



# Solutions

## Journal

# Taking Solar to the Next Level

Summer 2010

Also in this issue—

**A Crowning Achievement for the Smithsonian** p. 10

**No Race is Run Alone** p. 13

**Feebates: A Key to Breaking U.S. Oil Addiction** p. 16



# Solutions Journal

Volume 3 • Number 3 • Summer 2010



Taking Solar to the Next Level: Solar PV Charrette Tackles “Balance of System” Costs



A Crowning Achievement: New Smithsonian Promises to be Bright, Uplifting—and Energy Efficient



No Race is Run Alone: Technical Advisors Coach PGR Partner Cities for a Plug-In Future



Feebates: A Key to Breaking U.S. Oil Addiction



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# Solutions Journal

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## Seeing the Forest *and* the Trees

One of the most powerful ways to gain leverage over a big, thorny challenge is to break it down into components and to tackle those components one by one. This divides the work into “bite-sized chunks” and paves the way for expert practitioners to bring specific expertise and experience to chosen aspects of the challenge.

The downside of this approach comes when it’s time to bring those bite-sized chunks back together. Quite often, the practitioners working on each aspect have been optimizing their solutions for different and possibly conflicting benefits and outcomes. They may also be influenced by financial incentives that make sense for their segments, but not for all segments.

These conscientious practitioners can see quite clearly when mixed signals and disparate objectives spin out of control. However, they are often constrained by their initial commitments and usually have no context or forum in which to raise integration issues as they emerge. That’s one way to end up with bad decisions and poor designs that can result in vehicles, buildings, products, and environments that please no one.

The principle of *integrative design* offers practitioners a new way to think and a new way to collaborate. At the core is a commitment to design a whole system for multiple benefits rather than designing each component for individual optimization. More time is invested up front in modeling the possible outcomes, thinking through implications and possible conflicts, and building a shared vision. And then each practitioner stays connected to the others to share insights and discoveries on the way to completion.

This process of constant contact can feel strange at first to an expert who is accustomed to pushing forward on his or her own without having to check back with colleagues and collaborators. But in time they see things differently. And it’s thrilling to see the “aha moment” when they realize that the increased interaction actually speeds up the process overall and results in a better outcome. They come to value the suggestions of others and enjoy the opportunity to offer suggestions in areas that were previously “dark” to them. It’s almost a religious experience! (Check out our recently completed video showing integrated design examples and interviews at <http://bet.rmi.org/video>.)

As RMI’s Amory Lovins likes to say, “We dig wholes.” And much of our work at RMI involves helping skilled practitioners take a wider, more integrated perspective of their work.

This issue of *Solutions Journal* presents a number of examples of this integrated perspective in action. Our work at the Smithsonian and *Democracy Now!* show “whole-system” thinking as applied to individual buildings. Our Solar PV Balance of System Design Charrette convened many practitioners from inside and outside the solar photovoltaic industry to explore new and different innovations addressing a complex cost issue. And “feebates” represent an intriguing policy innovation that emerged from a whole-system perspective of the light-vehicle industry.



Thanks for reading *Solutions Journal*—and thanks for your support of our work.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael Potts". The signature is fluid and stylized, with a long horizontal stroke extending to the right.

Michael Potts, President and CEO



# Taking Solar to the Next Level

## Solar PV Charrette tackles “Balance of System” costs

By Rebecca Cole

Creativity is the key to transformation.

But creativity doesn't occur in a vacuum. Instead, creativity works best when people can pool their collective intellect and collaborate on game-changing ideas.

In June, Rocky Mountain Institute convened a design charrette focused on the solar photovoltaic (PV) industry. Held in San Jose, California, the event offered industry stakeholders and outside experts an opportunity to come together in the spirit of “coopetition” to identify designs and other improvements that could help bring down the “installed” costs (i.e., all the costs except the modules themselves) for commercial- and utility-scale PV projects.

“Despite all the dynamics of the industry, we really have a situation where you have people working on piecemeal solutions so you don't get the full power of integration,” said

Stephen Doig, PhD, a program director at RMI. “You have competition that inhibits cooperation.” Bringing diverse players together, he said, unlocks a power that often isn't available to for-profit businesses that are simply trying to get the job done.

For any industry to grow, rules have to be changed, explained Sandy Munro, a charrette attendee and CEO of Munro & Associates. “The rules are what hold you back,” he said. “But once people start thinking differently, the rules fall away.”

### Enormous Potential for Solar Energy

Solar PV will play an increasingly important role in meeting the world's energy needs, with continued double-digit annual growth predicted. One report, released last December by the Electric Power Research Institute, states that the solar PV market is a “billions-

of-dollars-per-year business for both module production and system installation.” However, only a tiny fraction of U.S. electricity is supplied via solar today—well under 0.1 percent in 2009. Installed system costs must come down in order for solar to be a viable part of the U.S. energy portfolio.

“We have a pressing need to find alternatives to fossil fuels,” Doig said. “The sun is by far the most abundant renewable resource out there. We are quite good already at converting that sunlight to electrical energy. The real issue is how do we get the costs down to a level where the adoption of solar energy takes off exponentially without the need for price supports or other incentives.”

While module costs have decreased significantly in the past decade, falling 33 percent in 2009 to current prices below \$2/watt, solar PV remains an expensive energy

option. This is largely due to “Balance of System” (BoS) costs (racking, mounting, installation, labor, wiring, power electronics, permitting, and other process expenditures), which generally account for about half the installed cost.

