we develop the capacity of all the stakeholders there, whether they're community development corporations or universities or local business leaders or elected officials? How do we bring these folks together so that everybody understands they can each get something?

What are some of those benefits? If they gave jobs to people, the crime rates would go down. The people who hold those jobs can actually become more stabilizing influences in their whole family, which also reduces both the corrections as well as the public service budget. You can have kids who are doing better in school as well. There are also the environmental services that cities could be saving money on, if they recognize that they can use natural storm water management techniques like developing more wetland restoration or doing green roofs on a building so that it's absorbing the storm water and doesn't have to be managed by a really expensive sewage treatment process. ... So communities are happy because they're developing jobs. ... Cities are happy because they can lower some of their environmental services costs and other municipal costs, like reducing the budgets even with corrections because people are not on the streets doing illegal crimes. They're actually being gainfully employed.

With all of your speaking engagements and consulting work and traveling, what keeps you going? Movement! Really. I've been really good at celebrating the small victories, even if they're ones that I haven't personally created. But knowing the U.S. House and Senate both passed a tax incentive package for renewable energy. That's progress. To know there are places in Appalachia that are still plugging away to build wind farms rather than mountaintop removal. To know there are more groups that are coming online and thinking about how they can develop their own green-collar job creation strategies. ... And the fact that when I speak out in public, I'm not preaching to the converted much of the time. I'm helping people think about a different way to do business as a country. That inspires me to keep doing it.

Do you think the public's awareness of environmental justice issues will increase with the new Obama administration? I've got great hope—my hope cup runneth over. It really does, because he was an organizer. He understands this stuff is hard and that people have real issues. And just the privilege that one has in being an organizer, where you get to see it and do something about it. I mean, he's like the ultimate organizer now if you ask me. Because he's got the pulpit. He's got the carrot *and* the stick. So he could do all sorts of things that really could help focus our attention to realize that we do need to green our ghettos first. Because that's where the point sources for greenhouse gases are happening.

How do you define "ghetto"? Frankly, the way I think [the word] was intended to be used. They're not just inner cities. I'm sorry, but I've been to some white communities where there are some ghettos. ... If you're living in Appalachia and they're cutting up the top of a mountaintop, and you're living at the base of what is essentially 2 billion gallons of sludge that could topple down on your house any given day. Or the water table is being destroyed and you can't bathe because the water that comes out of your tap is black. Or your family is suffering from all sorts of stuff, you know. They're all white. There aren't too many folks of color down there. But they're ghettos.

What are some of the biggest challenges you've had to face in your work and how did you overcome them? I think the biggest one was feeling that nobody cared and that I still had to fight. But just recognizing that it doesn't take a gazillion people to move a mountain. It really doesn't. Margaret Mead had it right: It is that small, thoughtful group of concerned citizens that keep beating the drum that people keep hearing in the background. And just recognizing that you're not alone. That sooner or later, whether it's an idea that's time is not right to come yet, you've just got to keep pushing.

Do you have any advice for a big research institution like the University of Minnesota? The thing that I think you guys should be looking at more, and I know you do it to some extent already, but thinking about what are the benefits quantitatively *and* qualitatively in having an environment that is nurturing of people...whether it's having parks and green spaces or living wage

jobs that don't degrade the environment. What does that do for the self-esteem of people? How does it keep people out of jail or in school? If you can do that level of research so it becomes much more of a qualitative measure that we're looking at. The quantitative stuff is really important, too, but I think what we're missing is the humanity that research can do.



Majora Carter's local and global environmental solutions hinge on poverty alleviation through green economic development, since green jobs can empower communities to oppose bad decisions.



environment.umn.edu/momentum

PODCAST

This interview has been edited for print. Visit us online to hear the conversation.



OUT WITH THE OLD IN WITH THE NEW

A positive outlook on life after oil. BY JOSEPH HART For anyone interested in alternative energy and curbing global climate change, these are exciting times. President Obama campaigned on ambitious proposals to invest \$150 billion over the next 10 years in clean-energy jobs, to put a million plug-in hybrid cars on the road by 2015, to implement a cap-and-trade program on greenhouse gases, and to increase our renewable electricity portfolio to 25 percent by 2015.

But is it ambitious enough? As the euphoria over Obama's election began to wear off, environmentalist Bill McKibben sounded a grim note into the blogosphere: Citing NASA scientist James Hansen, he reminded readers that if we want to maintain a planet "to which life on Earth is adapted," we're going to have to reduce CO₂ in the atmosphere from its current level of 385 parts per million to 350 parts per million—and fast.

This task, according to McKibben, "might well wreck [Obama's] political future." And the job becomes more complicated every day, as the global financial crisis deepens.

Peak oil fatalists will insist that it's probably too late anyway to make a graceful transition to a post-oil economy, since any alternative (such as photovoltaic cells or wind turbines) will require an ocean of petroleum to fabricate and bring online.

But whether graceful or cataclysmic, the transition has begun, and most of the dozens of scientists, environmentalists, policy

analysts and green-energy entrepreneurs we spoke to for this article are optimistic about the future.

We asked the experts a deceptively simple question: What technologies, programs or policies in place today would make the biggest difference for post-oil energy and global climate change if they were adopted on a wider scale? In other words, if our country invests \$15 billion a year in clean energy for the next decade, where will we get the most bang for the buck?

Rather than a list of green gadgets or alternative fuels, the answers include a set of loose principles that can see us at least through the end of oil and into a post-fossil fuels society. Simply put, the premises of this new energy doctrine are efficiency, decentralization and integration.

All in all, that's good news, because while cash and ingenuity will be required—and a lot of both—the foundations and models for this paradigm are already in place. What follows are six practical steps we can take as a nation to usher in the new era.

GET WEATHERIZED

It probably won't show up in a glossy photo spread in *Dwell* magazine, but merely increasing the energy efficiency of the country's existing housing stock is probably the easiest, most cost-effective and job-intensive step we can take. Basic weatherization—tightening windows and doors, insulating attics and basements—is inexpensive and remarkably effective.

"It's the lowest hanging fruit we have," says David Johnston, a leading green builder, founder of the Boulder, Colo.-based organization What's Working, and author of *Green from the Ground Up: Sustainable, Healthy and Energy-Efficient Home Construction*.

According to Johnston, an older home exchanges indoor air with the outside a couple of times per hour, a rate that can be improved dramatically with very little cash outlay. "I can take almost any house in America and reduce its load by 50 percent without spending a ton of money," he says. "It's not sexy, but it works."

Moreover, many of the homes most in need of retrofitting are situated in low-income and working-class neighborhoods where jobs are in short supply and where energy savings of 30 to 50 percent would make a significant difference in household budgets.

A patchwork of local, state and nonprofit programs provide weatherization for low-income families, sometimes combined with a job training mission. The U.S. Department of Energy funds these efforts through the Weatherization Assistance Program, a federal block grant program created in 1976 that has improved the heating and cooling efficiency of more than 6 million homes.

In Minnesota, for example, about 3,000 families have received assistance through the program. According to national research by financial consultants Fisher, Sheehan & Colton, there are now more than 60,000 Minnesota families with incomes below 50 percent of the federal poverty level, qualifying them for the program. These families pay approximately 60 percent of their available income for home energy costs.

