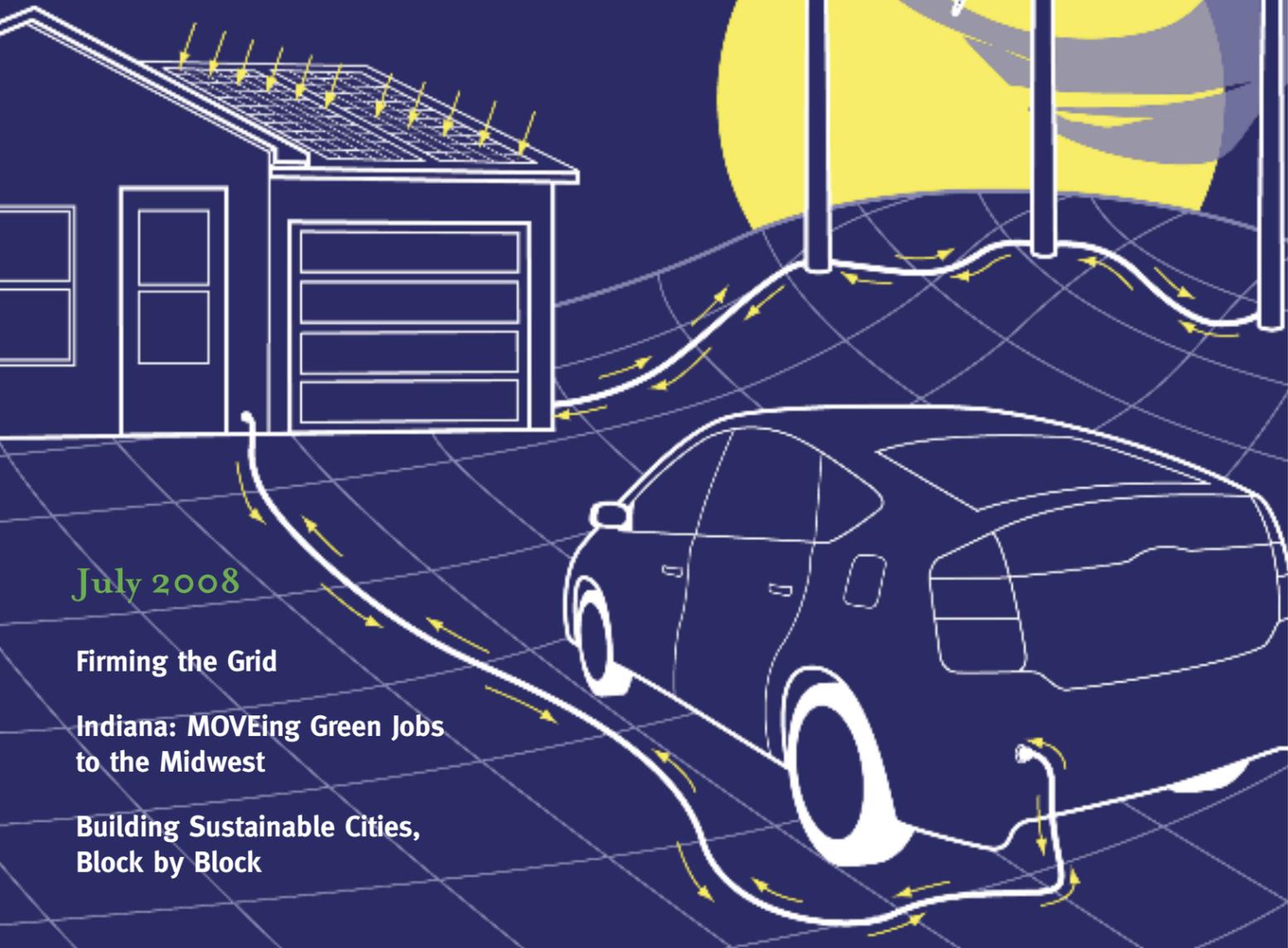


RMI Solutions

Journal

The Smart Garage = V2G:
Guiding the Next Big
Energy Solution



July 2008

Firming the Grid

Indiana: MOVEing Green Jobs
to the Midwest

Building Sustainable Cities,
Block by Block

Contents Volume 1 . Number 1 . July 2008

 Utilizing recycled fiber for this publication resulted in the following savings:

33.6 trees preserved for the future
97.02 lbs waterborne waste not created
14,272 gallons wastewater flow saved
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23,800,000 BTUs energy not consumed
Savings from the use of emission-free wind-generated electricity: 1,616 lbs air emissions NOT generated
Displaces this amount of fossil fuel: 3,844 cubic feet natural gas unused



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Innovation Man

By Jonah Bea-Taylor

RMI Vice President Stephen Doig lives life at a frenetic pace. But, through it all, he still finds time to crack jokes and muse on the next big idea.



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Getting a Firm Grip on Renewables

By Noah Buhayar

Wind and solar power currently supply only a small fraction of U.S. electricity demand. But RMI's Energy & Resources Team is hard at work, proving that both renewable resources can be a valuable and reliable addition to the country's energy mix.



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The Smart Garage (V2G): Guiding the Next Big Energy Solution

By Cameron M. Burns

In the early 1990s, RMI researchers dreamed up a new energy paradigm, integrating cars, buildings, and the electric grid. The only problem was that the technologies needed were either too expensive or not yet developed. Today, all that is changing.



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RMI Chief Scientist Amory Lovins traveled to Borneo on his vacation to visit a world-class organization working to protect orangutans. What he found was an inspiring story about rainforest rehabilitation and sustainable economic development.

In other words, Solutions Journal's savings from the use of wind-generated electricity are equivalent to: planting 109 trees or NOT driving 1,750 miles

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Cover Illustration by Kyle Duba

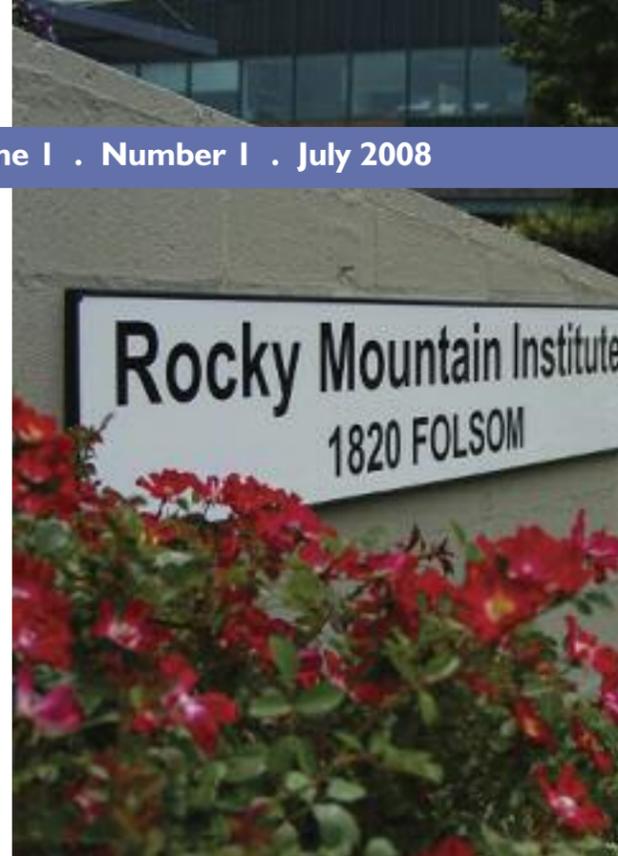


ROCKY MOUNTAIN INSTITUTE

President/CEO Michael Potts
Chairman/Chief Scientist Amory B. Lovins
Executive Director Marty Pickett

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Jonah Bea-Taylor



Jonah Bea-Taylor is taking his first steps into the media and communications world. He previously attended the London School of Economics where he studied organizational psychology and learned about the theory of business innovation and creativity. His profile article of Stephen Doig was a wonderful chance to see some of those ideas coming to life in the real world.

Noah Buhayar



Noah Buhayar is a freelance journalist and fellow at Rocky Mountain Institute. He formerly reported for The NewsHour with Jim Lehrer in Washington D.C. and is a regular contributor to many print and online publications. "RMI's forward-thinking work and its talented, passionate supporters are truly inspiring," he says. "Sharing these ideas and stories with this audience is a pleasure."

Cameron M. Burns



Cameron Burns' work with RMI has included everything from judging an architectural design competition to helping film crews negotiate the banana "trees" at RMI's headquarters building. Mostly, though, he tweaks words in the hundreds of consulting reports, conference submissions, and articles put out by RMI each year. "RMI's Smart Garage initiative is really inspiring ... it's great to see how it draws all these somewhat disparate threads together."

Cindy Cash



Long-time Boulder resident Cindy Cash graduated from the S.I. Newhouse School of Public Communications, jumped a fast train to Colorado out of Syracuse and never looked back. A seasoned advocate for Colorado children, she's donned many hats during her RMI tenure, but none as "rewarding as working on the first *Solutions Journal*." Interviewing Simon Rose was "the plum assignment. He's done it all and made a huge difference. What an inspiration!"

Kyle Duba



Kyle Duba blew into Boulder a few short months ago from the Pacific Northwest to take on the position of creative intern for RMI. Little did he know that three months later he'd be designing the very first *Solutions Journal* cover. A graduate of Pacific Lutheran University, who has a passion for rock climbing and photography, Kyle appreciates the opportunity to "use his creative forces to make a difference in how people live on this earth" and to help bring about change.

Launch of the RMI Solutions Journal

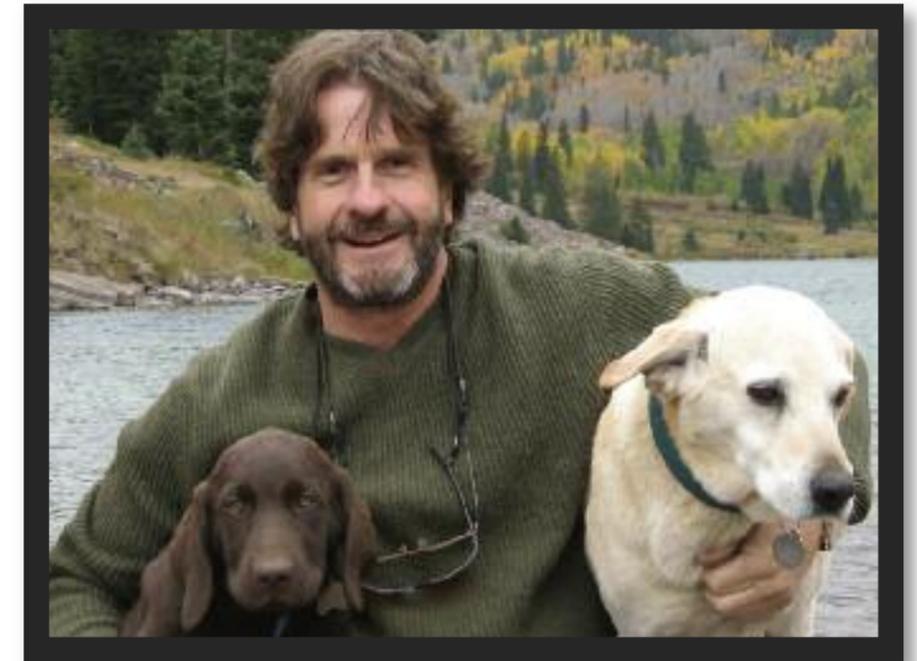
WELCOME TO THE RMI SOLUTIONS JOURNAL, the newly redesigned tri-annual publication from Rocky Mountain Institute.

The past year has been one of great growth and greater accomplishment for RMI. It has been marked by a number of high-profile client engagements, in-depth research projects, our 25th anniversary, and a renewed commitment to communicating our ideas and work to the rest of the world.

But which of our stories do we choose to tell first? RMI is so many different things. Research. Barrier Busting. Implementation. Big thinking. Radical solutions for attacking the world's dire needs around energy efficiency and the restorative use of natural resources.

But more than any of those things RMI is its people and their ideas. Inside this issue of the *Solutions Journal* we will be introducing you to a number of those people and a host of their ideas. Some of these people work here at RMI; some of them once worked at RMI; some have been long and dedicated supporters. But they are all members of the RMI family, deeply dedicated to our mission, and we invite you to get to know them a little better.

Among the questions asked in this issue: How does a Midwestern state place itself at the forefront of the "green jobs" movement? How can we begin to change the way we think about sustainable cities, one block at a time? How can we make the electrical grid stable with up to 40 percent or more of our power coming from renewable sources like wind and solar?