## Leveraging Market Opportunities

For the solar industry to continue to scale up, it must achieve major cost reductions. In the face of doubts about whether conventional solar technologies can reach widespread cost parity with other electricity sources, the solar industry can benefit from a clear roadmap of opportunities for cost reduction. To that end, the goal of the charrette was to brainstorm opportunities to reduce solar BoS costs to \$0.50/watt by analyzing the structural systems, electrical components, and business and regulatory processes required for commercial and utility roof- and ground-mounted PV projects up to 20 MW in size.

The charrette focused on installation approaches for rectangular, rigid modules that are feasible within five years. Despite excitement around flexible and building-integrated thin film products, conventional modules account for more than 95 percent of the market and will continue to play a large role even as new technologies become available in the near- to mid-term. After three days of intensive collaboration, the group introduced specific designs and processes that, at scale, could potentially lower BoS installed costs to ~\$0.60/watt to \$0.90/watt, compared with ~\$1.00/watt to \$2.00/watt in today’s case.

However, the most important metric to evaluate PV projects is leveled cost of energy, expressed

as ¢/kilowatt-hour. Unlike \$/watt, ¢/kilowatt-hour incorporates important criteria, including efficiency, solar exposure, and maintenance costs. Throughout the charrette, participants moved between these two metrics to optimize design concepts.

“One thing we realized is that when you try to attack BoS costs in one place, something pops out somewhere else,” said Sam Newman, a consultant with RMI’s electricity practice. “This process is just at the beginning, but I’m excited because I think we’ve seen a lot of best practices emerge and progress toward our goals.”

Some of that progress included new ideas to optimize the design approach. Managing wind load was determined to be the No. 1 challenge in terms of structural design and cost for both roof- and ground-based installations (see “A Mighty Wind,” p. 9). Meanwhile decentralizing the power



inversion—from direct to alternating current—offers system performance and cost benefits if certain challenges can be overcome.

Other high-potential opportunities discussed centered around:

- Parts integration and dematerialization of components;
- Greater standardization of mod-

ules, system components, and regulations;

- The use of high-volume manufacturing and installation processes; and
- Increased effectiveness throughout business and regulatory processes.

No silver bullet can drive down BoS costs, warned Robin Shaffer, senior vice president of sales and marketing for Sunlink Corporation. “There is no one thing that you can take advantage of,” he said. “You are going to have to work everything in the system and figure out the best combination.”

## Standards and Streamlined Design Critical to Scale

To get to scale, the solar industry has to go from “craft” production to high-volume manufacturing, Munro explained. The keys to high-volume manufacturing are streamlined designs and

standards that support system installation without hindering it. “The biggest thing is logistics, so that ‘just-in-time’ everything shows up on site,” he said, noting that “everything” includes labor and pre-assembled components. Although this type of assembly is happening somewhat today, the only way a streamlined, just-in-time manufacturing model can work is if comprehensive standards are implemented across the system. “We need flexible, rock-solid standards but we don’t want them to be an anchor,” Munro said. “Standardization is going

to be the first manufacturing hurdle.”

The industry has reached a tipping point, according to Doug Payne, cofounder and executive director of SolarTech. “Now that the hard costs have come down, the soft costs are forcing us to standardize,” he said. “We need to do it at every single part of the value chain—manufacturing,



installers, contractors, code officials, regional jurisdictions, banks, and financing options.” Once viewed through a “factory lens,” he explained, it becomes apparent where standardization needs to occur to increase the capacity of the entire industry.

“There are a lot of hoops industry players have to jump through, which in some cases are reasonable,” Newman added. “But in a lot of cases they’re based on an old standard or something that was for a different purpose.” With increased stan-



dardization of modules and codes, system installers can adapt accepted designs for site-specific constraints. These changes can contribute to cost reductions and industry growth in numerous ways: reduced investment risk, reduced design and permitting times and costs, and large volumes of increasingly standardized components that can be manufactured at a reduced per-unit cost. Much of the onus of standardizing in terms of safety and reliability, Payne said, is on the industry itself.

According to David Ismay, an associate at the legal firm of Farella Braun + Martel, if standardization can

be achieved, then solar PV systems up to a certain size should be a non-permit event. “It should be like buying a toaster,” he said. “It’s pre-certified, safe, and I just plug it in.”

## Opportunities for Rapid Assembly and “Plug-and-Play” Designs

If tens of thousands of commercial-scale PV systems are going to be installed every year, reducing installation time is critical. This challenge required input from the charrette’s structural, electrical, and process breakout groups. “RMI has done a great job in terms of bringing together the industry experts and cross-pollinating ideas from different industries,” said Gene Choi, a product strategist with module provider Suntech America. “We are always looking for opportunities to have better integration with the module and with the electronics. Without

them, we are a three-legged stool with only two legs.”

For the electrical conversion and interconnection piece, participants looked at a variety of increasingly decentralized inverter architectures (to convert the DC module output to AC power synchronized with the grid) as a way to maximize safety and efficiency with minimal cost. Module-level power electronics offer increased flexibility in system design and installation while improving energy output. “Having the electronics on the back of the modules is one of the final frontiers,” Choi said. “This idea of going to an integrated unit with

power conversion at the module level does provide significant advantages, but obviously there are engineering and cost challenges that need to be resolved first.”

The BoS designs identified at the charrette will be just some of the myriad approaches to reducing cost that will inevitably appear on the market in the coming years. But the magnitude of the reductions associated with these designs suggests that large-scale improvement *is* possible. These cost reductions will undoubtedly contribute to the growth of the solar industry and to efforts to reduce dependence on fossil fuels. (Look for RMI’s report summarizing cost analysis and recommendations in late summer 2010.)