"It's important for those families that weatherization can achieve energy savings of over 33 percent, especially for the highest energy burden households," says Marilou Cheple, direct programs supervisor for the Minnesota Office of Energy Security.

"We take a whole house systems approach with each home and carefully look at furnace efficiency, wall and attic insulation needs and indoor air quality," Cheple explains.

Minnesota uses a DOE-designed software program that generates cost-effective conservation measures for each unit served by the weatherization program. The Minnesota version of the software has become a model for other states and has received national awards.

Nationally, the DOE calculates that every dollar invested in weatherization returns more than \$2.72 in benefits, including reduced heating costs, pollution control, job growth and so on. In spite of this return on investment, the Office of Management

and Budget decreased the national funding for the WAP by 15 percent in 2007. And, while funding increased by 11 percent in 2008, the Bush administration cut the program's funding entirely for next year.

Discussions within the Obama transition team indicate that the WAP will be an integral part of his stimulus package and larger energy alternatives program. Given the renewed national interest in weatherization—and the obvious payoffs in terms of jobs, energy savings and cost savings—it seems this program could expand

I can take almost any house in America and reduce its load by 50 percent without spending a ton of money. **IT'S NOT SEXY, BUT IT WORKS.**

even further, both by income guidelines and into commercial properties.

Johnston imagines a nationwide effort on the scale of the victory gardens of World War II. In 1943, Eleanor Roosevelt helped launch the civic movement to plant victory gardens to ease demands on our war-time food supply. By the end of the war, around 40 percent of the country's produce was homegrown. Johnston pictures neighborhood associations and block clubs taking on home energy savings with the same zeal. "That's the initiative and scale that's necessary."



WASTE NOT, WANT LESS

Ask any kid to draw a power plant and, chances are, she'll draw a box with a smokestack. These are the ubiquitous cooling towers that belch steam—along with various airborne pollutants like sulfur dioxide and greenhouse gases like CO₂—into the planet's atmosphere.

Sean Casten of the Illinois-based Recycled Energy Development looks at cooling towers and sees something different: energy. "Towers exist simply to throw away energy," he says.

Just how much energy is wasted? The numbers are nothing short of staggering. Today's average power plant, says Casten,

For every one unit of energy going into the grid, **TWO UNITS ARE WASTED.**

operates at about 30 percent efficiency, far less than those built at the turn of the last century. That means that for every one unit of energy going into the grid, two units are wasted.

Now consider this: 40 percent of all CO₂ emissions are generated by electrical power plants, according to the U.S. Environmental Protection Agency.

Power utilities aren't the only ones tossing energy. Recycled Energy Development recently launched a project to capture waste heat from a silicon production facility in West Virginia. By harnessing that energy, the plant will produce 45 megawatts of power, the equivalent to that used by about 20,000 U.S. homes.

In a recent study, the DOE and the EPA added up all the sources of wasted energy in the country, factored in which could be saved, and calculated that 40 percent of our nation's energy needs could be met just by capturing that waste. "And we think that's a conservative estimate," says Casten.



While these waste recovery projects are industrial-scale, multimillion-dollar investments, cost is not the primary barrier to energy recycling. Instead, state and federal regulations are the culprit, making it difficult or even impossible to use energy more efficiently. Power utilities enjoy a monopoly on power generation. Only recently have regulations loosened to permit non-utilities to generate power and sell the energy on the open market.

In New England, the electricity wholesale market fosters efficiency not only by purchasing power from small-scale producers, but by rewarding conservation on the consumer side. "The utility will pay you for any load reduction, the same as building a power plant, so anyone can access that market, even small businesses," says Casten, who helped a lumber mill generate 500 kilowatts of electricity from waste heat, allowing the company to claim a conservation credit.

Of course, deregulation is not without its pitfalls. The rationale for the utility monopoly was to ensure access to the grid for customers who might not be profitable to serve. California's experiments in deregulation, which dovetailed with Enron's failed experiments in online trading of wholesale electricity (as well as the company's accounting fraud to cover the failure), resulted in massive blackouts and higher prices for consumers.

But these blunders are avoidable, and the benefits of adding small-scale power generation to the grid go far beyond energy recycling.

"The basic need is for a system where, if I want to build a power plant for my own selfish reasons, I need to be allowed to connect to the grid," says Casten. Regulations should protect consumers, the environment and the stability of the grid, he adds, "but that's all pretty simple."

GROW LOCAL

"Oil," writes farm and food activist Michael Pollan, "is one of the most important ingredients in our food." After automobiles, agriculture accounts for the largest share of the fossil fuel consumed in this country—some 19 percent. The dominant agricultural mode of centralized monocropping requires oil in the form of fertilizers and chemical sprays, machine-intensive planting and harvesting, and above all, transporting food from one part of the globe to another.

What's more, this dependence on petroleum isn't primarily the result of competitive pressures or the free market, but of federal policy. Through a combination of crop subsidies, conservation programs, foreign aid conventions and policies like those dictating school lunches, the federal government virtually commands that farmers rely heavily on oil to make a living off the land.

Pollan is one of a growing number of advocates for shifting these federal policies to encourage diversified farms that require minimal petroleum inputs and are located close to the markets they serve.

By way of example, Pollan points to the meat industry. Currently, farmers grow petro-chemical intensive feed crops that are trucked to centralized, gigantic animal confinement operations where excrement causes major pollution problems. Raising beef cows on pasture that is rotated to crop farming solves the problems with sunlight and nature: Cows eat grass, their excrement fertilizes the soil—no oil, no pollution.

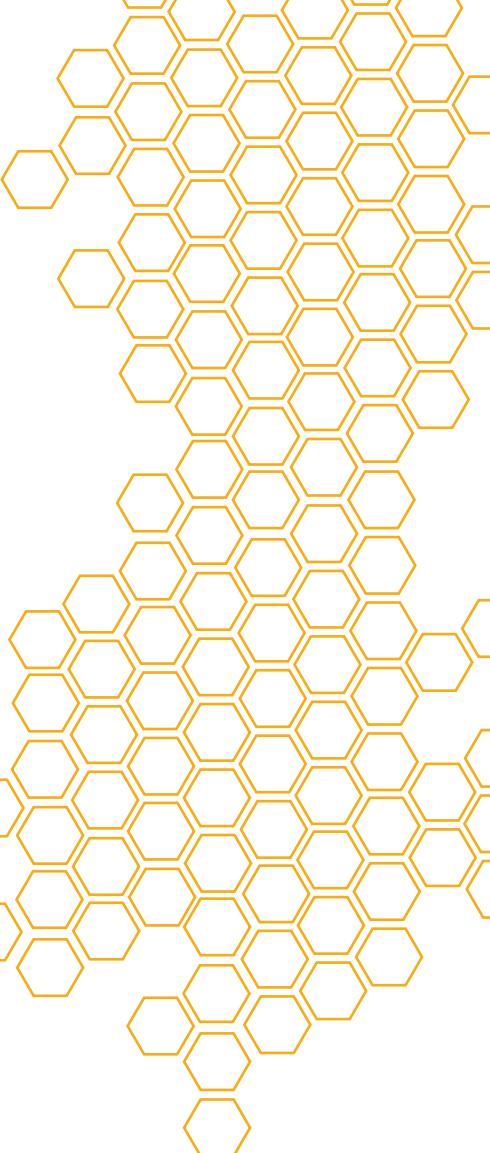
Experiments in diversified regional farming are legion. At the most basic level, these include direct agricultural markets like farmers markets and subscription-based farms. Researchers in Oakland, Calif., took the concept a step further in an experiment in urban agriculture. "Our intent was to demonstrate the capacity of dense urban areas to be more self-sufficient in meeting basic needs," explains Kirsten Schwind, program director of Bay Localize, a project of the Earth Island Institute.