And the most visionary of all is the question asked in our initial cover story: How does RMI help bring the building, transportation, and utility sectors together to help create the energy solutions of the future?

Also, we think that you will enjoy seeing a different side of our Chief Scientist and Chairman Amory B. Lovins, a man who spends his holiday trying to bring new awareness and support to a Borneo project dedicated to saving orangutans and their natural rainforest eco-system.

We hope you enjoy the read. If you have any comments or suggestions, please send them to us at SolutionsJournal@rmi.org.

Thanks again for your support.

Llewellyn Wells
VP of Communications and Media

This and all future issues of RMI Solutions Journal are available in digital PDF format and can be downloaded directly from our website at www.rmi.org. If you would prefer to download an electronic version of RMI Solutions Journal instead of receiving a printed copy by mail, notify us at solutionsjournal@rmi.org. We will add you to our email list and notify you whenever a new digital edition is available.

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ROCKY MOUNTAIN INSTITUTE SOLUTIONS JOURNAL

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The View From Here



Transformational Change at RMI

By Michael Potts, RMI President and CEO

MOST CHANGES IN INDUSTRY AND SOCIETY ARE incremental, focused on a single component or aspect that might improve performance, but often fall short of changing the fundamental design of a system. Incremental changes are necessary and helpful, but they aren't our specialty at RMI.

We look for opportunities to drive *transformational* change: to shake up the very foundations of a system or process. For example, we love to design high-performance buildings that consume 50 to 80 percent less energy than typical structures. These kinds of projects require a fundamental rethinking of the way buildings are built.

In other sectors, we are also striving for breakthrough change: trucks that are three-times more fuel efficient than current models, cars that achieve 150 miles per gallon, large-scale industrial processes that use 80 percent less energy, and electricity grids that rely on renewable energy instead of coal and natural gas.

In the past few years, companies and organizations have grown increasingly receptive to these kinds of forward-thinking ideas. Skyrocketing fossil-fuel prices are only increasing the sense of urgency. The public's growing awareness, combined with our own desire to dramatically increase our impact and effectiveness, is motivating us to drive transformational change in yet another arena: RMI itself.

Hopefully, you've noticed some of the changes that we've already made. RMI's increasingly transformed Web presence, our successful RMI25 event, upcoming National Solutions Council weekends, and the very journal you are reading right

now are all signs of how we are changing the way we communicate our work and innovation to the world.

This past fiscal year, our staff grew to more than 100 people. Philanthropy supporting our research and outreach grew by 50 percent. RMI also attracted the attention and partnership of pivotal industry leaders.

This growth, however, is only the first step toward changing the nature of our work. As more for-profit practitioners enter our fields, we will be shifting our efforts "upstream" toward research and innovation. Rather than let market forces sort out important questions, such as our reliance on the diminishing supply of fossil fuels, we are actively seeking out answers to guide industry and policy over the next several decades. This internal transformation requires a deeper commitment to philanthropy, which has been generously provided to us in proportion to the mounting evidence of our impact.

To encourage a smooth and thoughtful transition to this new model, I have asked our own team, our clients, our extensive network of advisors and collaborators, and our dedicated board of trustees, to help forge a new strategy for RMI. In this next year, we are embarking on a fundamental quest to determine our future direction in terms of scale, focus, and global reach.

These times at RMI are truly transformative. This work is crucial, fascinating, and fulfilling—and we are delighted that you have chosen to collaborate with us in striving to make our world a secure, life-sustaining, and prosperous place. •

What a Difference a Year Makes!

By Marty Pickett,
RMI Executive Director

THIS TIME LAST YEAR, WE WERE IN THE throes of planning a huge event to celebrate RMI's 25th year. We identified multi-year, game-changing initiatives to make huge inroads toward ending climate change. Our Built Environment Team had a dream to produce a film about high-performance buildings, making the business case for buildings that have zero energy use—or better yet, are regenerative and give energy back to the grid. We made sustainable communities one of our priorities. RMI's transportation team, MOVE, knew it could help prove that ultralight automobiles are safe—if only we had the funding for the needed research and crashworthiness testing. We were prepared to spin off a for-profit company to pursue innovations in plug-in hybrid electric vehicles once we raised enough funds to complete our proof of concept. Our Energy & Resources Team stood ready to put its expertise to work to enhance the use of solar energy and integrate it with wind power and plug-in hybrid electric vehicles. The list went on.

An amazing number of friends and supporters stepped forward to partner with RMI in these and other efforts over the past year. A record total of more than 2,300 individuals donated a total of more than \$7.5 million, with gifts ranging from \$10 to \$1 million (thanks again to Fred and Alice Stanback). We had support from 55 foundations, with grants for specific work as well as general support. Thanks to numerous RMI25 sponsors, symposia contributors, and more than 800 attendees, we raised more than a half million dollars at our RMI25 event last August. And many donors earned miles by donating online throughout the year!

Miriam Beard Vagts once said, "The results of philanthropy are always beyond calculation." Though I generally agree that



Photo by Aris Yi

philanthropic gifts are immeasurable in many ways, we can surely calculate some great results from the generous support—large and small—of so many individuals and foundations over the past year. To name a few significant ones:

RMI partnered with the U.S. Green Building Council to produce the film, "High Performance Building: Perspective & Practice" and we've distributed hundreds of copies. In December, RMI spun off a for-profit corporation, thanks to funded research that mapped a path for design and production of a certain class of plug-in hybrid electric vehicles. In February, our transportation (MOVE) team wrote a Yahoo! Green blog post about automotive safety and weight that generated dozens of responses, indicating that the public is hungry for more information. Thanks to the William and Flora Hewlett Foundation, we now have funding for in-depth research and collaboration with a crashworthiness expert to help prove RMI's arguments about the safety of ultralight vehicles. Because of support from the Kohlberg Foundation, we'll be collaborating with the Association for the Advancement of Sustainability in Higher Education to accelerate progress in campus climate initiatives, an obvious place to focus our efforts in sustainable communities. And supporters are helping us expand our work on energy efficiency, specifically solar and wind power and other renewables.

What a difference a year makes, indeed. •



Photo © www.laurendiscipio.com

INNOVATION MAN

By Jonah Bea-Taylor

IT'S 10 A.M. ON A WEDNESDAY MORNING AND Stephen Doig, RMI's Vice President for Energy & Resources, has already been working for four hours. He's sitting in a large conference room taking RMI's basic process for creating innovation to the next level. On the speakerphone with him is Christian Terwiesch, an expert on corporate innovation processes at the Wharton School of Business. Josh Traube, a fellow with the Energy & Resources Team (ERT), is listening to the conversation, taking notes on his laptop. The lights are off in the conference room, but early morning sunlight illuminates half of the long conference table, as Doig scribbles notes on a whiteboard. It seems like an unusually large, empty space for a conference call. But the big ideas fill every corner.

The problem, according to Doig, is that RMI has a great innovation process, but it needs to clarify its underlying mechanisms. Comparing truly breakthrough ideas to fruit on

a tree he says, "We come in, we shake the tree really hard, everybody really likes it, there's lots of fruit on the ground, but we go back saying, 'Now, how did we shake that tree?'" By working with experts like Terwiesch, Doig intends to help RMI create a process that is even more effective and systematized—one that we can easily explain and replicate throughout our client work.

Deep thinking may be Doig's forte, but he's also a very facile manager, handling the day-to-day needs of his team with aplomb. Before the conference call, he and Natalie Mims, a consultant with ERT, sketched out plans for ERT's new office, an annex to the 1820 Folsom Street facility affectionately named the "Cottage." The team is moving into that space so they can work more closely together and still have room to grow. "I'm using the full power of my Ph.D.," Doig joked while sketching out room dimensions with a Sharpie.

The Ph.D. he's referring to is in chemistry from UC Berkeley, where he specialized in bacterial photosynthesis. Through research fellowships, he also explored a number of other topics in chemistry, including the functioning of proteins and the design of photovoltaic solar cells. But it was the time between fellowships that ended up changing his career path.

In 1996, a colleague who was joining McKinsey & Company persuaded Doig to take a hiatus from academia and join the world of business consulting. The move was supposed to be only temporary—"for a year at most, and then I was going to go back to science," Doig says now. He ended up staying for ten.

"It was thrilling and a little bit shocking," Doig says about the transition from an academic schedule to McKinsey's business operations practice. While there, he worked with a wide range of firms in industries as diverse as aerospace and health care. His specialties at McKinsey comprise a laundry list of terms only a professional consultant can decipher: "operations strategy, frontline change management, supply chain optimization, and operational cost reduction, strategy and growth."

"We shake the tree really hard ... there's lots of fruit on the ground, but we go back saying, 'Now, how did we shake that tree?'"

As opaque as these specialties may sound, Doig now parlays some of his talents and experience into the education of future business leaders, as an adjunct professor at the University of Pennsylvania's Wharton School of Business. Since joining RMI last year, Doig has been thinking how to create curriculum around two of the Institute's seminal ideas: whole-system thinking and end-use efficiency.

When he has time to design that curriculum is anyone's guess. After setting aside the the Cottage sketches—but before his 10 a.m. conference call—Doig and Mims joined ERT Principal Kitty Wang to discuss another form of education: Sharing knowledge about the many exciting energy efficiency initiatives that utilities are already undertaking. The model is California, which uses far less energy per dollar of GDP than other state. Were the rest of the country to adopt California's practices, explained Wang, the country could realize huge energy savings. The biggest challenge is helping utility operators see beyond perceived barriers. With his characteristic touch of humor, Doig noted that some utility managers "grow up fossilized in the industry, then ... keep getting

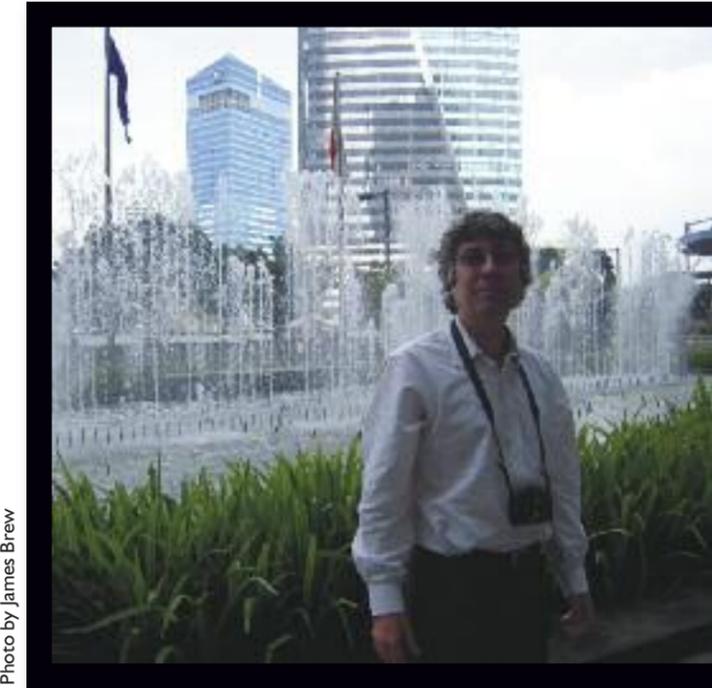


Photo by James Brew

Doig in Jakarta attending the Sustainability for the World's Mega-Cities Project. How do you shape a sustainable mega-city for 30 million people?



Photo by Jonah Bea-Taylor



Doig with ERT Principal Kitty Wang (left) and Consultant Natalie Mims.

Photo by Jonah Bea-Taylor

messages from very risk-adverse people not to try anything new. If we were to give them a clear roadmap, we could help make these options less threatening,” he adds.

As the conversation bounced among the three colleagues, Doig furiously sketched an outline on the board, asked refining questions, and synthesized the discussion into a full implementation plan. Always making sure their ideas were grounded in reality, he often bent over Mims and Wang’s laptop screens to refer to the California utility data they had gathered so far. In working these ideas to the next level, Doig again showed his unique ability to break conceptual ground—often in RMI’s tradition of finding huge potential in very small changes. “It’s the human condition to keep looking for that next ‘magic bullet’ thing that will be really cool and solve all the current problems—and the search goes on for indeterminable lengths. We miss what is going on right now.”