“The solar industry has been around for many, many years,” Choi said. “Right now, it is beginning to get its legs and really stretch out, really accelerate the pace, and change the world in terms of how we generate electricity and how we use electricity.”

From a national policy perspective, it is important that players in the BoS sector have an environment in which they can innovate, consolidate, and grow, allowing the U.S. to become a global leader in a market with huge potential. “PV has been in the noise for a long time, but because it was small and expensive people haven’t taken it seriously on a large scale,” Newman said. “At the rate this industry is growing, there’s a strong potential for it to get bigger, but it will only happen if people recognize that it can get to the cost-effectiveness we’ve imagined. It really feels like it is almost here.” •

*Rebecca Cole is RMI’s online editor.*



# A Mighty Wind

Managing wind is a challenge, but offers significant opportunities for cost reduction

By Kelly Vaughn

**A**mong the many barriers to implementing large-scale, cost-competitive rooftop- and ground-mounted solar arrays, wind is a major issue—not wind-generated electricity, but the physical force of wind, which threatens to damage or destroy solar modules exposed to it.

At RMI's recent Solar PV Balance of System Design Charrette, held June 22–24 in San Jose, Calif., industry stakeholders explained that wind is the No. 1 driver of physical structure costs.

"The effect of wind on mounting systems is far from a trivial concern," said Robin Shaffer, senior VP of sales and marketing at Sunlink. "Currently there are few organizations in the world that tackle the issue at an adequate level."

Wind is complex, dynamic, and location-dependent, and it puts considerable stress on solar installations. Managing wind forces safely and in accordance with building codes requires rigorous engineering and testing of design, and it increases labor and materials costs for both rooftop and ground-mounted PV installations.

"Most commercial roofs can't hold a lot of additional weight—so making solar systems both light and wind resistant can be challenging," said Lena Hansen, a principal with RMI's electricity practice.

Building codes require that components installed in or on buildings be tested or certified for obvious safety reasons. The testing establishes the amount of wind-generated force that solar modules on buildings can withstand to ensure the safety and integrity of the system.

To meet safety and integrity requirements, rooftop solar panels must be anchored for wind using either heavy ballasts or an affixed anchoring system. Ballasts dramatically increase the weight of the system, and may exceed rooftop load capacities. Anchoring systems generally require rooftop penetrations, which have their own challenges, including increased installation time and leakage risks.

Wind poses an equally daunting challenge for ground-mounted systems. These systems may require pile-driven support beams, heavy concrete foundations, or ballasts to anchor the systems to the ground, requiring expensive equipment, materials, and labor.

## Bio-Inspired Design and Charrette Ideas

Tim McGee, a charrette participant and biologist with the Biomimicry Guild, encouraged the team to look to nature

for inspired design that could address these engineering challenges. "Life has faced the same design puzzles we have faced, but has had 3.8 billion years to work on them," he said. "When we're looking for new inventive ways to solve problems, nature has an abundance of solutions."

Mimicking a bristlecone pine, which twists to reduce wind drag, or the spikes on a cactus, which create a protective barrier around the plant, could inspire the next innovative structural solution.

Charrette participants discussed numerous strategies to accommodate wind forces, including:

- **Minimizing Exposure**

Reducing a panel's tilt angle reduces wind forces on the panel (which can act like a sail). Keeping panels closer to the ground further reduces wind exposure.

- **Spoiling & Deflection**

Deflectors could be placed on panels where wind forces are the greatest, and vertical wind turbines, mesh wind curtains, and border fencing could be used to deflect wind before it reaches the panels.

- **Optimizing Site Layout**

Reconfiguring the system so there are gaps between panels—allowing wind to pass easily through the arrays—could reduce system-wide wind forces, and designing the system to address local wind characteristics could reduce the costs of materials in certain regions.

- **Flexible Racking Structures & New Structural Concepts**

"Change the physics that are hurting you into the ones helping you out," said Sandy Munro, charrette attendee and CEO of Munro & Associates.

Controlled failure mechanisms (that safely collapse panels when the wind reaches certain speeds) and flexible, compliant structures that automatically react to high wind speeds



(Continued on p. 31)



# A Crowning Achievement

## New Smithsonian promises to be bright, uplifting—and energy efficient

By Molly Miller

At the west end of the National Mall, near the Washington Monument and not far from where Martin Luther King delivered his “I have a Dream” speech, a crown will soon appear.

“Reaching toward the sky, the bronze-clad corona expresses faith, hope and resilience,” according to the website of The Freelon Group, Architect of Record for the Smithsonian Institution’s new National Museum of African American History and Culture (NMAAHC).

A primary architectural feature, the bronze-clad crown, or corona, will surround the museum galleries and allow daylight to enter through patterned openings and skylights. At night, the corona will have a subtle presence against the dramatic backdrop of the Mall.

In addition to The Freelon Group, the design team includes the firms of Adjaye Associates, Davis Brody Bond, and SmithGroup. The Freelon Group selected Rocky Mountain Institute to lead the sustainability effort for the new museum.

During the programming phase of the project, the Smithsonian Institution set the

goal of 30 percent reduction in energy below its most efficient museum, the National Museum of Natural History. To achieve this goal, RMI is using a number of sustainable design strategies. The new museum will send a message about the Smithsonian’s commitment to clean energy.

“It will, without a doubt, be the most environmentally sound museum on the National Mall,” said RMI Principal Architect Victor Olgay. “The Smithsonian is deeply committed to making this museum as green as possible.”

The project is currently in conceptual design and will soon enter the schematic design phase.