Working with structural engineers, GIS mapping experts and farmers, Schwind and her colleagues established rooftop gardens, as well as solar and catchwater systems, in a dense neighborhood of Oakland. In this experiment, the airborne vegetable gardens produced enough leafy green vegetables to meet the neighborhood's USDA dietary requirements.

If the Oakland experiment can achieve these results in today's market, imagine what could be accomplished with a shift in federal policy away from monocropping and toward regional and urban farming.

"There are a lot of wonderful ways of producing food closer to where people live, whether it's making use of rooftops or providing tax incentives to urban landowners for long-term food production use, or restructuring urban public lands like schools or parks, or even housing developments, to incorporate a food production component," says Michael Ableman, founder of the Center for Urban Agriculture at Fairview Gardens and author of *Fields of Plenty: A Farmer's Journey in Search of Real Food and the People Who Grow It*.

The result would be not only green jobs and energy savings, but better nutrition and a more secure agricultural sector.



IF THE OAKLAND EXPERIMENT CAN ACHIEVE THESE RESULTS IN TODAY'S MARKET, imagine what could be accomplished with a shift in federal policy away from monocropping and toward regional and urban farming.



DRIVE LIGHT

In certain circles, nothing breaks up a friendly cocktail party faster than the question of which fuel should power America's transportation fleet. It makes sense that a culture as focused on the automobile as ours would care the most about electric versus biofuel, hybrid versus plug-in, and hydrogen versus compressed air, to say nothing of mass transit.

In truth, all of these fuel alternatives offer unique advantages and pose their own problems. As a result, it's likely that our future oil-free economy will use a variety of transportation alternatives.

In the meantime, we should take a good look at our current fleet. In 2001, the American Council for an Energy-Efficient Economy did just that. According to their research, by using existing technology and methods such as lighter materials and increased aerodynamics, the U.S. fleet would achieve an average fuel improvement of 47 percent. Add in some newer approaches like hybrid engines and the overall fuel economy skips up by 72 percent.

National standards for fuel economy for passenger cars flatlined in 1990 at 27.5 miles per gallon, and in the decade preceding that, they remained virtually unchanged. (The most conservative ACEEE model predicts 40.8 miles per gallon for moderate-sized cars.)

Obama has pledged to impose stricter standards, but it's worth asking the question of whether these regulations are the most effective approach or if it makes more sense to leapfrog the gasoline engine entirely.

If that's the path, the growing consensus on alternative fuels is lining up behind electric cars. Electricity has a number of advantages over competing alternative fuels; it's arguably cheaper, cleaner and more efficient. And, unlike many other proposed transportation fuels, it's ready to go.

General Motors and Chrysler both have electric prototypes, some with gasoline-powered battery chargers, ready for production, while a dozen smaller companies like AC Propulsion and Tesla Motors are already manufacturing electric cars. Compared to other engines, electric motors produce more torque and better handling, features not to be taken lightly in the U.S. auto consumer market.

Most importantly, plug-in electric cars can play a critical supporting role in managing our electricity supply. In a decentralized, open electricity market, every charged-up automobile is a mobile battery that can contribute a little power to the grid. Multiplied by thousands of cars (which generally sit parked at work or home most of the time), this power source has real value.

Willett Kempton, a researcher at the University of Delaware's College of Marine and Earth Studies, has demonstrated that plug-ins could play a key role in balancing out our existing power supplies, which must be constantly adjusted to respond to consumer

I called an electrician, he put in a big plug, and I paid him \$600.
THAT'S ALL THERE IS TO IT.

demand. Moreover, with the demise of cheap coal and the dawn of cleaner, albeit intermittent, sources like solar and wind, plug-ins could provide critical stability to the power supply chain.

Again, the technology exists for the two-way power sharing of plug-in electric cars. In fact, Kempton uses the system at his home. "I called an electrician, he put in a big plug, and I paid him \$600. That's all there is to it."

The only barrier to widespread implementation is an affordable supply of the cars. "There's plenty of demand," says Kempton, who has conducted marketing research on the concept. "What we need is to get production going." Larger automakers have focused on gasoline hybrid engines instead of electric, and smaller electric-focused companies can't produce cars at a price comparable to the current models.

"You've got to have somebody kickstart it," says Kempton. "Obama could do this for about \$15 million and I could direct him toward the places that could do it. The bottom line is that someone has to be ready to say that we want to do this. If we don't, it'll be BMW or someone else—just one more U.S. technology that goes abroad."

BREAK UP GRIDLOCK

Our current energy system was designed 100 years ago, when fuel was relatively cheap and climate change was virtually unknown. It relies on a few centralized, wasteful and polluting energy technologies, and it leaves power consumers ignorant of their own consumption.

Our new energy systems need to be dynamic, responsive, multi-faceted and decentralized. It makes sense to power one home with solar and another with wind, run one factory on a methane digester and power another with an ultra-efficient turbine fired by our dwindling reserve of petroleum. And it seems logical for all of the above to share any extra power with neighbors.

The keystone to such a system is a "smart grid." One component of the next-generation power grid is real-time information for energy consumers. This alone can result in dramatic efficiencies. In one California pilot program, consumers reduced their load by 40 percent just by knowing how much they were using in the first place.

The smart grid also makes it easier to generate power on a small and decentralized scale. It starts to make real sense to recycle energy on an industrial scale, or install a rooftop solar array, or drive a plug-in electric vehicle, when the excess energy from any of these power sources can be sold at a fair price into the common wholesale market for electricity.

But loosening up the current utility monopoly won't be easy. "It's a \$650 billion monopoly and it's the biggest lobbying group in Washington," says Casten.

Some cities have successfully gone independent from private utility providers, declaring their municipality a public utility. Los Angeles and Sacramento have both done so and, according to Schwind, it has resulted in cheaper and greener energy. "But politically, it's very difficult to do," says Schwind, who recently lost a fight against the regional utility to launch a public utility for the city of San Francisco.

"PG&E spent \$10 million trying to defeat public power in one city," she adds. "They hired all the political operatives in the city."

The fact is utilities can gain by these changes.

In Boulder, Colo., Xcel Energy recently launched a city-wide smart grid project that will include sensors designed to distribute energy and correct problems, provide consumers with real-time consumption information, and integrate smaller-scale generation. The project moves in the direction of maintaining the grid itself, like the highway system, as a utility, while opening it up to private power generation sources.

More feasible, at least in the short term, are policy shifts to "decouple" monopoly utility profits from the sheer volume of energy that they sell, so that utilities are financially invested in energy conservation and opening up the grid in the ways that Xcel Energy has in Boulder. On the campaign trail, Obama pledged to do so.