By the time Doig makes it back to his office, it’s already 1:00 p.m. A camping backpack sits in the middle of the floor; Doig uses it to keep his office mobile while on a rigorous travel schedule. Stacks of paper (one for each project) are neatly lined up against the wall. Multiple spreadsheets and planners cover the desk. The clutter speaks to the pace of his life. In the past nine months Doig has been to Europe a couple of times, Australia, China, and New Brunswick—among many other more local destinations. His next trip will take him to Jakarta, Indonesia, where he will attend a conference on sustainable megacities with the Built Environment Team’s James Brew.

He admits that fitting in all these responsibilities requires a

bit of finagling. In particularly crammed moments, he has tried making cell phone calls while riding his bike to work—a tactic he describes as “possible, but stupid.”

Ultimately, though, Doig says he would like to find three months to sit down and use his strongest skills to advance RMI’s basic research. While it is exciting to apply conceptual work with clients on a day-to-day basis, Doig notes that real breakthroughs might require a different kind of focus. “It’s been my experience that good research takes concerted works of time ... I mean weeks strung together ... in a relatively loosely controlled manner, with some goals about what you want to get done by when. When I came here people were trying to squeeze in four hours one day and five later that week to do their research. And that pattern isn’t going to help us be very effective.” In the future, Doig would like to see the Energy & Resources Team have the support it needs to focus as much of 70 percent of its time on research.

Taking a break from the fifty or so e-mails that have piled up in his inbox during the day, Doig leans back in his chair and muses again about the potential that people are still missing to make a huge difference in how we use energy today. “We’re still caught up in the idea that there is a crisis and we’ll have to make big sacrifices,” he says. “But I think a lot of what needs to happen right now is to demonstrate that this works now; what is being done currently. This [high-performance] house really is 80 percent more efficient and it’s the same price; this utility has already done this; you can really conserve like this ... and everybody is still going to the coffee shop. What’s so bad about that?” •

Ingredients:

- Three RMI R&C teams
- Groundbreaking research, ideas, publications & case studies
- RMI’s new online strategy
- The World Wide Web

RMI on the Web

Instructions:

Outsource a designer/developer to assist you. For this recipe, we used Imulus - a Boulder, Colorado-based company.

Prepare each team individually. Begin with BET, then MOVE and finally, ERT.

Gather a wealth of information about each – its staff, its work and its projects. Ensure you have some good case studies to represent the team’s high level of expertise.

Assemble this information in an easy to use format, incorporating eye-catching design with functionality.

Sprinkle in imagery, flash, video, forums, interactive visuals together with other multimedia and online tools.

Blend in the latest news, events and publications from each team.

Your micro sites are now ready for use.

But if you don’t have the time to make your own, here is what we prepared earlier:

move.rmi.org . bet.rmi.org . ert.rmi.org (coming soon)



Our next recipe:

Watch out for our biggest online project to date -- the redesign and redevelopment of RMI.org. This promises to be the most challenging recipe yet for RMI’s web team.



The site should be available this fall and promises to dramatically boost RMI’s online reach and readership, with a better design, easier access to our vast library of research and integrated social media tools. •



Indiana Launches An Ambitious Clean Energy Plan

By Stephanie L. Johns

Indiana.

It's known for wide, open fields of corn and soy, scattered farm towns, and laid-back Hoosiers famous for their warm hospitality. Indiana doesn't strike most visitors as a place you'd find an aggressive economic development plan centered on advanced transportation and energy systems. But it is. Indiana may not be known for advanced manufacturing, advanced transportation components, lithium-ion batteries, and the capability to put them all together in fresh and exciting ways, but those capabilities and assets do exist in the state.

Which is why the State of Indiana is establishing something called the Indiana Energy System Network (IESN).

The idea for the IESN has its nucleus in Governor Mitch Daniels 2006 economic development plan for Indiana, 'Accelerating Growth.' The plan identified intellectual clusters and industry networks (think high-level research parks) as powerful drivers of economic activity and global competitiveness.

"'Accelerating Growth' is intended to help revive Indiana's remarkable history of pragmatic entrepreneurship and economic dynamism," Governor Daniels wrote. "By focusing on innovation, talent, and investment—the key themes of our plan—we can build for the future by rediscovering the excitement of Indiana's innovative past."

Pragmatic entrepreneurship and economic dynamism sound like a pretty tall order, but with the help of RMI and a forward-thinking group of businesses, academics, and workforce development entities, the State is finding the lofty goal doable. And it's mostly because Indiana has extensive untapped assets in the automotive, power electronics, and energy storage and conversion sectors. Now, Indiana leaders want to leverage those assets to make the region a hub for research, development, and execution of whole-system solutions that will reduce fossil-fuel use, expand business opportunities, and revitalize the area's economy. The IESN was formed as a collaborative network of businesses, academia, and workforce development entities to achieve that mission.

Illustration by Kyle Duba



Paul Mitchell, Policy Director, Economic & Workforce Development for the State of Indiana, exploring ideas at MOVE's recent Innovation Workshop.

Photo by Stephanie L. Johns

But building a viable industry network is no small task. Successful networks—like the world-renowned Research Triangle Park in North Carolina and the younger Advanced Materials Research Center in Sheffield, England—required a huge amount of time and commitment for success. Considering the speed with which technology, global markets, and expertise are shifting, figuring out the right way to go and doing so in short order, is critical.

Immediately after the State engaged RMI, it became apparent that the best way to launch the Network and build momentum was to hold an Innovation Workshop, one of RMI's unique information- and idea-sharing events, with about 50 representatives from a cross-section of organizations. The Workshop was designed to do several things: establish connections between organizations, enhance the awareness of assets and opportunities for collaboration, and identify some key projects the Network could pursue.

In the very large and fuzzy energy arena, defining focus is everything, so RMI worked with the State and Conexus Indiana (a group of companies collaborating to enhance advanced manufacturing and logistics in Indiana) to identify key discussion points for the Workshop. RMI staff also recognized that the Workshop would probably produce a number of additional opportunities that the Network could pursue once established. In addition, the Institute worked with the State and Conexus to identify appropriate attendees. The end result was a list of more than 40 participants, ranging from auto-sector firms like Delphi and Cummins and Rolls Royce, to universities like Purdue and Notre Dame, to energy companies like Duke

and I-Power. Finally, in June, RMI brought them together for two dynamic days of brainstorming ideas and drafting a plan for launching the Network.

Over the course of the Workshop, it became apparent that not only are there numerous companies and considerable research and expertise in advanced transportation and energy supply in Indiana, there is a remarkable consensus about the direction and focus of that work. On the first day, the brainstorming groups were broken up by topic: advanced transportation, energy supply, energy demand, and strategy and resources. At the end of the day, the top ideas that were generated were evaluated. Groups were then reformed based on categories that could define the activities of the Network. The categories included value stream development, technology refinement, and demonstration projects. An additional group was formed to examine the role the Network could play in workforce development, while the original "strategy and resources" group was assigned to refine the mission and strategy of the IESN.

One of the key challenges of forming networks is getting parties with disparate interests to collaborate. At the Workshop, participants realized that the Network could act as an aggregator of entities. The value wouldn't be in the entities themselves, but in the technology they collectively produced—think of a conductor and an orchestra or a project manager on a job site. Wind-power component manufacturing offers a great example. If the Network found there were gaps along the supply chain, it could identify companies that could fill those gaps (ideally companies already in the region), and then work to fill them.

Once such a system was working, the Network could market its collective value to the wind power industry. Other possible value streams based in Indiana included advanced powertrain components for hybrid and plug-in hybrid electric vehicles, vehicle-to-grid systems, distributed generation systems, and waste-to-power systems.

Once the core value stream for a particular opportunity area is mapped out, any gaps identified must be filled to create a competitive advantage for the region. These gaps could be in commercially available technologies or in missing, undeveloped technologies. For the former, the IESN could identify companies in the region with the right capabilities, and, for the latter, the Network might identify companies that could develop the required technology and facilitate joint venture agreements (JVAs) for development, testing, and commercialization of the technology.

A great example that the group focused on is the development of a "black box" needed to accelerate the commercialization of PHEVs and vehicle-to-grid technologies. This black box would handle the transfer and conversion of all forms of energy and information between devices, such as the vehicle and the grid and various components within the vehicle. Indiana already has a number of companies working to refine this technology, and the IESN could clearly play a role in facilitating that collaboration.

In time, the Network could facilitate the realization of many projects, but Workshop participants felt one high-profile project was needed to kick-start the Network. Ultimately, they felt it should be in the advanced vehicle and vehicle-to-grid space. Thus, they recommended that the Network build a fleet

of PHEVs using regional companies to demonstrate the viability of PHEVs and the management of power between the grid and the vehicles.

Once the market space and value stream for PHEVs has been identified, the IESN can help various companies collaborate to produce the vehicles. The final goal would be a large-scale, multi-state demonstration of these vehicles, their components, and energy management between the vehicles and the grid.

Underlying the business potential is the job creation potential. The Workshop included a number of representatives from the workforce arena, including representatives from academia and Indiana Workforce Innovations in Regional Economic Development (WIRED), who tried to figure out how to best connect the regional workforce to the Network initiatives. One idea that came up was the need for a centralized workforce organization, where job listings could be posted, interviews arranged, and various training programs made available.

Indiana could become a hotbed of high-tech, cutting-edge R&D in advanced transportation and energy systems. And the State is moving quickly to capitalize on the momentum of this Workshop. As RMI's research and the Workshop showed, the keys to success are speed and collaboration. This is a huge opportunity for the region, and the time is right for Indiana to move forward and establish itself as a leader in the advanced energy system space. RMI is honored to be part of this important process. •

Stephanie Johns is an Analyst with RMI's MOVE (Mobility + Vehicle Efficiency) Team.



With a new energy paradigm quickly developing, Indiana's assets in automotive and energy storage solutions could help it become a hub of innovation.

Doing Well by Doing Good

Sue Woolsey has spent her career helping governments, businesses, and non-profits operate more effectively. Looking back on her dynamic career, she says working with organizations that have great missions and creative people is what keeps her going.

By Noah Buhayar

VISIT SUE WOOLSEY AT HER HOME OUTSIDE Annapolis, Maryland and you might think you've stepped onto a proving ground for renewable energy and energy-efficient technologies. A 3.75-kilowatt photovoltaic array covers the farmhouse's southwest-facing roof. Out on the dock, Woolsey and her husband Jim have installed two small wind turbines. A geothermal heating system keeps the house reliably warm in the cold Maryland winters and cool in the hot and humid summers. To maintain a comfortable temperature, they've filmed their windows, installed attic tents, and re-insulated electrical sockets and other openings. Look in the garage and you'll find a plug-in Prius, modified by battery manufacturer A123.

"The first month the geothermal was operative, our electricity bill went down by nearly 70 percent from the same month the year before, although we added the charging of the Prius to the load," Woolsey says proudly.

Her fascination with renewable energy and energy efficiency dates back to the late-70s when she was Associate Director for Human Resources at the Office of Management and Budget (OMB) in the Carter Administration.

RMI cofounder and Chief Scientist Amory Lovins had recently published his landmark *Foreign Affairs* essay "Energy Strategy: The Road Not Taken?" in which he argued for an "end-use/least-cost" approach to the energy problem.

"There was a big buzz about him in the whiz-kid policy community," Woolsey remembers. "So I was really excited to meet him."

One day, she and her colleague Elliot Cutler, then Associate Director for Natural Resources at OMB, decided to seek him out. Woolsey still remembers the hallway on the second floor of the old Executive Office Building where the three first met.



"We're not competition."

"We should be well ahead of competition."



Even though her work at the time was very focused on the “human, domestic side of the budget,” Lovins’ analysis and reasoning appealed to her. He really exemplified how, “if you question the assumptions effectively, you can turn the issue on its head and see a whole new range of answers,” she says.

Prior to joining OMB, Woolsey had worked for five years at the Department of Health, Education, and Welfare, evaluating HeadStart and many other programs.

The experience taught her that federal policies often contain some startling internal contradictions. For many years, the food stamp program, for instance, required an eligible family to pay money to receive the government benefit. Five dollars of food stamps might cost \$1.50. But “if you didn’t have \$1.50 to buy \$5.00 worth of food stamps, you couldn’t get anything,” says Woolsey. That posed serious problems for people who were most in need—the people who didn’t have any money to begin with. The purchase requirement had been imposed to limit the cost of the program, but the disincentives to participation had operated in exactly the wrong fashion.

At OMB, Woolsey worked with Congress to eliminate the purchase requirement. This increased the cost of the food stamp program because it encouraged more people to enroll, and Congress decided not to apply the incentives to those higher on the income scale. But it also helped the government achieve its stated objective: feeding the country’s poor.