“This is where we really start to design the systems and how they interact,” said RMI’s project manager Elaine Gallagher Adams, with a gleam in her eye. “Making the corona functional is one of the more fun and exciting parts of the process,” she said. “The corona is an important symbolic image in the design, and it will also serve as a second skin. The air in between the skins will heat up and can be used for heating. The corona skin will also shade the windows. The openings in the corona will be designed to relate to climate and sun.”

Daylighting is a primary area of focus for RMI. “The Smithsonian





really wants daylighting,” Adams said. “Daylight is uplifting and they want a visit to the Museum to be an uplifting experience.”

Integration of daylight into the dramatic architectural forms is both challenging and rewarding. While daylight is a wonderful attribute to public spaces and for exhibiting artifacts, the sensitivity of the artifacts requires daylighting that can be managed, controllable, and indirect.

The buildings heating and cooling systems also must be carefully controlled. “HVAC is rarely sexy, but it is interesting in this case,” Adams said. “Gallery space, containing artifacts, needs to be more tightly controlled using mechanical systems, while open public spaces lend themselves to passive design,” she explained.

Similarly, certain artifacts within the exhibits need specific environments with specific levels of humidity—fabrics tolerate less humidity; wood needs a little more.

Coordinating everything from daylighting, HVAC, and exhibit design to security in a prominent public building is a bit of a juggling act. RMI is leading the team to incorporate integrated design principles in the decisions.

“The project team is a very talented group, and the challenge is creating consensus because the

team is so big,” Adams said. “Integrated design requires everyone to work together, and when there are 22 team members—that is a huge challenge. The museum design team includes those in charge of food service, security, sprinkler systems, AV, exhibit design, landscaping, and, of course, the Smithsonian staff.

The NMAAHC design team is currently exploring using groundwater for an open-loop heat exchange. The system would run groundwater through plates under the building and use the constant temperature of the water to meet heating and cooling needs. This system could go a long way toward meeting, or exceeding, the Smithsonian’s goal of 30 percent lower energy use than their most energy efficient building.

“Tiber Creek used to run through that site,” explained Bill Browning, a former RMI research associate. Working with landscape architect Gustafson Guthrie Nichol on the Smithsonian’s National Museum of the American Indian in the 1990s, Browning’s team turned that same groundwater into a spectacular opportunity to pay tribute to a native landscape, by creating a wetlands over the former Tiber Creek bed. “It’s pretty cool to stand on the sidewalk and look out across wetlands to the Capitol,” Browning said.

When it comes to energy ef-





efficiency and renewable energy, things have come a long way since the design of the National Museum of the American Indian. (While not designed to obtain USGBC LEED certification, the building is now in the process of obtaining LEED certification for Existing Buildings.)

“There’s a much bigger push in the federal government in terms of green building issues,” Browning said. “There are more opportunities now. Having conversations about green building is essentially easier now. This was a brand new topic for the Smithsonian then. It is now required for all their capital projects.”

Inside the new museum, visitors will find exhibits that describe the African American experience from slavery through the Civil Rights movement and beyond. They will also be able to experience and appreciate African American art, music, dance, as well as scientific achievement.

“NMAAHC will use African American history and culture as a lens into what it means to be an American,” said museum director Lonnie Bunch. “When I think about many American values like resiliency, optimism, and spirituality, there are few places where one can better understand their origin and evolution than through African American history and culture.”

The design team wants Bunch’s inspirational vision for the museum to extend beyond the exhibits to the building itself. •

*Molly Miller is a communications specialist at RMI.*



**Previous page:** The visitor experience begins on the museum’s threshold before entering the front door. The landscape design also provides perimeter security and sustainable water management.

**Top:** The primary architectural idea for the museum is the crown or corona form.

**Bottom:** Softly lit wooden planks will hang from the ceiling of the Central Hall—the main public space within the building.

**Photo credits:** Architect: Freelon Adjaye Bond / SmithGroup; Illustration: Imaging Atelier



# No Race is Run Alone

## Technical advisors coach PGR partner cities for a plug-in future

By Kelly Vaughn

**R**eady, set, go! Currently, cities across North America are in the middle of a very important race: the transition to electric vehicles.

As automakers such as General Motors and Nissan prepare to roll electric vehicles off their assembly lines starting at the end of this year, cities are vying to become “select markets” in the initial rollout. This means demonstrating that significant consumer demand exists and that a solid infrastructure can accommodate an electric vehicle influx. Luckily, they’re not running the race alone.

“When a municipality steps up and really wants to take charge with electric vehicles, that is a great place to start but they need something more,” said Mike Waters, advanced transportation manager for Progress Energy in Raleigh, North Carolina. “That’s where the technical advisors come in.”

Waters is a technical advisor to cities involved with Project Get Ready (PGR), RMI’s transportation initiative to prepare cities for plug-in vehicles. Developed in 2008 after RMI’s Smart Garage Charrette ([move.rmi.org/innovation-workshop-category/smart-garage.html](http://move.rmi.org/innovation-workshop-category/smart-garage.html)) with the ambitious goal to sign on 20 partner cities throughout North America, the program offers cities and advisors—a diverse group comprised of automakers, electric utilities, charging station providers, academic institutions, and other NGOs—a way to prepare for plug-in readiness.

“Our technical advisors are the thought leaders on PGR,” said Matt Mattila, PGR project manager and transportation lead for RMI. “They bring a critical understanding of what is in the pipeline—which technologies, processes, or information cities need to adopt, share with consumers, and help drive a greater market for plug-ins. They really serve as coaches to our cities and have even helped bring cities into the initiative.”

knowledge of new products on the market, and giving advice on best practices and rolling them out.