COME TOGETHER

In May 2007, a tornado hit the southwestern Kansas town of Greensburg. The town of some 1,500 was utterly destroyed. Most of its buildings were leveled. At a town meeting a week later, the mayor, a conservative former head of the Kansas State Patrol, rallied support for rebuilding—and doing it on an environmentally sustainable model.

"I had taken a concept paper for green rebuilding down to this first meeting," says Daniel Wallach, who lives about 30 miles from the town. "I didn't even know they were talking about it. They were shell-shocked. I said, 'Can I go out and try to make this happen?' and they said, 'Sure.'"

What emerged was a plan to rebuild to LEED standards and power the new town with 100 percent renewable energy. The Greensburg story is instructive, because if a conservative small town in Kansas can embrace a radical clean energy program, anyone can.

"Our No. 1 task was about honoring people by listening to them, and educating them. So it was a two-way conversation," says Wallach, who now directs the nonprofit Greensburg GreenTown, which

assists the town in its drive for clean energy and conservation. "It's really important to engage and solicit input and build ownership as much as possible."

Wallach helped direct a community planning process that brought the entire town into a discussion about goals. And he spent a lot of time on what he calls "de-pigeonholing" the green movement.

"It's about positioning the movement so that people in this demographic can embrace it very comfortably and see that it's really *their* movement," he says.

"This is a very strong culture of independence and interdependence at a very local level. ... These are people whose ancestors are close to the land. They built windmills to power their wells because it was just common sense. And that's what this project is about: It's just common sense."

JOSEPH HART is a freelance writer and editor, an author, and a contributing editor to the *Utne Reader*, where he covers a range of topics including alternative energy and green issues. He lives and works in Viroqua, Wis.

AMERICA'S LEADING VOICES IN ENERGY AND THE ENVIRONMENT SHARE THEIR THOUGHTS ON WHERE THE "GREEN GREENBACKS" SHOULD—AND SHOULDN'T—GO.

BILL MCKIBBEN

Writer, environmentalist and author

"Home insulation: It's cheap, it's quick, it creates jobs (you're not going to send your house to China to get it done), and it not only saves carbon, it also saves folks money right away—and winter after winter."

DAVID ROBERTS

Staff writer at Grist.com

"The federal government is one of the biggest consumers in the world, with enormous vehicle fleets and a vast array of buildings. It should immediately pledge to purchase only fuel-efficient cars and trucks, to renovate all its buildings to increase energy efficiency, and to bias all its procurements heavily in favor of low-carbon alternatives. This would create guaranteed markets for clean technology and reduce the government's own footprint."

LESTER BROWN

President of the Earth Policy Institute and author of *Plan B 3.0: Mobilizing to Save Civilization*

"The key to further growth in investments in renewable energy and efficiency is incorporating the cost of climate change in the price of fossil fuels. One way to do this is to simply restructure taxes, lower income taxes and offset this with a tax on carbon to reflect the cost of climate change in a way that does not raise taxes."

ANN VILEISIS

Author of *Kitchen Literacy: How We Lost Knowledge of Where Food Comes From and Why We Need to Get It Back*

"Regional food systems based on sustainable farming practices would bring excellent benefits: Energy savings, reduced carbon emissions, more jobs and better food."

JEFF GOODELL

Contributing editor at *Rolling Stone* and author of *Big Coal: The Dirty Secret Behind America's Energy Future*

"In a world that takes global warming seriously, coal is public enemy No. 1. If the industry can figure out a way to burn coal without melting the planet, great. But if not, it's time to say goodbye to coal."

ALEX STEFFEN

Co-founder and executive editor of *Worldchanging.com*

"I'm a huge fan of renewable energy, smart grids, clean tech, green building and sustainable design, but without a fundamental shift in our land-use patterns away from sprawl and toward bright green cities, none of these other strategies will be enough."

COMMON INTERESTS

We've been having discussions about energy and the environment for a long time, but it's only recently that any kind of consensus has emerged around the topics.

Older modes of thinking that construed environmentalists as "tree-huggers" who stood in opposition to progress and economic growth have been cast aside. The new consensus, in the face of grave environmental and economic problems, embraces both trees *and* economic development.

In part, this shift results from external pressures like the impact of global climate change and the growing scarcity of oil. But it's also a natural consequence of years of research in organizations like the University of Minnesota's Initiative for Renewable Energy and the Environment, a signature program of the Institute on the Environment.

IREE launched in 2003, and from the start, it personified this integrated approach. "Before we had a name or any funding, we had a mission," says Dick Hemmingsen, IREE's director and founder, "which was to concurrently address technology, energy, economic development and healthy ecosystems."

Specifically, the organization sought to galvanize faculty at the U of M who expressed an interest in research in alternative energy and policy. "We made an early decision to tease out of the wood-work faculty who were interested, so we cast the nets widely," says Hemmingsen.

Since then, the initiative has awarded some \$20 million in grants to more than 140 research projects in alternative energy sources like

bioenergy, solar, wind, hydro, hydrogen and geothermal; as well as projects to increase energy efficiency and policy-based research.

One of the more high-profile projects has been work by U of M ecologist David Tilman, whose research focuses on mixed ethanol feedstocks and has repeatedly made news headlines around the world. (Biofuels research makes up about 40 percent of IREE's funding, according to Hemmingsen.)

Other projects range from engineering efforts to improve battery quality to attempts to convert wind power to anhydrous ammonia. On the policy side, IREE has focused on life cycle assessment of alternative energy, a key set of methods for making public investment decisions about alternative fuels.

IREE's early work and successes positioned the organization for today's renewed interest in energy, the environment and economic development. For Hemmingsen, it's been gratifying to watch this reawakening.

"We in the U.S. have been largely oblivious. We've had cheap energy—both transportation and electrical," he says. "Now there's a real transformation. Four-dollar-a-gallon gas gets a lot of people's attention, and more people are seeing environmental impacts. Increasingly, there are more and more concerns about energy independence. It's all coming together to drive interest."

And, with a recent annual funding pledge of \$5 million a year from the Minnesota Legislature, IREE will be at the center of the transformation.



In the past five years, IREE has granted nearly \$20 million to 140-plus projects involving some 400 faculty, scientists and students. Most recently, IREE awarded more than \$600,000 in matching grants.

Visit iree.umn.edu for a complete list of IREE-supported projects, funding opportunities and other info.



environment.umn.edu/momentum

VIDEO

Visit us online to watch "IREE Innovators": Five IREE researchers give a tour of their work in biofuels and next generation engines; bioenergy from woody plants; solar thermal heating systems; hydrogen from algae; and biomass gasification.

MEET THE PRESS

compiled by EVE DANIELS

BREAKING INTO THE "GREEN BEAT"

DON SHELBY
WCCO-TV



H.J. CUMMINS
Star Tribune



MARK NEUZIL
MinnPost.com



STEPHANIE HEMPHILL
Minnesota Public Radio



I was a general assignment reporter in northeastern Minnesota, and of course I was reporting on a lot of environment-related issues like forestry and Lake Superior. When the company cut the Duluth position, they offered me the environment beat, working out of St. Paul. I jumped at it because I think it's the most important thing we have to report on. But I lament the fact that I've increased my carbon footprint several times over, because I still really live in Duluth.