These early experiences in Washington not only revealed Woolsey’s knack for taking on big responsibilities—at OMB, she was running 51 percent of the federal budget—but also her keen eye for process and organizational dynamics.

A Stanford- and Harvard-educated psychologist, Woolsey says her understanding of the way people think and act in groups was invaluable. For her, academic concepts like group theory and role theory found practical application in the halls of government. The key was parlaying that understanding into action and progress.

“I found in my government career that you could get a lot done in bureaucracies if you kept your eye on” what you wanted to accomplish, she says.

In 1980, Woolsey left government and landed a job writing editorials for the *Washington Post*. Nonetheless, she retained an abiding interest in government programs and their inconsistencies.

On Memorial Day, 1980, she published an unsigned editorial describing the compensation for naval petty officers returning from the Persian Gulf versus the federally set wage other workers were paid under the Comprehensive Employment and Training Act (CETA), the government’s program to reduce unemployment

rates. The results were shocking. According to Woolsey’s analysis, sailors returning home to Norfolk, Virginia made as little as \$2.54 per hour—even after housing allowances, tax advantages, and food were factored in to their wages. In contrast, people employed under CETA were making \$3.75 per hour.

According to officials who accompanied him that Memorial Day, President Carter read the editorial on his way to greet returning sailors in Norfolk. He immediately scrapped his speech and rewrote it to include his support for a military pay increase that was working its way through Congress.

If Woolsey had not been convinced of the importance of communications and media before, she was now. “I probably had more effect on Jimmy Carter as a member of the press than I did in his administration,” she jokes.

Her career as a pundit was short lived, however. By the end of 1980, she joined the consulting and accounting firm Coopers & Lybrand (later to become part of PricewaterhouseCoopers) as a consulting partner. It was there, she says, that she deepened her understanding of organizational management and operations, a skill set she would later use in her posts at the National Academies.

The position at Coopers & Lybrand “gave me a lot of background about how things are done by a wide range of companies, universities, and nonprofits,” she says. “So when I went to the Academies, and people said, ‘This is just the way things are done,’ I could say ‘Well, the people at X organization tried it this other way and had a lot of success.’”

Of all the places she worked in her distinguished career, Woolsey says the National Academies were the most obsessive about process. For over a decade and a half, she would serve as the Academies’ Executive Director of Behavioral and Social Sciences and Education, Chief Operating Officer and, finally, Chief Communications Officer.

Listening to her discuss committee selection, public comment periods, and technical reviews at the independent

research organization reveals a world of deeply entrenched behavior. But it was a world she was well suited to help. During her tenure, the Academies streamlined their operations and became far more effective at communicating its research to the public. In this latter endeavor it was, again, her willingness to rethink processes that paid off.

Most studies at the Academies are initiated when a government agency asks a question, explains Woolsey. For example, the EPA wants to know whether it is using the right kind of metrics to measure mercury levels in groundwater. “Generally, you put together a committee with all the areas of specialization, and they look at all the available data and draw conclusions and make recommendations,” she says.

But the problem with this approach was that these reports ended up being written primarily for the client (e.g., the EPA) or for colleagues of the scientists and engineers on the committee. Though technically of the highest quality, they generally went unread by most of the public.

“What we decided to do was ask, from the audience point of view, ‘Who cares about the mercury in the groundwater?’ People who work on developmental psychology, pediatricians, parents care,” says Woolsey. The EPA might be asking the question that prompts the research, but the research can have a larger impact if you think about the audience in broader terms. In the case of the groundwater study, the Academies published a popular summary of the health research on mercury for the general public.

In 2004, Woolsey made yet another career change. She now serves on the boards of a number of companies, non-profits, and universities, including Colorado College, Caltech, the Institute for Defense Analysis, the German Marshall Fund, Fluor Corporation, and Van Kampen Mutual Funds—and of course, Rocky Mountain Institute. “To some extent, this is a dilettante’s paradise. I love new challenges, steep learning curves,” she says. But this humbleness belies her deep understanding about how to make these organizations run better.

And not everything she’s doing is entirely new, either. Her interest in efficient and productive ways to be environmentally responsible—“doing well by doing good”—that Lovins sparked more than three decades ago, remains at the core of her involvement with RMI.

“Of all the work that I’ve done on figuring out how organizations work best—working with highly scientific types, working with development—this comes together for me in a lot of interesting ways.” •

RMI’s Board of Trustees is comprised of an extraordinary group of accomplished and forward-thinking individuals. It is our pleasure to introduce you to each of them through a series of profiles and interviews.

Sue Woolsey Elected Lead Trustee

In April, Sue Woolsey was elected RMI’s Lead Trustee. Along with her extensive management and operations experience, she brings a true passion for the Institute’s mission.

Over the last three decades, her long friendship with RMI cofounder and Chief Scientist Amory Lovins has deepened her own interest in energy and natural resource issues.

Woolsey sees both exciting and challenging times ahead for the Institute. Over the last few years, RMI’s work and interests have moved to the center of policy, economic, and business debates. “Green” has become mainstream in nearly every aspect of life.

“For a long time, we were the dog chasing the school bus,” she says. “But now we’ve caught the bus.”

That change, says Woolsey, means that RMI needs to refocus its mission and make sure that its research remains leading edge.

“We’re not competition. We should be well ahead of competition,” she adds. According to Woolsey, getting to that point requires taking a serious look at the Institute’s business model and making sure that projects are truly mission-driven and that they foster the creative talents of RMI staff.

“Sue is a fully engaged board member who has earned enormous respect from the other trustees as well as staff,” says RMI Executive Director Marty Pickett. “She will play a key role in shaping RMI’s strategic vision.”

Reflecting on her growing role, Woolsey says, “I am passionate about enabling organizations with a great mission to work well so that the people in them can do their best work and enjoy their efforts and creativity.”

Getting a (Firm) Grip on Renewables

By Noah Buhayar

ONE OF THE BIGGEST DRAWBACKS INVESTORS and utilities have found with solar and wind power is that they are “variable.” Simply put: they can’t generate electricity when the sun’s not shining or the wind isn’t blowing. That’s problematic because we’ve grown accustomed to getting energy whenever we want it. Flick a switch and the lights should go on, regardless of whether it’s sunny or windy outside.

In the past, utilities believed that they had to compensate for this variability by installing more traditional, fossil-fueled power plants. The more wind or solar power on the grid, the thinking went, the greater the need for backup generating facilities to be there when the wind or sun wasn’t.

Enter RMI’s Energy & Resources Team. Over the past year, Senior Consultant Lena Hansen has led a series of research projects to rethink the implications of wind and solar’s variability. In the process, she and her colleagues are re-evaluating the economics of putting more renewable energy on the grid.

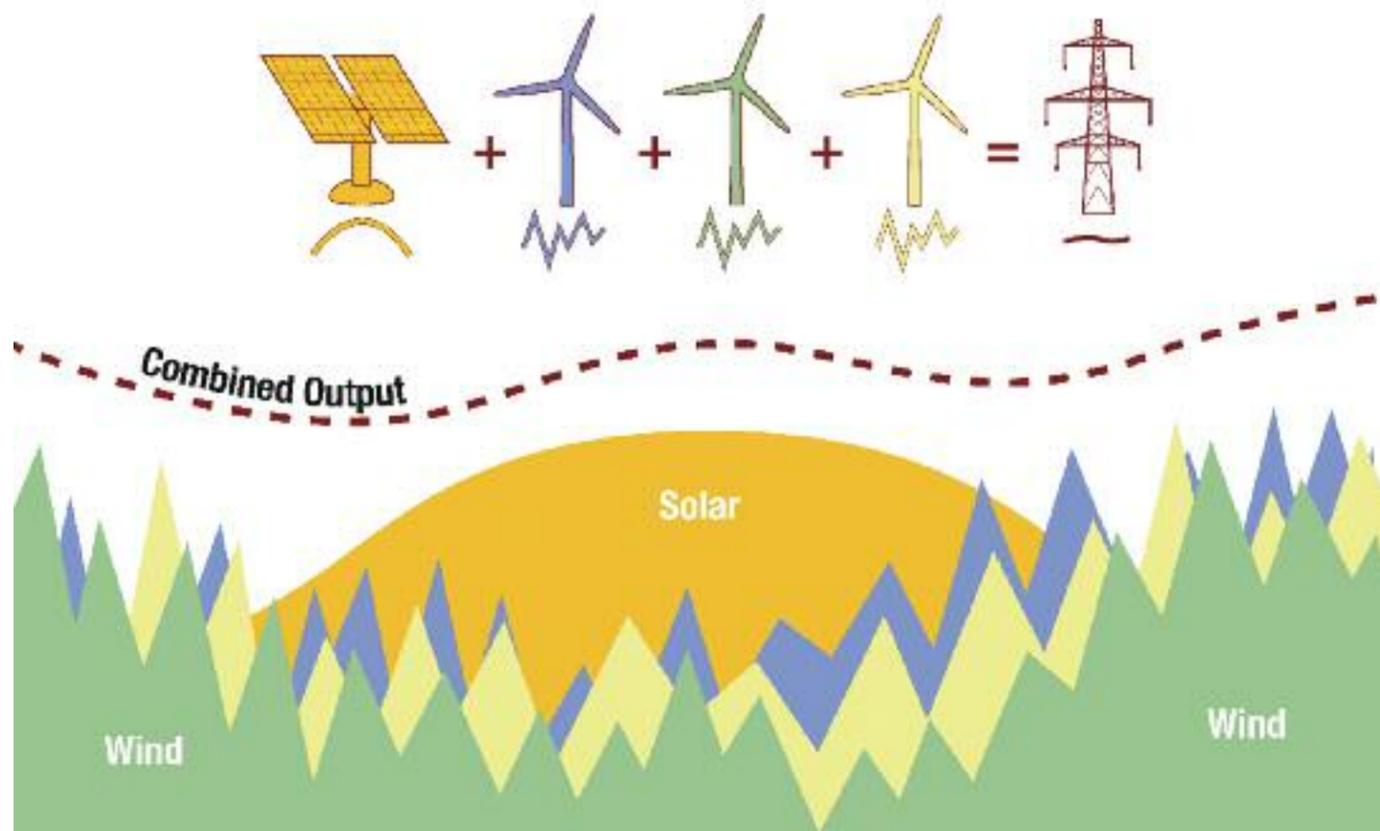
The key, according to Hansen, is for utility managers to think of all their wind and solar installations as a portfolio.

“No person would invest in just one stock,” says Hansen. In the financial markets, most people forego the huge risks and potentially large gains of owning shares of one company for the reduced risk and smaller rates of return of owning shares in multiple companies, she explains.

Hansen argues that the same should go for utilities investing in wind and solar. “By diversifying the portfolio of sites, you mitigate variability,” she says. “Put another way, the wind blows differently in different locations. So spread out your resource to reduce total variability.”



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The trick is to balance risks and rewards. Very windy and very sunny sites produce more power than sites that are less windy or less sunny. But they also tend to be more variable.

Ultimately, explains Hansen, utility managers have to make a tradeoff between variability and power output. However, by modeling a bunch of geographically spread-out sites, Hansen and her colleagues hypothesized, utilities can start to make educated guesses about the optimal portfolio—one that maximizes power generation and minimizes variability.

To test the hypothesis, Hansen and former RMI fellow Jonah Levine compiled hundreds of tables of meteorological data for a one-year period, then set about looking for overlaps in the times when the wind is blowing.

As it turned out, 2004 data were the most complete, enough to model what would happen at 63 sites across the Great Plains.

“The basic idea,” explains Levine, “was to look for a complementary effect.” Simulating wind sites over a large geographic area should have decreased variability in the whole system without adversely affecting power output. The results were promising. Overall, Hansen and Levine noticed decreases in system variability for all the portfolios they studied.

Those findings spurred a second study, conducted earlier this year, that combined both wind and solar resources in one portfolio. The team’s hypothesis was that just as wind tends to blow differently in different places, the sun often shines when there is no wind. Using data from the National Renewable Energy

By combining multiple wind sites with solar generation, total power generated for the grid becomes much more stable. This potentially replaces base load generation sources such as coal and nuclear.