“As a utility, we may not lead the initiative, but we are definitely a key stakeholder in the discussion—we are there to help serve the city and support it,” Waters said.

Within any given city, many well-established sectors must change to accommodate plug-ins, and diverse players must build a new system of connectivity in order to coordinate charging times, billing, consumer preferences, and other factors.

“Access to the best available information and knowledge of the most recent research on electrified transportation is critical when city officials are making planning and adoption decisions,” said PGR advisor Con-



**Matt Mattila, PGR project manager for RMI, coordinates technical advisors who coach partner cities for electric-vehicle readiness.**

### What is a Technical Advisor?

PGR technical advisors support cities in a variety of ways. They help develop criteria for whether a city is ready for EVs (see “The Project Get Ready Menu” on p. 15), and serve as a “support group,” answering questions about what’s in the pipeline, sharing

stantine Samaras, a post-doctoral fellow from Carnegie Mellon and associate engineer at RAND Corporation. “Having a diversity of perspectives and expertise can supplement the applied experiences of cities and improve the ultimate outcome.”

## Getting Cities on the Fast Track

PGR provides the framework to share best practices and expedites the planning process with shared lessons and resources.

And although each city is unique, Mattila explained, questions come up in meetings that are very similar. To address those individually would take a great deal of time. Having technical advisors ensures resources are centralized and ultimately speeds up the process because each city isn't reinventing the wheel.

Take PGR advisor ECOTality, a provider of vehicle charging products and services and a veteran of the electric transportation industry since the early '90s. The company has overcome challenges in its market area, includ-

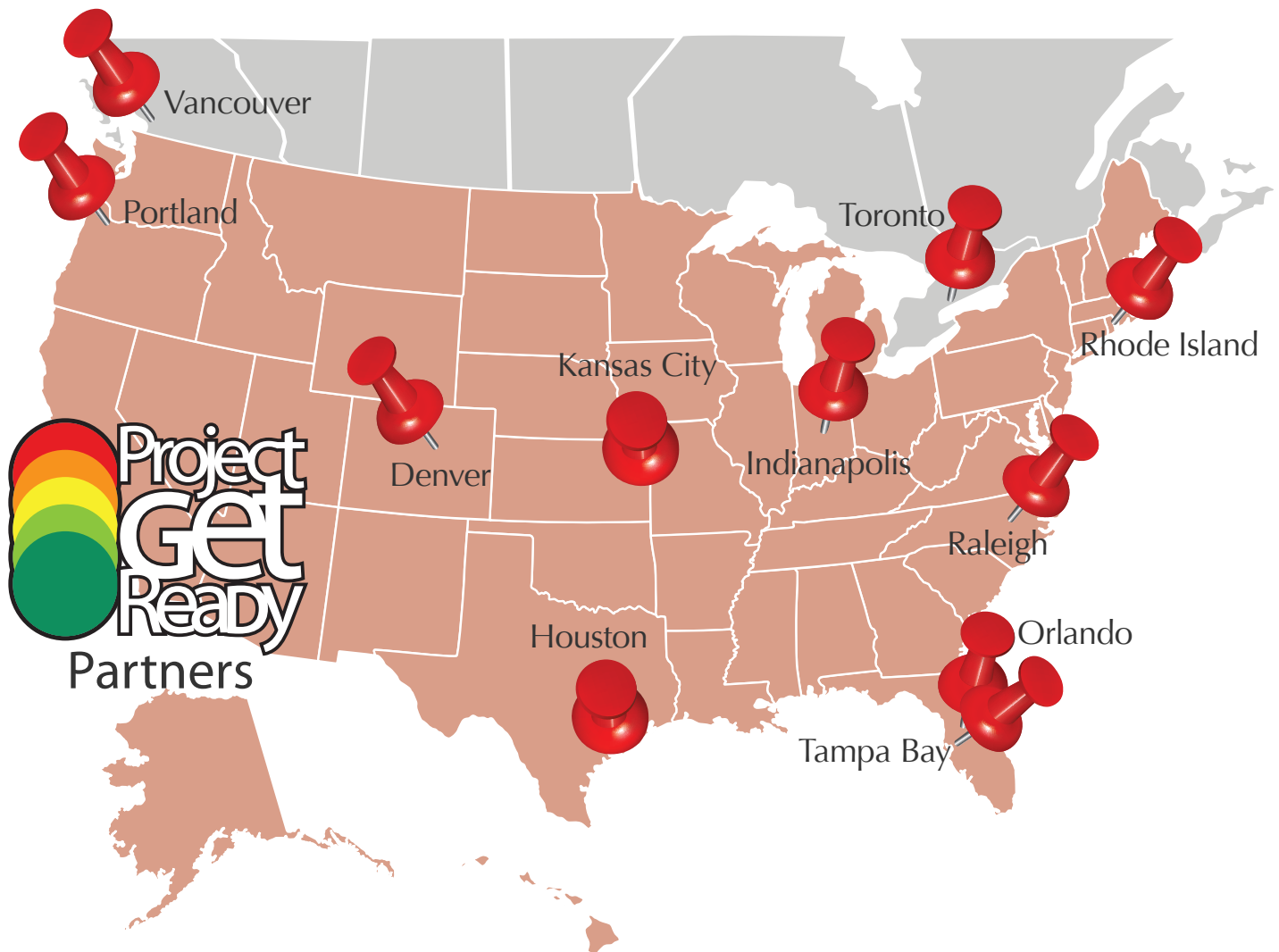
ing equipment installation: where it should be placed, what the rules for accessibility are, how the permitting process can be streamlined, and what questions are likely to be raised by electrical contractors.