I began to look at issues involving the environment by starting out working with a magazine, writing about fishing and fisheries issues... what kind of fish were in the river, how were they reproducing, how were they surviving and so on. More from the traditional outdoor adventure writing perspective, but what used to be a common way to get into the environmental reporting business. Or at least, one of the ways to get into it was to start out in the Teddy Roosevelt mold and then expand your beat to include energy and science and other kinds of issues.

Minnesota's top environmental reporters go on the record with Momentum.

"Mainstream environmental journalists in the 21st century are, for the most part, journalists who cover the environment, rather than environmentalists who practice journalism," writes Mark Neuzil in his latest book, *The Environment and the Press: From Adventure Writing to Advocacy*. ¶ While that may be true, today's energy and environment reporters still need to negotiate the tension between unbiased journalism and well-informed activism on a daily basis. Add in the pressures of staff and budget cuts to newsrooms nationwide, and the future of environmental news is all but nebulous. Yet, with the challenges and uncertainties comes a wealth of opportunities. ¶ During E3 2008, an annual conference hosted by the Initiative for Renewable Energy and the Environment, Neuzil and other Minnesota media veterans examined the role the press plays—or doesn't play—in informing and influencing society's views on environmental issues. Here, we've pulled together some compelling quotes from the Nov. 18 panel discussion, along with a few bonus bites.

OBJECTIVITY VS. ADVOCACY

We like to hold on to this notion of objectivity...[where] we ascribe to an approximation of objectivity through fairness, accuracy and balance. If we can hit those three things then we're as close to objective as we can possibly be. But by choosing what story is going to be on the front page...that's not objective. Who do we interview in the story and how much do we play them? How many column inches do we give them? ... We choose who to interview and what things to say. I think hidden in there is our bias.

I still work at a newsroom where the rule is complete objectivity. I try to represent all points of view, you know, except craziness. [The environment] is an example of a subject that might explain why journalism is gravitating more toward opinion and personality. People will gravitate toward the point of view that they agree with because it makes sense to them. ... [The audience] wants to be able to trust that someone who knows what they're doing is telling them what they need to know.

One of the biggest struggles for me in adapting to...online journalism has been the idea that your content can include more of your personality, or perhaps even your personal opinion, than would ever have been allowed...when I worked for the Associated Press. ... One of the difficult things to adapt to is the fact that the editors can say, "Go ahead and write what you think a little bit more." I'm afraid to say that people like me...who were trained in a certain way are going to be few and far between as the years go along.

I certainly strive for accuracy, balance and fairness. But I also start with the assumption that everyone cares about the earth. Or everyone says they do. I think journalists held on for far too long to the idea that they had to provide time to the climate change skeptics. It allowed our audience to stay in denial.

PUBLIC RESPONSE

An Inconvenient Truth was an important piece of filmmaking that came at the right time, [but] I think it was a terrible piece of mismanagement that Al Gore was the "force celeb" in this case, because it immediately divided the country along political lines. So the extreme right is who I hear from the most when I do stories about the science of global warming. ... Everybody reads into your journalism what you don't maybe intend for them to read into it. But I like [the fact that] it gets them talking.

It's hard to cover a 100,000-year in advance, slow-going story in daily bites. It still surprises me how every time I write an energy story, I get a whole lot of people saying, "It's a lie, it's not true." So there is a huge chunk of people still out there. ... I [also] get a lot of really good e-mails from people, smart e-mails and thoughtful e-mails.

The beauty of an online publication like MinnPost is there is instantaneous feedback. ... They can tell you down to the last man Jack who has read it and how long they spent on that page—and did they really read it or were they just blipping on their way through to the latest story about the Twins. ... Because they can do those precise measurements of online stories and what people are interested in, we're able to tailor the coverage.

FRAMING SCIENCE

The story is not just what you see at the pump and not just people complaining about the high prices, but talking to economists and saying what happens when it reaches \$4 a gallon for gasoline. Everything is related in this business of energy and environment. ... It's just a continuing thick, fat story and you have to keep it all in your head. ... Instead of talking about how it's done—talking about the science—you're talking about people's lives.

There is a trick to explaining something complicated, and that is: Picture your mother and what would you say to her first and second and third. ... That's a kind of "reporterly" thing to do. I do worry a little bit that, because science advances so gradually, that the energy stories [are] going to become like the last election. You know, two years of interminable news and we're going to lose people. So I'm not quite sure what to do with that yet.

Too often in my experience scientists are so cautious about communicating to the public, in part because they may have been burned by a reporter in the past or misquoted...and partly because they realize the slow nature of the process they're involved in. [But] communicating as often as you can with journalists and with the public directly is really only going to be to your advantage. In some cases you might have to move outside your comfort level, and perhaps go out on a limb a little bit, but that might be the price to pay.

I love doing stories about research. Most scientists I've talked to are extremely generous about helping me understand their work, and then it's my job to make it understandable and interesting for listeners. It's true that most scientists are careful, conservative and non-dramatic. But they're also passionate, so I can focus on that.



environment.umn.edu/momentum

VIDEO

Visit us online to watch extended footage of the E3 2008 Media Roundtable, featuring further observations on energy/environmental journalism from Shelby, Cummins and Neuzil.

Fueling the Future

How do we ensure long-term food and fuel security? A researcher at the University of British Columbia argues that our cars aren't alone in needing a new diet. by SIMON DONNER

It's been a tough couple of years for the public relations staff in the biofuels industry.

The production of biofuels from crops like corn has been blamed for everything from driving up global food prices and deforestation in the Amazon to depleting oxygen in the Gulf of Mexico (not to mention raising the price of tequila).

Even the basic purpose of today's commercial biofuels production has been called into question.

A study by researchers at the University of Minnesota, published last year in the journal *Science*, found that if previously undeveloped landscapes are cleared for biofuels production, then those biofuels emit more greenhouse gases than gasoline and diesel.

Policymakers and the public are now asking if it's efficient or ethical to use croplands to feed machines rather than people.

There's one obvious place to look for an answer. In North America, we have been feeding the majority of our crops to machines for decades. These elaborate, protein-producing devices are best known by their common names: cows, pigs and chickens.

Eating animals is hardly new. Our nomadic hunter-gatherer ancestors relied on meat for a large proportion of their protein intake. But the advent of agriculture and rise in population after the end of the last ice age led humans to settle in villages and shift to a more energy-efficient, grain-based diet. Over time, meat would be reserved for those who could afford the land and workforce required to raise animals.

Diets in the developed world changed again with the discovery of fossil fuels, especially oil. This cheap source of energy allowed us to produce nitrogen fertilizers, transform crop genetics, fuel agricultural machinery and transport agricultural products around the world. Buoyed by high crop yields and newfound agricultural wealth, we began feeding large quantities of grain and oilseeds to our farm animals.

Today, the average American eats as much as 275 pounds of meat each year, up from 197 pounds in the early 1960s.

Feeding the literally billions of cattle, poultry and pigs now requires a large proportion of the world's—and mainly America's—croplands. More than two-thirds of the American corn, soybean, sorghum, barley and oats harvest is used to produce animal feed. That's more than two-thirds of the fuel used to operate machinery, more than two-thirds of the agricultural chemical use and subsequent water pollution, and more than two-thirds of greenhouse gas emissions from croplands.