Lab and Levine’s study, Hansen and ERT fellow Bryan Palmintier simulated 43 wind and solar sites throughout the Midwest. All 43 sites were within the Midwest Reliability Organization’s (MRO) area of responsibility regarding the grid. MRO is one of nine North American electric reliability regions, comprising Minnesota, North Dakota, Nebraska, as well as portions of Montana, South Dakota, Iowa, Wisconsin, the Upper Peninsula of Michigan, and two Canadian provinces. After running the numbers, they found that variability in the whole system went down by 55 percent compared to the average of all sites studied. Surprisingly, those results bore out whether they looked at the entire study group, or as few as six optimally selected sites.

“If you look at the average wind or solar site alone, there’s a good amount of time each day that it’s not generating electricity,” explains Palmintier. “But if you combine all the wind and solar sites together, you find that 90 percent of the time you can get seven megawatts out” of facilities that at peak production might generate 100 megawatts.

That increase in electric output may sound small, but Palmintier contends that it’s substantial enough to get utilities to think differently about their investments, especially if paired with programs to help users better manage the times at which they draw power from the grid.

To bolster these findings, the RMI team then expanded their analysis, first over a longer time period and then over a larger geographic area.

For MRO, Hansen and her colleagues simulated what would happen if they took into account three years of data. The findings were essentially the same as those from the first simulation, meaning that under “normal” weather patterns, the “optimal” portfolio of sites still reduced variability by the same amount.

Also, the composition of the optimal portfolio didn’t change much between the one-year and three-year simulations that the team did, explains Josh Traube, a fellow with the Energy & Resources Team. Three-quarters of the sites that were in the optimal one-year portfolio were also in the optimal three-year portfolio. And even if the three-year simulation were constrained to the sites chosen by the one-year simulation, the electrical output and variability stayed relatively similar.

This means utilities don’t necessarily have to gather multiple years of data to make an informed decision about where to site the wind or solar installations in their portfolios.

“At least in this example, if you were to do only a one-year analysis, you wouldn’t penalize yourself unnecessarily,” says Traube.

The next step was to expand the simulation to include most of the Great Plains. Using additional data from the Southwest Power Pool and the Electric Reliability Council of Texas, Traube and Hansen simulated the power output and variability for 63 sites. Their conclusions: increasing the size of the study area tends to decrease variability as well. Much like the previous simulation, these results could be obtained with an optimal portfolio of as few as eight sites.

For Hansen, this last finding is crucial. If you’re a utility, she



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explains, “you don’t have to spend all your money on a huge number of sites to get the really big benefit” of a diversified portfolio.

Ultimately, the RMI team hopes its research will demonstrate to utilities how to put more solar and wind on the grid. There’s a financial incentive to decrease wind and solar’s variability, says Hansen. If utilities can rely even a little more on power from these installations, they won’t have to make as large of capital expenditures on coal or natural gas plants.

“The industry needs to properly understand the value (or conversely the cost) of variability,” she says.

During the spring, the team presented their findings at the Power-Gen Renewable Energy & Fuels conference, the American Solar Energy Society’s annual conference, and the American Wind Energy Association’s annual conference. By participating in these industry forums, Hansen says she and her colleagues hoped to “seed the conversation with these kind of strategies and help wind [and solar] developers think about how they can apply them” in their long-term planning.

There’s no panacea for moving away from fossil-fueled power generation. But Hansen and her colleagues’ leading-edge research on variability, together with new storage technologies, better methods for responding to electricity demand, and two-way communication on the grid can go a long way toward supplying electricity—when we want it—without emitting greenhouse gases. •



Fellow Bryan Palmintier (center) of the Energy & Resources Team gets a “firm grip” on Senior Consultant Lena Hansen and Fellow Josh Traube.

Photo by Kyle Duba



Photo by Muskegon, MI Chronicle, Merissa Ferguson

With nearly 300,000 vehicles, the U.S. Postal Service is an ideal candidate for using plug-in hybrid electric vehicles.

The Right Question at the Right Time

By Cindy Cash

Three years ago, while watching his mailman make the neighborhood rounds, Simon Rose was suddenly struck with a remarkable idea: What if mail trucks went hybrid? This question and his generous funding sparked some of RMI's latest breakthrough ideas on transportation.

THE SQUAT, BOXY TRUCK ROLLED AROUND the corner hugging the curb, and then jerked to a stop. It was just another run-of-the-mill day in South Miami, lush, green, and fragrant. But, for some reason on this particular day in 2005, the vehicle's awkward movements were oddly mesmerizing. So much so, they captivated Simon Rose's attention.

Suddenly the engine cut out and the ocean breeze swept through the royal palms, returning a sense of peace to the neighborhood. The mail carrier, blue-clad and moving quickly, trotted away from his truck with a small brown box under his arm and a stack of neatly organized envelopes. He stuffed the mailbox full, turned around, and headed back toward the curb. As Rose opened his gate, the sound of the engine revving up interrupted the tranquil afternoon once again and the truck lumbered ahead to the next driveway. The long-time RMI



Photo by Jody Finver

Long-time RMI donor Simon Rose

supporter watched intently as his mail carrier, Alfredo, repeated the very same set of motions: he shut off the engine, emerged with a handful of mail, deposited it in the box, climbed back into his seat, cranked up the engine, and the vehicle lumbered ahead.

Before long, the truck slowly sidled up to Rose's gate and eased to a stop. The two men had developed a friendship over the years and Rose liked to check in and ask Alfredo about his family.

That day, however, Rose's mind was elsewhere. He recalls asking his mailman, "Why the heck doesn't the USPS use hybrids? You don't have to shut it off. You're going to be on batteries most of the time, and when you're braking—which you're doing a lot—these hybrids recharge. It just seems like a perfect application for a hybrid."

Simon pauses before continuing, "And Alfredo looked me in the eye and said, 'You know why they don't do it, Simon? It's because it makes too much sense!'"

Rose thought of RMI "almost instantly," as he remembers it.



Illustration by Kyle Duba

Growing up in Westchester County, New York, Rose learned about the power of individuals taking action—"the Power of One," as he calls it—from a very young age. Civil rights events, anti-war rallies, protest marches. He remembers his mother taking him to all these and more.

From these experiences, he learned "that most people sit it out on the sidelines, and that the people who are activists can affect change."

Sideline sitting isn't Rose's style. He's racked-up a lifetime of remarkable adventures since leaving Westchester in the early 1970s. And along the way, he's effected change and impacted everyday lives in countries around the world and throughout the United States.

These experiences all set the stage for his epiphany about mail trucks going hybrid. "It just got me back to that Power of One," he recalls. "Unless somebody stands up and says, 'Why not try this idea?' It can get overlooked completely."

All it took was a phone call. Rose approached RMI with an offer to fund research exploring the energy optimization of fleet vehicles, like delivery trucks. John Waters, then head of RMI's Breakthrough Design Team, thought the idea was spot on and started organizing research efforts.

Two years earlier, the Institute had published *Winning the Oil Endgame* (another project for which Rose helped obtain

realized the project was feasible. "If you do it this way," he says, "[we realized] you could actually make some money. ... It led us to look at emerging markets for PHEVs."

With the groundwork laid, RMI set about convening a consortium of industry and non-profit partners, including Google, Alcoa, Johnson Controls, and the Turner Foundation, for an Innovation Design Workshop in Palo Alto, California. The goal was to develop breakthrough approaches to fleet fuel economy, lightweighting, and other design issues. Rose was invited to participate.

Looking back on the event now, he can hardly believe how far his idea has developed and advanced. "It was just a talk with a mailman, and then I'm out at a design conference where you've got some incredible minds sitting around the table coming up with all these breakthrough discoveries."

The groundwork and potential suggested by this collaboration was so compelling that, in early 2008, Waters spun off a for-profit venture to pursue some of the ideas further.

"By merely looking out his window, analyzing a situation, and placing a phone call, Simon Rose was instrumental in RMI assessing the vast inefficiencies of the U.S. Postal Fleet and inspiring us to 'go fix that problem,'" he wrote in a recent e-mail message. "Without Simon's involvement and willingness to lead with his funding, there may be no solutions underway to replace 162,000 vehicles averaging 10 miles per gallon."

Rose is a little more humble about his contribution, giving much credit to RMI and its Development staff. "The fact that RMI is so open—and also so open to really fostering relationships with its donors—is something that enabled things like the plug-in hybrid project," he says.

essential funding), and now was devising plans to implement various aspects of that strategy. "It was good synergy," says Marty Pickett, RMI's Executive Director and interim Vice President of Development. "His idea came at a time when we were focusing in that area generally."

Rose began by providing foundation funding for a technical assessment of Plug-in Hybrid Electric Vehicles (PHEVs). One of RMI's senior consultants at the time, Jeff Ronning, had built some of the first such vehicles in the 1990s and was eager to test the feasibility of Rose's idea. The results were promising.

Shortly thereafter, Rose managed to obtain further foundation funding for yet another study to test the business case for the idea. Michael Brylawski, vice president of RMI's transportation group, MOVE, led the research once they

"Sometimes it takes a person with an idea—and a desire to see it happen. But thanks to an organization like RMI, this idea is up and off and running right now. It never would have gone anywhere if I had pitched it to the government, or maybe another kind of organization. The timing was right and I hope it continues to be that way." •



Rose (right) with Alfredo

The Smart Garage (V2G*):

Guiding the Next Big Energy Solution

In the early 1990s, RMI researchers dreamed up a new energy paradigm integrating cars, buildings, and the electric grid.

The only problem was that the technologies needed were either too expensive or not yet developed.

Today, all that is changing.

*Vehicle to Grid

By Cameron M. Burns

ROCKY MOUNTAIN INSTITUTE HAS long been a leader in the diverse fields of energy, transportation, and green building. But today the Institute stands on the cusp of a completely new era that will see all three coalescing into a new energy paradigm: the “Smart Garage.”

Smart Garage is an idea, a sweeping concept, about the seamless integration of vehicles, homes, and offices via the electric power grid. The components of the system would share power and share it in such a way that consumers would make better choices about the energy they use, they would have access to more reliable, cheaper, and cleaner energy, and they would need less of it. This shift—which could help change the way we interact with energy systems in our society—is occurring because of recent advances in both the grid and vehicles. These innovations are happening so quickly that RMI is gearing up to guide the hundreds of products, the thousands of players, and the billions of dollars that will come together in this next big energy solution.

A Simple Concept

Electricity is a beautiful but fickle mistress. It’s best made in the amounts that society needs, generally near where it’s needed, and nearly exactly when. And because it’s the life support system of everything from medical equipment to financial data, we are slaves to its ways. The simple problem is electricity cannot be cost-effectively stored in large quantities.

Seventeen years ago, RMI Chief Scientist Amory Lovins and a small group of transportation researchers—including Michael Brylawski, Vice President of RMI’s transportation group, MOVE—developed a concept about vehicles and the grid.

The idea was simple: vehicles with electric drivetrains would, by most extensions, include some kind of electric storage or conversion device or combination of devices—batteries, fuel cells, whatever. Even back then it was obvious that there was a lot more power in electrified vehicles and their storage devices than there was in all the power plants connected to the grid.

The real benefit of electric vehicles, however, is that they bring a new level of stability and control to the grid—including giving power back when it’s needed most (in blackouts or at times of peak demand). By some estimates, a battery-electric vehicle, with about 40 kilowatt-hours of usable energy, could power an entire residential block for over an hour if necessary.

In 1991, however, this technology was just a gleam in the eye of RMI’s researchers for several reasons. For starters, there was nothing close to an electric grid that could handle such operations. Cost-effective electric traction for vehicles was still years away. Batteries that could store the required power had yet to be developed. Integrated renewables and buildings were relatively unsophisticated. And digital, Internet-based, and wireless communications were mere infants. Today that’s all changed.





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Green Trends for the Car, Home, Office, and the Grid

Even if you pay only passing attention to the electricity industry, you're probably aware of talk about a so-called "Smart Grid." Although the smart grid is largely an idea at this point, those exploring it are already touting its virtues.

The smart grid is basically the same grid you've grown up with except that it's tricked out with modern equipment—sensors, rapid communications devices, and distributed intelligence. Its various components talk to each other and report problems and failures, update each other's data, and send messages to users like homeowners and factory managers.

Proponents say its capabilities could range from turning parts of the grid off when power failures occur (so that they don't propagate across wide areas) to energy management activities like "demand response" (a way of letting customers know when power is scarce, and thus expensive, so they can opt to trim or defer power use). The Smart Grid can also accept power in better, more intelligent ways from storage systems—like electric cars.