"Many of these questions have since been resolved in our market areas through the collaborative process of face-to-face meetings with the many stakeholders over the years," said Stephen Schey, a PGR advisor and director of Etec Stakeholder Services, ECOTality's parent company. "Now, we are able to share this information with PGR through Deployment Guidelines."

"Different players in the industry have worked on a variety of issues and found that it is definitely more work than you think in the

beginning," Waters said. "Once you dig down, you realize there are a lot of stakeholders involved, and the devil's in the details when you try to address these barriers. We are glad we started early and can share these lessons so others can mimic our successes or learn from our mistakes."

Many technical advisors have dedicated tremendous resources to the plug-in transition—resources that cities simply don't have. For example, PGR advisor Underwriter Laboratories (UL) has already developed new safety standards for electric-drive batteries and charging infrastructure, and UL continues to invest heavily in the R&D of new testing methodologies. By lending its technical expertise to PGR, UL can help certify charging stations and address consumer misconceptions about safety.





## What's in it For Them?

As PGR continues to evolve, it is the symbiotic relationship between the technical advisors and the cities that reflects the initiative's success and motivates new companies to join.

"It's important for all of us to be constantly thinking from the mind of a consumer," Waters said. "But that is not easy because the consumers (for EVs) don't exist today." By advising city leaders, technical advisors are privy to citizens' concerns about what needs to happen and what challenges need to be overcome. At the end of the day, it's about being flexible. "Collaboration helps give technical advisors an idea of what needs to happen now at the ground level," Waters said. "But as consumers are created, we all need to be able to adapt and learn as we go." •

*Kelly Vaughn is RMI's public relations specialist.*

# The Project Get Ready Menu

There is no black-and-white checklist for what a city needs to do to overcome the numerous barriers standing between it and plug-in readiness. Different communities have different needs, concerns, resources, and approaches.

The Project Get Ready Menu outlines and prioritizes the most important actions cities must take to welcome electric vehicles. This includes "must-have" actions—core criteria to gauge readiness (such as bringing down upfront costs for consumers)—and "nice-to-have" actions that might not be necessary but have the potential to greatly accelerate success.

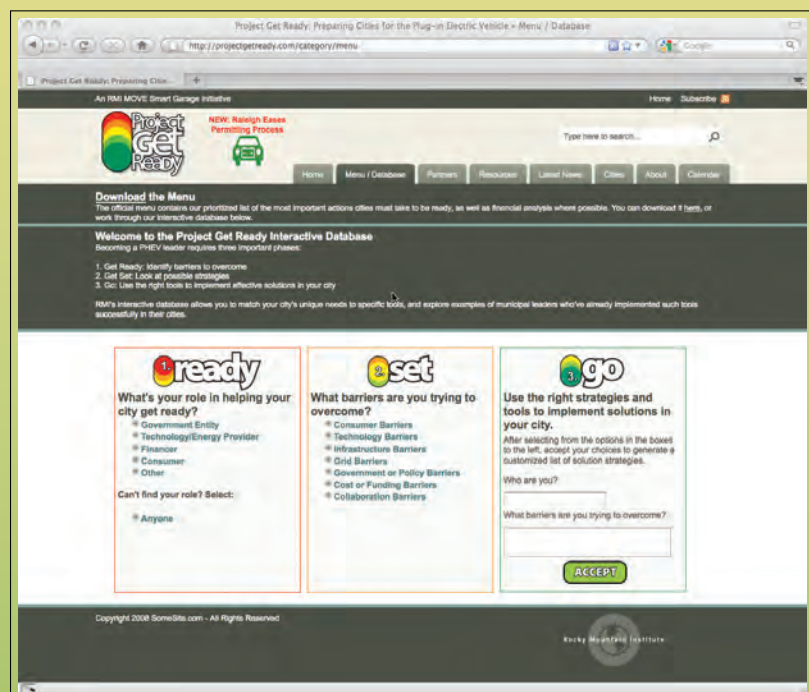
"The technical advisors have assumed the role of answering tough questions throughout the course of PGR," said Matt Mattila, PGR project manager. "With the menu, they provide the guidance needed to consolidate questions and highlight benefits or motivations to pursuing certain readiness actions. They have helped make sense of a complex process for cities."

Statistics related to costs, jobs, and other city-based benefits are all part of the menu, and are largely based on research by PGR's advisors in academia. Carnegie Mellon, for example, was key to the development of PGR's total-cost-of-ownership calculator, charging infrastructure data, and estimates on life-cycle greenhouse-gas emissions from electrified transportation.

"This menu is dynamic and it will change as we learn from our partners what works and what doesn't," Mattila said. "The menu helps us determine who is ready and who is not, but in the end it is about creating and coordinating an active plug-in community."

To download the menu or see PGR's interactive database of action items, visit [projectgetready.com/category/menu](http://projectgetready.com/category/menu).

—KV



Based on research by PGR's advisors in academia, the PGR Menu includes statistics related to costs, jobs, and other issues.



# FEEBATES

## A KEY TO BREAKING U.S. OIL ADDICTION

By Bennett Cohen and Cory Lowe

Rocky Mountain Institute is committed to getting the United States off fossil fuels.

Oil addiction, in particular, is a habit RMI would like to help the U.S. kick. The scale of U.S. oil consumption (nearly 19 million barrels per day) combined with its virtual monopoly of transportation energy (97 percent oil-based), creates strategic weakness, economic insecurity, widespread health hazards, and environmental degradation. To kick the oil habit, the U.S. needs to shift toward radically efficient vehicles, which enable alternative fuels—electricity, advanced biofuels, or hydrogen—to compete robustly with oil.