In the coming decades, the demand for both animal feed and transportation fuels is expected to rise sharply as Asia and the developing world become wealthier. According to the Food and Agriculture Organization of the United Nations, per capita meat

consumption in China has doubled since 1990, and it could double again.

Can our agricultural system meet this increasing demand while also reducing greenhouse gas emissions, tropical deforestation and water pollution? The solution may be switching to more efficient machines.

Like the cars we drive, the animals we eat have wide-ranging efficiencies. Beef cattle are the SUVs of animal agriculture. Renowned energy expert Vaclav Smil calculated that the U.S. agricultural system uses 32 kilograms of feed to produce 1 kilogram of edible beef. Poultry is the fuel-efficient compact of the animal world, with around one-eighth the feed ratio of beef.

The good news is that Americans have been slowly shifting their diets from beef toward more efficient forms of food production. Since the 1970s, per capita beef consumption has decreased 20 percent, while per capita poultry consumption increased by 40 percent. And more and more Americans are forsaking beef or all meat out of health concerns.

Like the cars we drive, the animals we eat have wide-ranging efficiencies.

Beef cattle are the SUVs of animal agriculture.

A more aggressive move toward poultry, dairy and vegetable-based diets could greatly decrease the land, energy and fertilizer needed to feed the population. In turn, this change would decrease direct greenhouse gas emissions from food cultivation and nutrient pollution to waterways. My own research indicates that reducing beef consumption in American diets would also reduce nitrogen pollution in the Mississippi River and shrink the dead zone in the Gulf of Mexico.

Changing diets would also free up productive croplands for cultivating second-generation biofuels based on unfertilized grains, oil crops or grasses. This newly available land would help eliminate concerns that diverting productive croplands to biofuels cultivation causes the clearing of native vegetation and the release of stored carbon elsewhere in the world.

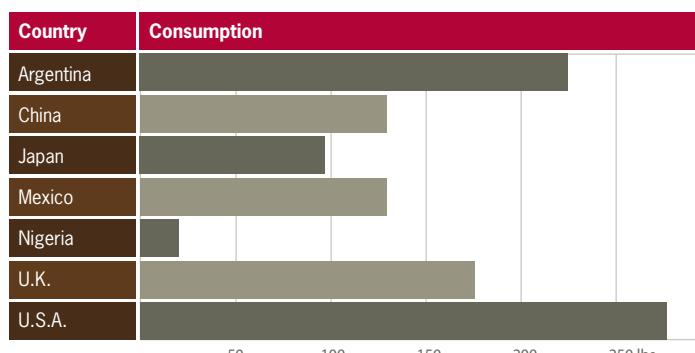
In a carbon-constrained world, food efficiency may be just as important as fuel efficiency.

SIMON DONNER is an assistant professor in the geography department at the University of British Columbia and an associate fellow of the Institute on the Environment. His research on the trade-offs among biofuels production, meat consumption and nitrogen pollution appeared last year in the *Proceedings of the National Academy of Sciences*.



WHERE'S THE BEEF?

Meat consumption* in pounds per person, per year



SOURCE: Food and Agriculture Organization of the United Nations



environment.umn.edu/about

ABOUT US

Visit the "People" page to learn more about the Institute fellows, who will sound off via Scientist's Soapbox in each issue of *Momentum*.

Making Waves

Large lakes researcher Tom Johnson is drilling into our past and rewriting history. by TIM GIHRING



PHOTOS: JOSH KOHANEK

Johnson examines a sediment core from the north basin of Lake Malawi, East Africa. At first glance, the tubes of mud appear uniformly monotonous. Yet they hold subtle, chemical signals of environmental variability through time, including periods of intense drought, unusual temperature fluctuations and changing wind patterns. Scientists are just beginning to realize many of these changes through advances in scanning X-ray fluorescence and new approaches to organic geochemistry.



environment.umn.edu/momentum



VIDEO

Visit us online to watch "Lake Superior and Climate Change: Part 3," featuring insights from the LLO's Tom Johnson and Bob Hecky on the geologic histories of lakes across different climates.



If our understanding of why early humans walked out of Africa is one day vastly refined, it may be because Tom Johnson motored out on some of the continent's largest, deepest lakes and peered into life 100,000 years ago. Already, his insights derived from sediment core samples are reshaping discussions of climate change and evolution.

But mostly, our perception of the planet will change because Johnson wasn't big enough for football. He grew up in landlocked Virginia on Minnesota's Iron Range, dreaming of becoming Jacques Cousteau. "How do you get out of a mining town in northern Minnesota?" he asks. "You either play football or become an oceanographer."

Several decades later, after studying at Scripps Institution of Oceanography, conducting oceanographic research for the Coast Guard during the Vietnam War, and heading the oceanography program at Duke University, Johnson is back in Minnesota...studying lakes.

It was an offer he couldn't refuse. In the mid-1990s, the University of Minnesota lured him from Duke to Duluth to found the Large Lakes Observatory, the country's first institute devoted to an international program of great lakes research, from Lake Superior to Lake Baikal in Siberia.

"The need for research on large lakes is as acute as the need for research of oceans," Johnson says, pointing out that thousands, if not millions, of people depend on these lakes for food, water or work.

The vast reservoirs are also bellwethers of climate change, and their sediment beds—as deep as they are old—offer remarkably rich histories of ancient Earth. But you wouldn't know this from the relatively tiny percentage of government research money devoted to lakes (they aren't as "sexy" as oceans, admits a fellow LLO researcher), an imbalance Johnson has worked to change.

In Johnson's office, located on a hill overlooking Lake Superior, rests an antique Japanese fishing float and a vintage boat bumper woven from reed-like wood, totems of his fascination with the exotic and the deep.

In the 1980s, he first ventured to East Africa to send long tubes into some of the world's oldest lakes, pulling up sediment from 10,000 years ago. The stuff reads like a textbook on the paleoclimate record—a thriller, actually. Johnson helped launch the first major research boat on Lake Tanganyika, and later discovered evidence of African megadroughts that repeatedly emptied enormous waters, such as Lake Victoria. It's a find that helps illuminate the pace of evolution, since hundreds of fish species now thrive in the lake that was dry not so long ago.

More recently, Johnson and a multinational team of researchers drilled much deeper into human history. Living in a converted shipping container on a drilling barge for six weeks in the searing tropics, Johnson gathered core samples that revealed a shift from extreme drought to a wetter, more stable climate—at around the same time as early human populations are believed to have expanded and migrated out of Africa.

Back in the observatory, Johnson continues to sift through ancient sediment, thereby transforming our understanding of the planet's climate history and its effects on ecosystems. And if Johnson never does step into Cousteau's salty sea flippers, that's OK with him.

"There is a goldmine of research to be done on large lakes," says Johnson. "It's a good time to be here."

TIM GIHRING is the senior writer of *Minnesota Monthly* magazine.

THE GREATEST OF THE GREAT



Researchers at the U of M, Duluth's Large Lakes Observatory focus on lakes in North America, Central Asia, East Africa and elsewhere across the globe. Not up on your large lakes? Here's a refresher: the world's 10 largest fresh water lakes by surface area.