Numerous organizations are quickly investigating the potential of a smart grid, what it can do, what it might cost, and how to set one up. In the early 2000s, RMI was part of a multi-year project with PECO Energy in Pennsylvania, Nevada

Power, and all three major California utilities to see how much demand could be reduced using smart technologies and demand response. Another example comes from Boulder, Colorado. In March 2008, Xcel Energy announced that it would start implementing a full-blown smart grid there sometime this year.

A second important trend is the vehicle sector's rapid move toward fully electric or partially electrified vehicles, notably plug-in hybrid electric vehicles (PHEVs). The causes are many and varied (\$4-a-gallon gasoline, greenhouse-gas emissions, consumer energy choices, etc.), but the reality is undeniable.

"Vehicle start-ups are sprouting like mushrooms, and we haven't seen this in years," notes RMI Analyst Laura Schewel, who manages the Institute's Smart Garage project. She lists new automakers such as ZEN, Miles EV, Fisker, Phoenix, Aptera, Vectrix, GEM, Zap, and Venture Vehicles—all of which came on the scene within the past few years, or even months—as evidence of what's happening.

Companies such as Tesla Motors and Th!nk are already selling electric vehicles in small quantities, and Toyota and General Motors have both committed to having a plug-in hybrid electric vehicle for the U.S. market by 2011. Renault-Nissan recently announced the development of a mass-market electric vehicle in conjunction with Morgan Stanley-backed Project Better Place, a business based on revenues from charging the new vehicles.

RMI got into the fray as well, spinning off a for-profit PHEV technology developer, Bright Automotive, early this year.

Green building design has also come a long way, as have photovoltaic (PV) cells. Increasingly, PV systems are being incorporated into the exterior walls and roofs of buildings, inconspicuously absorbing light and generating a charge.

"Depending on how you evaluate . . . there's a 30–75% reduction in emissions by using coal-based electricity rather than liquid fossil fuels in cars and trucks".

— John Waters, former RMI Practice Leader

"It would be potentially a minor adaptation in most cases," says RMI Principal Architect and Senior Vice President Greg Franta, FAIA. "On the other hand, some situations would not just be suitable at all, and in some climates we're going to have more problems than in others in terms of renewables. In new buildings it should be easy to incorporate."

Several green building projects that RMI has worked on in recent years point the way to the Smart Garage paradigm, namely the University of Denver's Sturm College of Law and the Missouri Department of Natural Resource's Lewis and Clark State Office Building. Both have power outlets so visitors and employees can hook up electric vehicles for charging (the Law School planned to buy green power for those vehicles; the Lewis and Clark building has its own photovoltaic system).

RMI Top Brass Greg Franta, Mike Brylawski, Stephen Doig, and Amory B. Lovins



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Economic Motivations

The economic prize for developing a Smart Garage energy paradigm is considerable.

Utilities sell a disproportional amount of their power on hot summer afternoons. At night, business plummets. For the utility, that means their expensive generation and transmission equipment stands idle. “Night-charging” vehicles, therefore, could be a lucrative twist on the business of selling electrons.

The National Renewable Energy Laboratory recently estimated that if half the nation’s light vehicles were ordinary plug-in hybrids they would represent a night-charging market of 230 gigawatts. That’s good news for the U.S. wind industry. In many areas, wind tends to blow harder at night, creating more energy when the vehicles would be charging.

“The utilities are going to sell a lot more electricity with plug-in hybrid electric vehicles,” notes Brylawski. “[A] utility will be able to better match variable supply resources (like wind) with demand. ... [C]ars will buy power mostly at night when the utility wouldn’t normally sell power. In other words, these kilowatt-hours would normally not even be used. The Smart Garage paradigm is like a discount store for the utilities because they can then sell their previously unwanted kilowatt-hours to a really hungry new market.”

The Smart Garage could even create revenue for the consumer. On hot summer afternoons, utilities often struggle to keep power flowing so offices are lit and buildings are cool. Electricity is sometimes in such demand that it could be worth dollars per kilowatt-hour, not cents. Under this new paradigm, car owners could let their batteries drain onto the grid during the day, then drive home from work on gasoline. The value of this “load shaping” could be credited to the car owner’s electricity bill.

Additionally, utilities must reserve some portion of their capacity to respond to second-by-second variations in the load and to provide “reserve” power in case of power plant or transmission line failure. The storage capacity of cars could be used to provide these “ancillary services” to the utility. And, again, the utility would pay the customer for using his battery.

Aside from utilities, many other industries stand to gain from the Smart Garage, too. Companies specializing in everything from the wireless telecommunications business to the financial sector to component-making to electric-load aggregation could see their markets expand or even find ways to enter entirely new markets.

The battery industry offers a stunning example of the potential: lithium-ion batteries—which are becoming popular with electric car companies—represent a business that’s less than fifteen years old. And yet, worldwide investment in lithium-ion battery technology R&D is well over \$1 billion annually, and expected to grow to more than \$5 billion by 2015, according to RMI’s survey of the industry.

Carbon Reduction Benefits

The carbon reduction benefits are also huge. A Smart Garage energy paradigm could simultaneously reduce the environmental impact of both the transport sector *and* the electricity sector. Driving a vehicle that uses electricity creates fewer greenhouse-gas emissions than driving a vehicle that uses gasoline, even if the electricity is made from fossil fuels (such as coal).

“There have been more than seventy studies on this question,” noted John Waters, a former RMI practice leader who left last year to lead The Bright Automotive spin-off. “Do we net a better carbon dioxide reduction by relying on the grid rather than relying on gasoline or diesel? Depending on how you evaluate it and which region of the country you study, there’s a 30 to 75 percent reduction in emissions by using coal-based electricity rather than liquid fossil fuels in cars and trucks.”

A fleet of 500,000 PHEVs could reduce carbon dioxide equivalent emissions by 40 million tons compared with the equivalent gasoline-powered vehicles over the ten-year life of the PHEV, RMI calculated last year.

A recent study by the Natural Resources Defense Council (NRDC) and the Electric Power Research Institute (EPRI), which RMI believes uses conservative estimates on achievable mileage, found that widespread deployment of plug-in hybrid electric vehicles by 2050 could reduce the U.S. greenhouse-gas emissions by more than 500 million tons annually.



Photo by CalCars.org



Photo by Aris Yi

Also, improving the finances of PHEVs by reaping benefits from the power sector, Smart Garage will accelerate the penetration of important green technologies—hybrid cars and wind turbines, to name two.

More importantly, wind turbines built to serve the night car-charging market would still spin whenever the wind blew and may eventually be able to meet a considerable portion of America’s electricity demand—a huge step toward reducing the country’s reliance on fossil fuels.

The Smart Garage Summit and Model

Rocky Mountain Institute is in a unique position to steer the Smart Garage paradigm.

“We know a lot about the grid, the needs of buffering wind and solar with some sort of storage, and we have a strong vehicles background,” notes RMI Vice President and Energy & Resources Team Leader Stephen Doig. “That’s a nice combo that most can’t match. But in the end, this is going to take a lot of collaboration so for now we are really just instigators.”

RMI’s position today is somewhat analogous to the Institute’s position in

2003, when RMI devised and published a strategy around energy-efficient data centers. That effort required deep knowledge of the grid, power supplies, building design, and server architecture—among others.

“Obvious analogies will be in the development of the cell phone,” notes Lovins. “About twenty things came together to make a cell phone possible, like packet switching [in which messages are cut up into chunks before being sent then transmitted individually—often times via different routes—and then reassembled at their destinations] and developments in micro electronics and batteries and miniature antennas as well as the convergence between global wireless and the Internet.”

So how do you steer a massively complex paradigm shift? One way is to develop the leading analytical model to show how the implementation of the various aspects of the full Smart Garage concept might come together, and to hold a summit to talk it through with industry partners. To date, those partners include the Google Foundation, Ford, Johnson Controls, Duke Energy, and Danaher, with at least ten more expected to participate.

MOVE team members Laura Schewel and Dave Anderson at RMI’s Snowmass Headquarters.

The model would include the obvious, like different kinds of batteries, different kinds of car models, the miles a commuter drives, and other characteristics of a wide range of scenarios. Even within the battery sphere, as Schewel points out, differences in chemistry, cost, size, durability, environmental impacts, and other factors can mean very different outcomes. The greatest complexity lies in how those factors interact over time. Coupled with a dozen automobile configurations, there are hundreds of different scenarios the model will describe in the near-, medium-, and long-term.

“We’re trying to design it so that it has a very simple interface,” Schewel says. “And we’re going to publish it open-source on the Internet so the public can use it. They might log on and change, say, the 35 most relevant parameters like their region’s weather, or gas prices, or driving patterns, and each will get unique results.”

The results could include everything from emissions to energy prices to information about the optimal hours for charging.

The state-of-the-industry analysis will include a description of the business case for all the sectors involved, an analysis of how to implement Smart Garage so that early investors aren't penalized, and a description of how to influence investment in the various aspects of it. The report will also include a description of technical aspects of Smart Garage—how electricity flows from grid to car and back, what kind of connectors would work, what kind of standards for software are needed, how metering will work, and other nuts and bolts. The third component of the analysis will be an overall "Roadmap" of the way that the Smart Garage might come together. Obviously, coordination is critical.

"There are roughly 30 to 40 manufacturers of vehicles, there are 300 to 400 car and truck models, and there are 3,000 retail electricity providers," notes Brylawski. "So you clearly need standards so that the hundreds of models of car can talk to the thousands of retail electricity providers and provide a somewhat seamless system. And you can't do that without standards, and



you can't do that when you collaborate with only three automakers and three utilities. You really have to have a broad consortium of companies across the value chain."

Clearly, with so many players, with such interwoven cross-sector participation, and with such huge financial, environmental, and lifestyle incentives, the Smart Garage might ultimately prove to be one of RMI's most important projects ever.

"There are lot of people working very hard to implement major shifts towards a greener world, doing things like installing solar on their roofs, or pushing Detroit and Japan to come out with radically new cars, or fighting to get wind power mandated by the government," Schewel says. "Sometimes, it feels like a lot of environmental movements are happening in isolation, or, worse, fighting for limited resources, public attention, and funding. Smart Garage gives us the opportunity to work together, on a mutually beneficial technology that drives all these threads of the green movement forward together." •

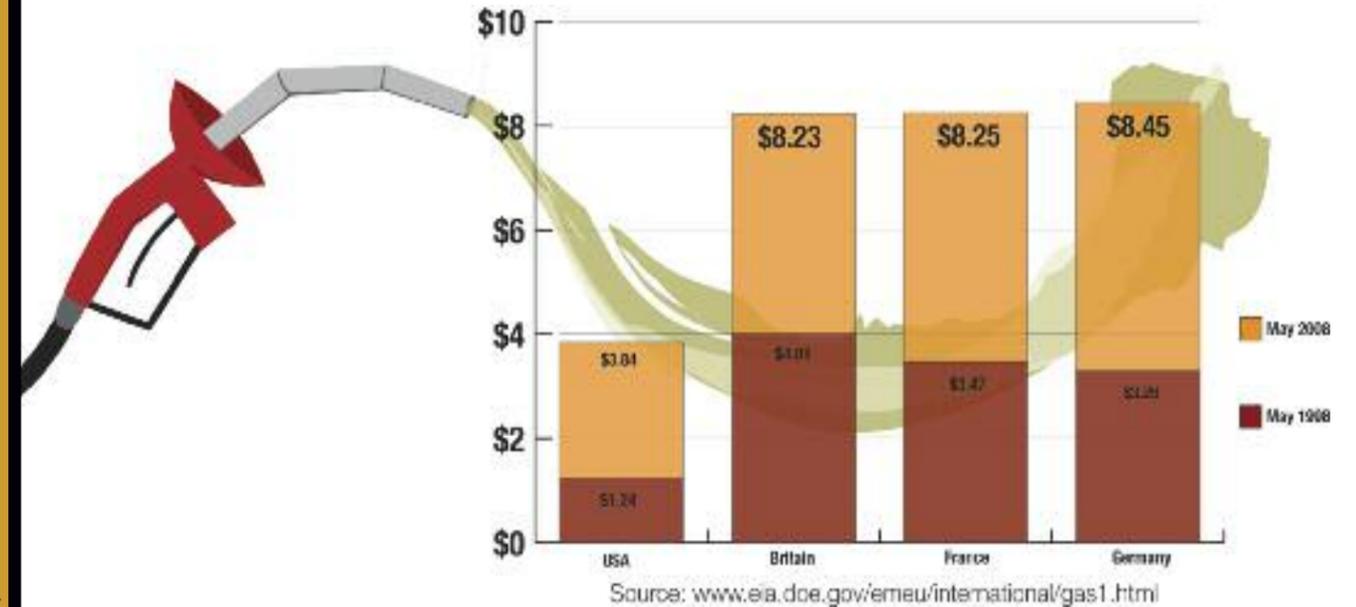


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Jürgen und Michael Utrecht

DID YOU KNOW?