Rocky Mountain Institute is apolitical and nonpartisan, but unabashedly endorses the feebate concept and thinks it should have strong trans-ideological appeal. Co-invented by RMI Chief Scientist Amory Lovins, Richard Garwin, and Art Rosenfeld (who named it) in the 1970s and de-

scribed in detail in RMI's 2004 *Winning the Oil Endgame* ([www.oilendgame.com](http://www.oilendgame.com)), a feebate is an innovative policy that greatly speeds the development and deployment of efficient vehicles. The California Legislature actually approved a similar "Drive+" law by an astonishing 7:1 margin in 1980, but Governor George Deukmejian pocket-vetoed it after a mixed initial reaction from automakers, and it's been bottled up ever since.

The basic idea of a feebate is simple. Buyers of inefficient vehicles are levied a surcharge (the "fee"), while buyers of efficient vehicles are awarded a rebate (the "bate"). By affecting the purchase cost up front, feebates speed the production and adoption of more efficient vehicles, saving oil, insecurity, cost, and carbon.

Though efficient vehicles' reduced operating costs make them a good buy over the years, consumers' implicit real discount rates, up to 60-plus percent per year (and nearly infinite for low-income

car-buyers), make miles per gallon a relatively weak economic signal: long-term fuel savings are so heavily discounted that buyers, in effect, count just the first year or two—as minor an economic choice as whether to buy floor mats.

In contrast, feebates capture the life-cycle value of efficiency (or the cost of inefficiency) and reflect it in the sticker price. By increasing the price spread between less and more efficient vehicles, feebates bridge the gap between consumers' and society's perceptions of the time value of money. This corrects the biggest single obstacle to making and buying efficient vehicles.

Feebates can shift purchasing patterns in the short run and spur automakers' innovation in the medium and long run. But to do both, a feebate program, like any well intentioned policy, must be properly designed and implemented. As RMI Principal Nathan Glasgow notes, "With feebates, the devil is really in the details."



# FEEBATE FORUM

In 2007, RMI organized and hosted the first Feebate Forum, pulling together 27 experts from the auto and insurance industries, NGOs, academia, and government to discuss feebate design and implementation schemes. Through open dialogue, the group developed a set of design recommendations, barriers, and next steps for feebates ([www.rmi.org/rmi/Library/T08-09\\_FeebatesLegislativeOption](http://www.rmi.org/rmi/Library/T08-09_FeebatesLegislativeOption)). The participants agreed on the following design goals:

1. Metrics should be based on fuel efficiency or greenhouse gas emissions, and all types of transportation energy can be included—not just diverse fuels but also electricity.



2. The size of the fee or rebate shouldn't depend on vehicle size. The feebate should reward buyers for choosing a more efficient model of the size they want, not for shifting size. A size-class-based feebate preserves the competitive position of each automaker regardless of its offerings, debunks the myth that consumers must choose between size and efficiency, and doesn't restrict freedom of choice. Buyers can get the size they want; the efficiency of their choice within that size class determines whether they pay a fee or get a rebate, and how much.



3. Feebates should be implemented at the manufacturer level, so automakers, rather than a government agency, should pay the fees and collect the rebates. This lets manufacturers monitor results and adjust their vehicle mix accordingly, and it avoids any need for taxpayers to foot the bill for any costs. However, a good feebate program should be revenue-neutral, with "fees" paying for "bates" plus administrative costs—a potentially attractive feature. And since the "fees" are entirely avoidable by choice, they're not a tax.



4. The "pivot point" between fees and rebates should be adjusted annually, so the program is tuned up to stay revenue-neutral, and automakers have a predictable and continuous incentive to improve the efficiency of their offerings, spurring innovation.



5. Feebates should be designed for complete compatibility with efficiency or carbon-emissions standards, so automakers aren't whipsawed between incompatible incentives or requirements. In practice, feebates may drive efficiency improvements much larger and faster than standards require, making the standards unimportant except to prevent recidivism.