LAKE AND LOCATION

LAKE AND LOCATION	AREA (sq. mi.)
1) Superior, U.S.-Canada	31,820
2) Victoria, Tanzania-Uganda	26,828
3) Huron, U.S.-Canada	23,010
4) Michigan, U.S.	22,400
5) Tanganyika, Tanzania-Congo	12,700
6) Baikal, Russia	12,200
7) Great Bear, Canada	12,000
8) Malawi, Malawi-Mozambique-Tanzania	11,600
9) Great Slave, Canada	11,170
10) Erie, U.S.-Canada	9,930

MAP SOURCE: Wikipedia

Investing in Innovation

One of Minnesota's oldest investment firms is banking on the newest advances in clean technology. by MARK NEUZIL

Lois Quam is helping the investment house Piper Jaffray find the next new company that is building a better mousetrap—perhaps one that's solar-powered. Or biodiesel. Or cellulose. Or something we haven't heard of yet.

Quam is the managing director of alternative investments for Piper Jaffray. She came to the 114-year-old Minneapolis firm in 2007 from UnitedHealth Group, where she was noted as *Fortune* magazine's highest-rated Minnesotan in its list of "Most Powerful Women in Business."

The future is now for Piper Jaffray and Quam in the clean technology and renewable energy sectors.

"I've always liked to work in an area that is socially relevant and has high potential," says Quam. "As I became more concerned about climate change, I decided it was most important to me to work in the green economy."

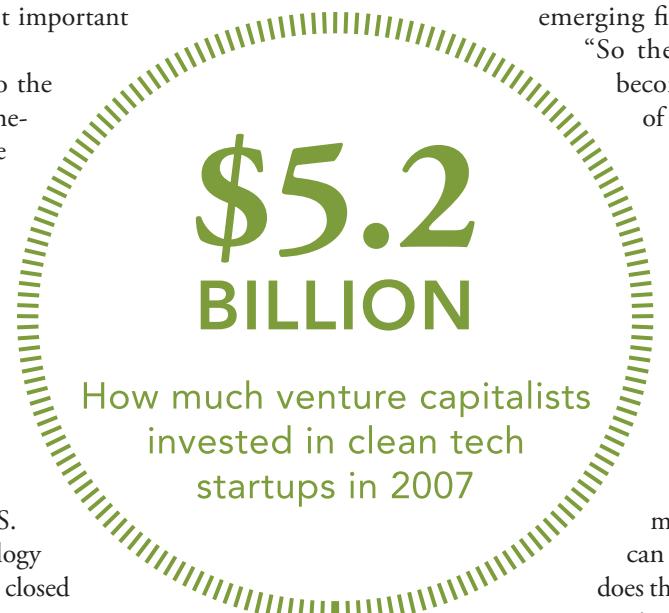
Quam's "aha" moment came on a trip to the Arctic with explorer Will Steger. "It was something to see all that ice and see it melting," she recalls. "It's one thing to read about it and another thing to see it."

At a conference in October in New Jersey, Quam told the audience, "I believe this green economy is poised to be the mother of all markets."

In line with this outlook, Piper Jaffray searches for up-and-coming companies as well as middle-market corporations and other investment opportunities in the green fields of commerce. The firm launched the first U.S. "fund of funds" in clean energy and technology in 2005; the fund was so successful that it was closed to new investors in 2007.

To expand the firm's global franchise in clean tech and renewables, Piper Jaffray also recently appointed Doug Cameron as managing director and chief science adviser. Cameron was formerly the chief scientific officer at Khosla Ventures and director of biotechnology at Cargill.

Cameron says the biotech industry is attractive to investors for several reasons. "This is partly because of the high petroleum-chemical industry feedlot cost, even at current low petro prices. [And the] bad carbon dioxide footprint of many current chemical processes, high margins of chemicals related to fuels, and lower volumes related to fuels." As a result, he says it's easier for startups to have an impact in this area.



In Minnesota, Cameron likes the growth possibilities of biomass and wind energy. He feels the state has the potential to become a leader in bio-based chemicals and materials, including plastics and specialty and commodity products.

"Bio-based materials are still a bit under the radar screen, especially given all the activity in Minnesota," says Cameron. "Many new companies in this area are emerging all over the country."

In North America and Europe, venture capitalists invested \$5.2 billion in clean tech startups in 2007, according to the Cleantech Group, a San Francisco-based consulting firm.

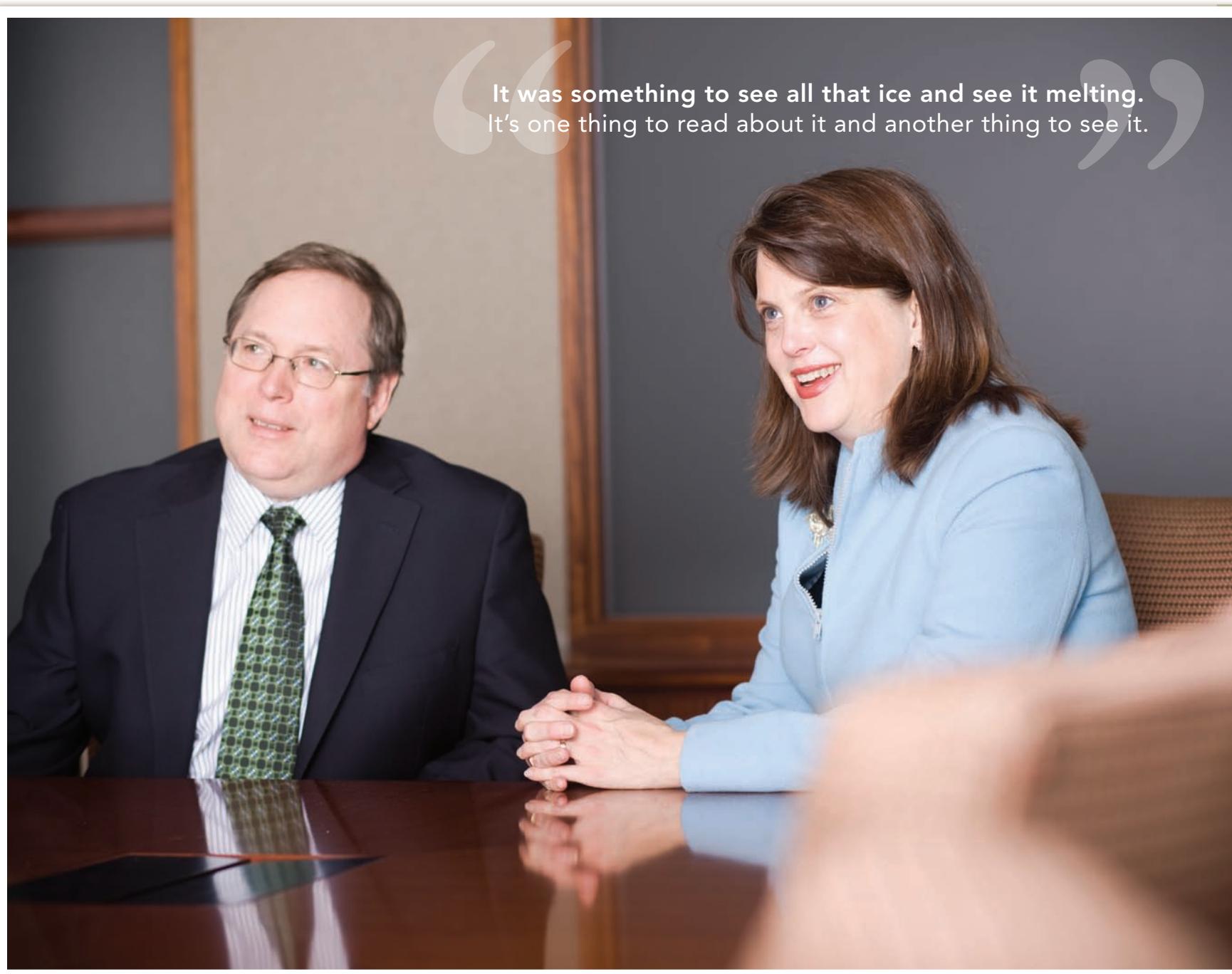
"Piper Jaffray is focused on the emerging firms," says Quam. "So the mid-sized firms become the great firms of the future."