Monthly retail gasoline prices per \$US gallon of gas (including tax) in different countries



Source: www.eia.doe.gov/emeu/international/gas1.html

So you think we need to **Win the Oil Endgame?**
Go to www.oilendgame.com

Illustration by Kyle Duba

TAKING ACTION ON IDLING

It may seem like idling uses less gas than turning your car off and on again, but it usually doesn't. In fact, idling 15 minutes per weekday can cost you up to \$100 in wasted gas over the course of a year, and American drivers use more than 2 billion gallons of fuel each year while idling. To top it off, an idling car produces twice the emissions of a car in motion.

If you plan to stay put for more than 10 seconds, turn your car off.

Contribute to reducing our dependence on oil by reducing your own oil consumption. Rocky Mountain Institute's Mobility and Vehicle Efficiency team exists to catalyze profitable, efficiency-led solutions to reduce our reliance on oil as fuel, following the guidelines outlined in RMI's groundbreaking, solutions-oriented analysis to tackle the oil challenge, *Winning the Oil Endgame*.

This tip was brought to you by **Ideal Bite** at www.idealbite.com



Building Sustainable Cities, Block by Block

For all the fanfare, green buildings are often just “islands of sustainability”—excellent case studies in what’s possible, but ultimately unconnected to their surroundings. RMI’s Built Environment Team is partnering with an innovative California non-profit to change that.

By Katie Crane

IT’S APRIL AND RMI PRINCIPLE JAMES BREW is hard at work on a presentation for a fundraising event hosted the next day by the San Francisco-based non-profit Urban Re:Vision. As he double checks his slides, Brew explains why the green building community needs to step up its game a notch—and begin thinking not just of individual buildings, but in terms of entire city blocks and communities. Presently, more than half the world’s population lives in urban areas. If current trends continue, there could be as many as five billion people living in cities by 2030, according to a United Nations study. Clearly, Brew says, there’s a need for integrated planning.



Beddington Zero Energy Development (BedZED), the UK's largest eco-village. The first large-scale, carbon-neutral community is a mixed housing and work space development located near London.

Photo by Flickr.com/Telex4

In late August, Brew and other RMI staff members will be participating in a charrette with Urban Re:Vision to develop a framework for the ideal sustainable city block. The two organizations will hold additional sessions throughout fall 2008 to refine the framework with help from energy, transportation, engineering, architecture, design, and natural resource experts, as well as municipal officials. Once the basic requirements have been set, Urban Re:Vision will launch a competition in January 2009, challenging architects and designers to apply the framework to actual blocks in six American cities.

"It's all about scalability," says Brew. "It's about taking what we do at RMI every day to a higher level."

Architectural firms and universities from each city will be asked to develop designs for demonstration projects focused on

sustainable energy, transportation, buildings, among other elements. Actual components of the block will vary depending on the city, Brew explains. "Every specific site is all about context. In one city it could be about skyscrapers, or a transit hub or station on a light rail line; housing is likely to be another component," Brew says. Ideally, after the competition, the six cities will take the designs further and use them as starting points for a master plan and ultimately build a block.

The project is the brainchild of Stacy Frost. In November 2006, Frost founded Urban Re:Vision to promote a whole systems approach to designing city blocks. "People are used to looking at whole cities, not on the scale of just one city block," she says. "Yet contemplating change for an entire city can be overwhelming, whereas city blocks are what people care about. Even within a city, they want to live in a community, one that responds to their social

needs and provides a healthy, vibrant economy without necessarily being dependent on and attached to a larger infrastructure."

Frost grew up in northwestern Pennsylvania and received her undergraduate degree from Princeton University in architecture and neuropsychology. "For me, this is exactly the combination of the two," she says. "I've always believed you can design your experiences, and your experiences create your neuro pathways and your emotional, physical, and social well-being." For instance, if city governments design ugly structures and provide

Urban Re:Vision is targeting cities from each region of the United States for the competition: Atlanta, Austin, Boulder, Bozeman, Chicago, Dallas, Denver, Las Vegas, Los Angeles, Miami, New York, Phoenix, Portland, St. Louis, and Seattle are among those under consideration. But Frost says that her team—three employees, herself and some independent contractors—is open to suggestions. "Certainly, if a developer came to us with a site that met our criteria, we would definitely consider it. Our goal is implementation ... sites that not only have real development potential but would also have a positive impact on the surrounding communities should they be developed. We would like the site to represent one of many urban challenges faced by cities today," she says. There will be no sites outside the United States, but international architectural firms, students, and designers will be invited to participate in the competition.

The winner of the contest will receive a cash prize, one that is "compelling but not obscene," says Frost, who at the moment is personally funding Urban Re:Vision.

**At its core,
Urban Re:Vision's
competition aims to develop
concepts for making
urbanization sustainable...
by considering all the elements
that comprise a city
block simultaneously.**

So what will the winning entry entail? "We would see this completely regenerative city block that is self-supporting in all its systems and processes but is still part of the entire city," Brew says. Moreover, the city block would help people change the way they interact with the city. "There would be places and spaces both inside and outside of buildings to promote and support social

interaction. It's the part of building ratings system that is overlooked, but it is at least one-third of the definition of sustainability," Brew says.

For Frost, the solution is less clear. "What I love about this is that I don't know the answer," she says. "What I'm asking for is more than I've asked for in the past," she adds, referring to previous sustainability-themed competitions that Urban Re:Vision has held. The design would consider the whole system, including social support and education, aspects not necessarily included in the sustainability discussion currently. "There's no reason to be leaving these things out, it's a closed loop," she says. "As we're faced with population density, it will be even more important to create groups within that density. I can only imagine that will create vibrancy at all levels." According to Frost, the overall goal is "a system that enables people to make design decisions that result in beauty, efficiency, equity, and interconnectedness. Something people can really be proud of." •

little access to green space, that can have a measurable effect on residents' welfare, an effect Frost refers to as "nature deficit disorder." It is clear that Frost has larger goals in mind, ones that fully incorporate social well-being into the concept of sustainability.

At its core, Urban Re:Vision's competition aims to develop concepts for making such urbanization sustainable—not just by changing one building or transportation system at a time, but by considering all the elements that comprise a city block simultaneously. "Doing one building at a time that achieves LEED platinum is interesting, but it's not enough," Brew says, referring to the Leadership in Energy and Environmental Design green building certification program. "LEED is a starting point, but LEED is not sustainable. This type of project is a true testing point for RMI's Next Generation Utility concept, for example," Brew says. "How do you implement distributed generation? Come play in the sandbox with us and test out your ideas."

A Vacation with a Purpose

RMI Chief Scientist Amory Lovins traveled to Borneo on his vacation to visit a world-class organization working to protect orangutans. What he found was an inspiring story about rainforest rehabilitation and sustainable economic development.



By Cameron M. Burns

RMI CHIEF SCIENTIST AMORY Lovins has long been a fan of “higher primates”—species that use their intellect for the benefit of their communities and the environment, even if inadvertently. One of his favorite such creatures is the orangutan (*Pongo abelii* and *Pongo pygmaeus*; in fact about three-dozen orangutan dolls populate the entryway to the Lovinses’ home.) So, when they had some vacation time in May, Amory and his wife Judy, both landscape photographers, decided to travel to Borneo “to hang out with our orange swinger buddies.”

The couple visited a number of outposts of the Balikpapan Orangutan Society/Borneo Orangutan Survival Foundation (BOS), one of the world’s leading organizations dedicated to protecting and advocating for the orange and their habitat. Characteristically, while Lovins was on a personal trip, he ended up learning as much as he could about rainforest rehabilitation and the remarkable attributes of the modest sugar palm—both of which tie into Rocky Mountain Institute’s approach and belief that ecosystems are vital, resilient, and repairable.

At one of the BOS sites, Lovins explains, “They showed us ... a 19-square-kilometer lush rainforest that [the] staff has rapidly created, one square meter at a time. Nobody knew this was even possible.”

As Lovins tells it, the land in East Kalimantan on which BOS’s experimental rainforest was established had been repeatedly logged and burned. About the only thing that was left was Alang-alang (*Imperata cylindrica*), a species of razor-edged, silica-rich grass that secretes cyanide, depletes soil nutrients, and is almost impossible to get rid of.

But in the early 2000s, BOS founder Dr. Willie Smits discovered that he could kill the grass in a year and a half by shading it out with fast-growing acacia trees, which can then be harvested and used in construction. Once the land was shaded, BOS staffers were able to create a local-flora understory that held water, moderated temperatures, and began building duff, the partly decayed matter on the forest floor. Ultimately, the team planted 1,300 species of trees—millions of them, more than a thousand per day—along with soil mycorrhizae and other microbiota to stimulate growth. Some six or seven years later, during the Lovinses’ visit, the trees were maturing and some had reached full height.

“You could just about see the forest grow,” Lovins says. “It didn’t have the density and diversity of insects and birds that you have in a mature primary forest. But they’re coming in and already there are 137 bird species, nine primate species, and they’re all bringing seeds for whatever was missing. ... When reintroduced, the orangutans, which are the capstone species, actually farm the forest. They excrete the seeds of what they want to grow where they want it to grow. So when they revisit that fig tree when it’s ready to harvest, it’ll also have this other kind of tree right next to it that they really like to eat the fruit of at the same time and fruits about the same time. The rainforest and the orangutans all coevolved.”

What will protect the forest from the rampant illegal loggers, whom the Lovinses saw at work nearly everywhere they went? The local people, because Dr. Smits’s strategy so bases the project’s design on their welfare, and makes them so much better off, that now they won’t allow wood thieves, however powerful, to destroy their newfound livelihoods in agroforestry.

In addition to these insights, Lovins also learned about the sugar palm (*Arenga saccharifera*), a promising biofuel feedstock. To combat deforestation, Dr. Smits began researching what could grow in a complex rainforest, where soils can lack humus, sunlight can be scarce, and harvesting is tricky. Sugar palm, he discovered, grows very well in rainforest settings, is not a seasonal crop, and requires careful manual tapping (so harvesting it creates year-round jobs).

Dr. Smits’s research suggests that sugar palm can produce 19 tons of ethanol per hectare per year (or much more with selection), far outdistancing oil palm, which can produce 4.7 tons, and jatropha, which can produce 4.3 tons—both of which are typically considered excellent crops for biofuels



Judy Hill, Amory’s wife, shares his passion for protecting primates and their rainforest home.

(sugar cane, by comparison, produces about 3.5 tons of ethanol). But those fuel crops are suitable for monoculture, and rainforest is often cleared for oil-palm plantations (in Borneo, generally as an excuse, not an intention: the hidden central aim is to steal timber). Sugar palm, requiring diverse forest around it to flourish, is thus a way to grow the energy crop—and scores of important medicinal and other crops—while protecting, not destroying, biodiversity.

Making biofuel from sugar palm would also create a lot of jobs. According to Dr. Smits’s calculations, sugar palms provide at least 50 times more jobs per hectare than making biofuel from sugar cane because of the manual tapping. That tapping, he concludes, “is affordable due to the [sugar palm’s] much higher productivity.”

Cottage biofuels industry or not, Lovins says the main takeaways from his trip are: “Yes, you can restore rainforests, which are vital to biodiversity and climate, and you can integrate ecological and economic and cultural restoration very successfully by making the welfare of the local people your top priority. [It’s] kind of like Gandhi-ji’s remark that if you look after the poorest, everything else will look after itself.” •

BREAKING GROUND,

BUILDING GREEN

FOR MANY WHO HAVE WORKED AT ROCKY MOUNTAIN INSTITUTE, LIFE EXPERIENCES PLAY A BIG ROLE IN HOW THEY SEE THE WORLD AND ULTIMATELY, WHAT THEY DO FOR IT. FORMER RMI CONSULTANT BILL BROWNING, ONE OF THE NATION'S LEADING ADVOCATES OF GREEN BUILDING, IS NO EXCEPTION.

By Cameron M. Burns

PICTURE A GEODESIC DOME HIGH in the Rockies. It's covered with a transparent film that lets the sunlight in and traps heat. Even on the coldest winter days, the temperature inside is warm enough to keep fish alive and swimming in a small pool and to grow vegetables without a mechanical heating system. It's only 25 feet in diameter, but the dome can theoretically feed a family of four.

"Sadly, Bucky died two weeks before he was supposed to arrive at Windstar to spend the summer working on the project," Browning recalls. "So while I met him and talked with him, I did not get to work directly with him."

Despite this setback, the group persevered and finished the full-size greenhouse. It was operational for a few years, but by the late 1980s, Windstar ran into financial troubles and had to shut it down.

That early brush with integrated design, however, stuck with Browning. He left Windstar in 1987, but stayed in the Roaring Fork Valley to pursue other opportunities, including research and consulting work at RMI. He was keenly interested in how communities get built and the relationship of that process to the environment. At RMI, he finally came to the conclusion that it wasn't the architects who were making the decisions—it was the developers.



Photo © Jamie Horton; Blue Pixel Photography

“At one point, Bill said, ‘You know, I think we can change the whole development paradigm from the bad guys who rip up the land to a force for healing natural and human communities for profit,’” recalls RMI cofounder and Chief Scientist Amory Lovins.

says. “The thought was, ‘Real estate developers are not exactly the kinds of people we want to work with.’ My response was, ‘If you don’t like the way they’re doing things and you’re not willing to engage them, then there’s not going to be any change.’”

Almost immediately, RMI was hired to work on a variety of green building projects. But it wasn’t until a couple of years later that GDS’s impact was really felt. Prior to starting GDS, RMI had been an advisor to the original American Institute of Architects Committee on the Environment, and there was considerable momentum around what would later be called the “green building movement.” Then, RMI was brought into a meeting by the Clinton Administration to explore a lighting retrofit of the White House.

“One of the things that really made GDS’s reputation was the ‘Greening of the White House in 1993,’” Browning recalls. “Initially, the White House was thinking they just needed a lighting retrofit and some recycling, then several environmental consultants and I convinced them they could do much more, including auditing the results.

That event, really, was the first large-scale green design charrette ever held. It involved 130 people for three days. The U.S. Green Building Council was formed about the same time, and many of the people who helped form the USGBC were there. It was one of the signature events of the green building community.”

Over the next decade GDS consulted on hundreds of green building retrofits, new developments, and general sustainability goals for such high-profile clients as the Pentagon, Wal-Mart (the firm’s Eco Mart), and the organizing committee for the 2000 Summer Olympic Games in Sydney.

GDS was not only successful in influencing design, the team of talented thinkers and designers was able to also inform the building industry through books, CD-ROMs, speaking engagements, and writing. Lovins notes that one of the most important papers ever produced at RMI came from the hands of Browning and DOE researcher Joseph Romm. In “Greening the Building and the Bottom Line,” Browning and Romm were able

to describe and support with eight case studies for the first time the link between efficient green buildings and human productivity.

“[It was] the notion that if you can see what you’re doing, hear yourself think, breathe cleaner air, and feel more comfortable, you’ll do more and better work,” notes Lovins. “It was immensely valuable.”

He was keenly interested in how communities get built and the relationship of that process to the environment...Browning finally came to the conclusion that it wasn’t the architects who were making the decisions — it was the developers.

Browning left RMI in 2004 when he was offered the director of design and environment position at Haymount, a 4,000-home “new town” in Virginia. Nine months later, he formed his own consulting firm with RMI colleague Jeff Bannon, which later morphed into a new business with renowned green architect Bob Fox: Terrapin Bright Green (terrapinbrightgreen.com).

Today, Browning’s projects with Terrapin are typically large-scale developments, not individual buildings. One of his current efforts is a new city in Korea that will boast some 50 million square feet of commercial space and 50,000 residences. Another project aims to redevelop a disturbed site in Arizona with 20,000 residences and 20 million square feet of commercial space. Even with this busy schedule, he still manages to find time for research. He’s currently leading a multi-year study that looks at worker productivity issues in buildings, expanding on the work he started at RMI in the 1990s.

“There’s an original curious mind there that’s already done a career’s worth of important creativity,” says Lovins. “And there’s a lot more left in him.” •



Photo by Aris Yi

Just like Bill Browning before them, RMI’s current interns and fellows enjoy getting up close and personal with Bucky Fuller’s geodesic dome. Left to right: Sally DeLeon, David Anderson, Aristotle Yi, Alok Pradhan, Jonah Bea-Taylor, Jamie Ponce, Drew Sloan, and Laurie Ramroth.

Browning then left RMI to get a graduate degree in real estate at the Massachusetts Institute of Technology. His thesis included case studies of green developments in California and argued that development projects that take a piecemeal approach to green design cost more than those that take an integrated approach. Designing for the whole system, he found, could achieve more with no additional up-front cost.

With diploma in hand, Browning returned to RMI and in 1991 founded the Institute’s longstanding green building consulting arm, Green Development Services (GDS).

“It’s somewhat strange that there was some push back from some staff and the board when we were starting GDS,” Browning

Coming Next Issue:



Crash Test Dummies

Do lightweight, fuel-efficient cars have to be less safe than heavy, inefficient cars? Not at all. Armed with crash test data and market research, RMI’s MOVE team is debunking this piece of conventional wisdom and pushing the automotive sector to adopt light, safe designs.



Greening the Purple “Y!”

Helping internet giant Yahoo! go carbon neutral is no small undertaking. But RMI alumna Christina Page is up for the challenge.

Don Woods

For Denver-based banker Don Woods, the newest member of RMI’s Board of Trustees, banking is an activity that can bring value not only to the bank itself, but to the people and economy of a community, as well as the natural environment. Read about Don in the next issue of RMI Solutions Journal.

Friends of RMI ... Helping Us Bring Solutions to the World



Denver screening of our High Performance Building film

RMI hosted over 180 community and corporate leaders interested in sustainable building to view the premiere of “High Performance: Building Perspective and Practice.” RMI partnered with the U.S. Green Building Council to produce this compelling film that documents the business case for building green. This film is the inaugural project of the Built Environment Team’s Cooling the Warming initiative. •

Ellie Caulkins, Daniel Ritchie, and Marty Pickett at the Denver launch of the High Performance Building film.



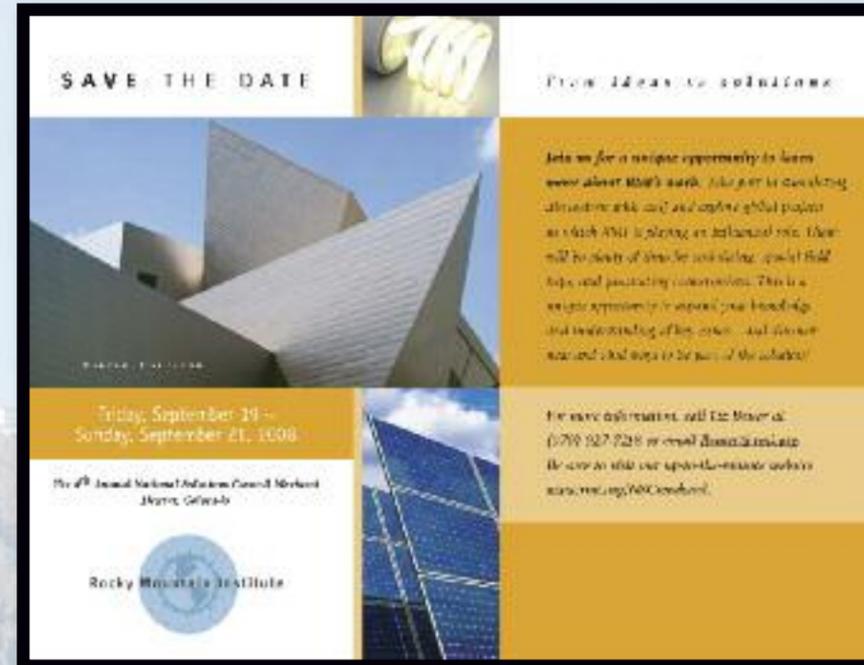
Profitable Solutions for Climate Change

In April, Amory Lovins and Greg Franta were invited by NSC members to speak at special events throughout Florida. According to Senior Development Officer Jim Kozel, “Profitable Solutions for Climate Change,” was presented to members of the Jupiter Island Club, Palm City’s Sandhill Cove Community members, and to a full house at Morton’s Steakhouse in Palm Beach. Hosts included RMI Trustees Mary Caulkins and Sharmy Altschuler (also members of the NSC); RMI friend and benefactor John Pratt; NSC member Frank Navarro; and Mrs. Alex Anylie, mother of NSC member Sebastian de Atucha. The whirlwind tour wrapped up with Amory and Jim joining NSC members Bill and Jane Knapp—who had driven down from Sarasota—for breakfast in West Palm Beach. •

Sharmy Altschuler, Amory Lovins, Karl Kister, Mary Caulkins, and Greg Franta outside the Tangerine Theatre on Florida’s Jupiter Island.

Save the Date: 4th Annual National Solutions Council Weekend

From Ideas to Solutions



RMI Development Officer Justine Nathanson and a committee of Denver-based NSC members have been busy planning a fascinating and inspirational weekend of activities for fellow NSC attendees. The theme for the 4th Annual National Solutions Council Weekend is “From Ideas to Solutions.” This event is a unique opportunity to learn more about RMI’s work and to expand your knowledge and understanding of key issues.

A special RMIQ (RMI’s Quest for Solutions) lecture Friday evening kicks off the NSC Weekend with panelists discussing “Solutions for a New Energy Paradigm.” Saturday morning, participants will meet with one of the three RMI research teams to explore current projects and global concerns specific to their area of expertise. These activities run concurrently, so participants will choose which track to attend.

A highlight of the Weekend is time with Amory Lovins. “Tea with Amory” will be a special a time to relax and explore questions, ideas, and solutions with RMI’s cofounder and Lead Scientist.

The Weekend closes on Sunday with brainstorming breakout sessions where participants will have the opportunity to experience the dynamics of working through barriers, by sharing their insights and knowledge on real topics of the day.

The NSC Weekend is a wonderful time to discover new and vital ways to be part of the solution. A benefit to RMI’s NSC membership, the NSC Weekend is free for members of the NSC. For those interested in attending, but unable to join RMI’s National Solutions Council prior to September 19th, the conference fee is \$500. Check out www.rmi/nsc for more detailed information.

We look forward to seeing you there!

Ginni Galicinao

*Friday, September 19, 2008
through Sunday, September 21, 2008*

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RMI Event Calendar *July through November, 2008*

Here are a few events that RMItes are hoping to attend in the coming months. We list these as suggestions for our readers.

RMI V2G (Vehicle to Grid) Summit

Early Fall, 2008

Interactive meeting bringing RMI together with experts and stakeholders from throughout and beyond the Smart Garage system, discussing the interconnection of the vehicle fleet, buildings, and the power grid to create energy system synergies in efficiency, cost, and emissions. nc.rmi.org

RMI National Solutions Council

September 19–21, 2008 . Denver, CO

Join RMI for a unique opportunity to learn more about its work. Take part in stimulating discussions with staff and explore global projects in which RMI is playing an influential role. rmi.org

West Coast Green Conference

September 25–27, 2008 . Silicon Valley, CA

Green building expo and conference.

westcoastgreen.com

Annual Clinton Global Initiative

September 24–26, 2008 . New York, NY

Convenes a diverse group of approximately 1,000 world leaders to examine today's most pressing global challenges. The program for the 2008 annual meeting will concentrate on four focus areas: education, energy and climate change, global health, and poverty alleviation. clintonglobalinitiative.org

Alternative Car & Transportation Expo

September 26–27, 2008 . Santa Monica, CA

Seminars, panels, and exhibits on the latest information and examples of vehicle and transportation technologies. altcarexpo.com

SustainCommWorld's Green Media Show & Expo

October 1–2, 2008 . Boston, MA

Forum for education, solutions exploration, and dialogue among thought leaders, solution providers, brand owners and other key players engaged in the creation, production, and distribution of communication media with regard to sustainability. sustaincommworld.com

World Energy Engineering Congress

October 1–3, 2008 . Washington, DC

Conferences and seminars on a variety of current topics and a comprehensive exposition of the market's most promising new energy and green energy technologies. energycongress.com

Greenbuild Conference and Expo

November 19–21, 2008 . Boston, MA

USGBC's Greenbuild conference and expo is an unparalleled opportunity to connect with other green building peers, industry experts, and influential leaders as they share insights on the green building movement and its diverse specialties. RMI staff attending. greenbuildexpo.org



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