She says her company looks for three factors before it invests. One, does the company make something or provide a service that is an asset to customers? Two, does it serve a sizable market, so the business can grow? And three, does the organization have or can it get the resources it needs to be successful?

"In any investing, the details matter," says Quam. "The green economy is a great category, but that doesn't mean that every energy company is a great investment."

MARK NEUZIL is a journalism professor at the University of St. Thomas, St. Paul. He is also a regular contributor to MinnPost.com, the author of five books with energy and environmental themes, and an associate fellow of the Institute on the Environment.

PHOTO: JOSH KOHANEK



Cameron and Quam at Piper Jaffray's U.S. headquarters in downtown Minneapolis

Nuclear Reactions

by JAKE KULJU

Nuclear power has been a staple of the nation's energy grid for almost half a century. At present, it supplies roughly 20 percent of the nation's energy needs. The fleet of plants is aging, however, and plans for new plants are on the table. • As solar, wind and other renewable energy sources are getting on their feet, is a new generation of nuclear power plants what the country needs to jump-start a clean energy revolution? • To find out, Momentum checked in with two widely respected authorities from different sides of this much-debated issue: One heads a major U.S. electric utility and the country's largest nuclear fleet, while the other represents a major science advocacy group with more than 250,000 members. Consider these excerpts from the experts...

“ What nuclear can really do to help a good energy policy is two things: First, it can supply a very large increment of electricity at a reasonable price with almost no carbon dioxide contributions. And second, it can allow you to have a clean electricity base as you move toward things like plug-in hybrid cars, which allow you to alleviate your oil imports.

Nuclear and wind aren't particularly good partners because you want to run the nuclear plant all day; the wind happens to blow better at night and that's when there's less demand. You have to back up wind with gas, whereas it is much easier to supplement a nuclear base load with natural gas as a peaking fuel. Solar is a more natural counterpart [to nuclear].

It's pretty clear that the Yucca Mountain permanent spent fuel disposal site that has been national policy for a number of years just isn't going to get done in the next several decades. So what we really need is a federal policy that says, OK, here's where you should put the spent fuel in surface storage facilities, and this will be the federally approved solution.

The real issue is whether federal policy is just that you leave it at the existing plant sites, or whether you have a better policy that, after some number of years at a plant site, you start moving it to a federally controlled facility. This is one of the most difficult issues in a resurgence of the nuclear industry because people aren't exactly standing in line to have these new federal sites. ”

JOHN ROWE

chairman and chief executive officer, Exelon Corporation

ALAN NOGEE
director, Clean Energy Program
Union of Concerned Scientists



environment.umn.edu/momentum

PODCAST

Visit us online to hear the extended interviews with Rowe and Nogee, as well as an in-depth conversation with Paul Wilson, a nuclear engineering professor at the University of Wisconsin, Madison.

ACROSS CAMPUS



FEB. 4

**Beyond Fossil Fools:
The Roadmap to Energy
Independence**

Coffman Memorial Union,
Minneapolis

Join University of Minnesota alumnus Joe Shuster, author of *Beyond Fossil Fools*, for a relevant and revealing talk on the most important issue of our time: energy.

FEB. 19

Mapping Global Adaptation Hotspots

Cargill Building, St. Paul

Shalini Vajjhala, a fellow at Resources for the Future, outlines a new online Global Adaptation Atlas that captures spatial information on climate impacts and adaptation activities.



FEB. 23

**Sustainable Housing:
Research and Practice**

Rapson Hall, Minneapolis

Experts from the Center for Sustainable Building Research present an evening workshop on sustainable approaches to housing design.

MARCH 6

What's Next in Law, Health and the Life Sciences?

Debating Openness, Access and Accountability
Humphrey Center, Minneapolis

Top speakers from across the country discuss emerging issues in environmental, genomic, neuroscience and health care research.



MARCH 9

Design for Sustainable Systems

Rapson Hall, Minneapolis

Jim Patchett, founder and president of the Conservation Design Forum, explores the relationship between terrestrial and aquatic ecosystems.

MARCH 26

**Living on a Shrinking Planet: Challenges
and Opportunities for a Sustainable Future**

Nolte Center for Continuing Education, Minneapolis

Jonathan Foley, director of the Institute on the Environment, offers insights on global environmental systems and their interactions with society.

APRIL 23

**Environmental Policy Formation: Political
Economy and Behavioral Economics**

Nolte Center for Continuing Education,
Minneapolis

University of Illinois professor Amy Ando examines the vulnerabilities of the environmental policy development process.

MAY 6

Biochemistry of Biofuels

Coffman Memorial Union, Minneapolis

The nation's leading bioenergy experts share the latest advances in biofuels research and technology.

Visit environment.umn.edu/events for more details and additional events.

AROUND THE WORLD

A dream agenda for globe-trotting eco-geeks

FEB. 10-13

Map World Forum

Hyderabad, Andhra Pradesh, India

www.mapworldforum.org

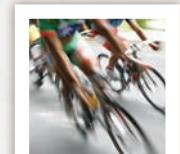


MARCH 24-29

Ideas Festival

Brisbane, Queensland

www.ideasfestival.com.au



MARCH 29-31

**World Conference on Sport
and the Environment**

Vancouver, British Columbia

www.wcse2009.com

APRIL 19-23

**European Geosciences Union General
Assembly**

Vienna, Austria

meetings.copernicus.org/egu2009



MAY 26-28

POWERGRID Europe

Cologne, Germany

www.powergrideurope.com

INSTITUTE ON THE ENVIRONMENT

UNIVERSITY OF MINNESOTA

Driven to DiscoverSM

1954 Buford Ave. • 325 VoTech Bldg.
St. Paul, MN 55108

Nonprofit Org.
U.S. Postage
PAID
Minneapolis, MN
Permit No. 155

Search Will plastic soup enrich millions?



► U of M civil engineering student Brian Bell, working with Engineers Without Borders, is researching ways to alleviate trash problems in developing countries like Haiti. Using the sun's energy, Bell and his team are experimenting with melting plastic garbage and then molding it into products Haitians can use, turning waste into something worthwhile. So the search continues.

More at umn.edu

UNIVERSITY OF MINNESOTA
Driven to DiscoverSM