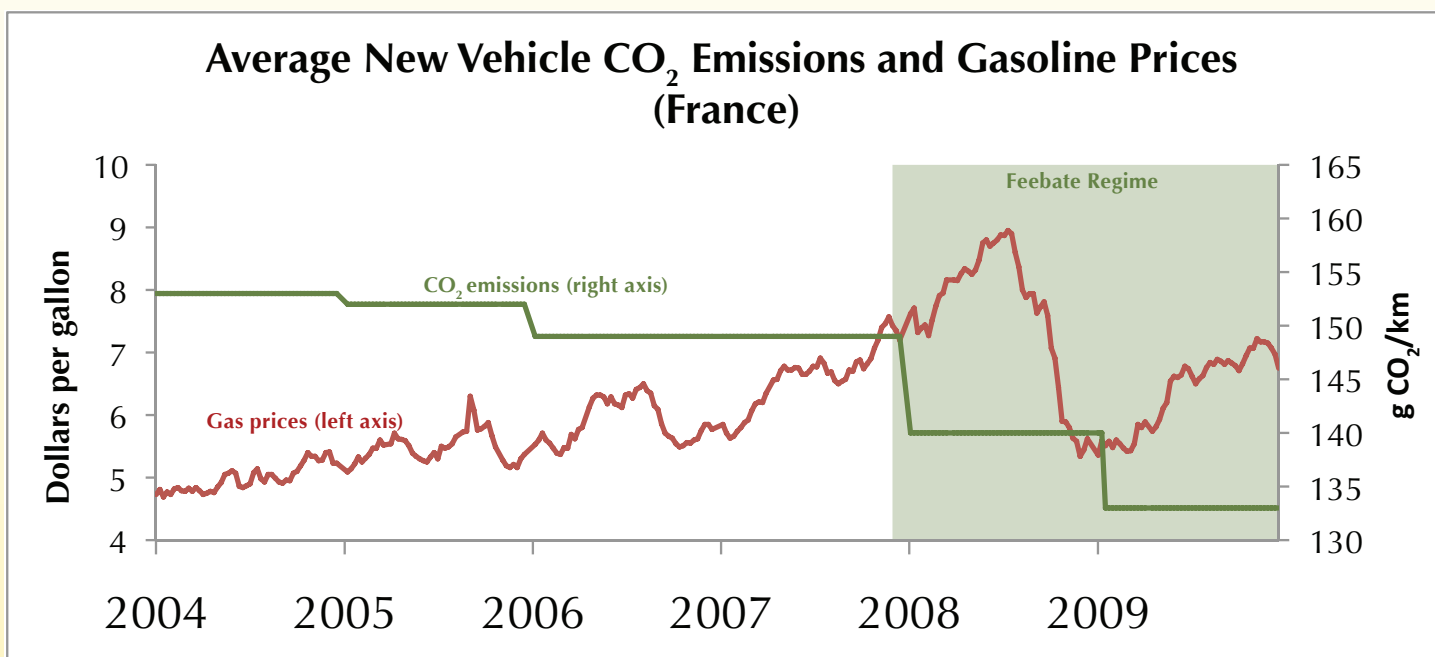
## France: A Case Study

Around the same time RMI hosted the Feebate Forum in the U.S., France introduced the largest feebate program to date. It was dubbed *bonus-malus* after the French insurance terminology, where a *bonus* cuts your premium for a good driving record while a *malus* boosts your premium because you're considered riskier. The French program is an excellent example of how the feebate concept can work in a large

taxpayer money is funding the program rather than its remaining revenue-neutral, though the oil and carbon dioxide savings are well worth the cost.

Averaging 133 grams of carbon dioxide per kilometer for the 2009 new light-vehicle fleet, France's vehicles now have the lowest carbon emissions in the European Union. By comparison, the UK's 2009 new vehicles emitted, and the EU average is, 146. Between 1995 and 2007 (when

the feebate's impact is somewhat unclear because fuel prices soared as it was starting. When feebates began in early 2008, fuel prices were around \$7 per gallon (already relatively high for France, though typical of most EU and other countries: U.S. gasoline and diesel-oil taxes, hence prices, are almost uniquely low). A few months into the program, fuel prices had soared to \$9 per gallon. It's unclear how this affected new vehicle pur-



Retail gasoline prices and new vehicle fleet average CO<sub>2</sub> emissions in France, 2004-2009

economy (France's 2009 nominal GDP was the world's fifth-largest, after the U.S., Japan, China, and Germany).

So far, it's worked—beyond all expectations. Although designed differently than the ideal U.S. program outlined at the Feebate Forum, the French program has been enormously successful at reducing the carbon dioxide emissions rates of new light-duty vehicles bought in France.

Unlike the characteristics suggested by participants at RMI's Feebate Forum, *bonus-malus* is administered by the government rather than vehicle manufacturers. With far more rebates (*bonus*) than fees (*malus*) collected, the government paid out \$214 million in 2007 and 2008. This ultimately means that

the French feebate was introduced at year-end), the emissions rate of new vehicles sold in France was falling at an average rate of 2.25 grams of carbon dioxide per kilometer per year. During the first two years of the feebate program, the annual emissions decrease more than tripled to 8 grams per kilometer. Overall, the efficient *bonus* vehicles' market share nearly doubled, from 30 to 56 percent, while the inefficient *malus* vehicles' share fell threefold, from 24 to 8 percent.

France would love to keep this momentum going and has no plans to end the feebate program; there's even talk of extending feebates to many other energy-using products.

While these are stunning results,

chases. By mid-2008, prices had collapsed to around \$5.36 per gallon, and through 2009 they remained under \$7, but vehicle emissions kept on plummeting. This suggests that the feebate was responsible for the decreased emissions during 2009. Perhaps the 2008 price spike caused buyer wariness that lingered through 2009, but the continued strengthening of the sales shift even as fuel prices fell suggests a strong policy effect.

## Conclusion

So where did all this efficiency come from? The French program was not size-neutral as RMI recommends for the U.S., and the data show it shifted



new-car buyers toward smaller vehicles. The market share of the smallest (economy) cars grew from 44 percent in 2007 to 57 percent in 2009, much as we'd expect for such a fleetwide feebate structure: smaller vehicles tend to have higher efficiency and lower carbon emissions, so unless unusually inefficient, they'll earn a rebate that's attractive to many buyers. For the U.S., RMI recommends a size-neutral feebate design to shift the entire market toward lighter, more aerodynamic, and advanced-powertrain vehicles, not just smaller ones.

California is currently considering the introduction of a statewide feebate bill. A state program would probably do more to shift the in-state vehicle sales mix than to spur innovative design, since even a market as big as California represents only a fraction of the U.S. auto market. Nonetheless, RMI is following this program closely.

In 2008, California's aggressiveness on fuel efficiency spurred higher national CAFE standards, and a number of other states follow California's lead on Clean Air Act and related policies. States and regions can make fine laboratories for refining policy innovations that later guide uniform national policies.

In August 2009, Senators John Kerry (D-MA), Jeff Bingaman (D-NM), and Olympia Snowe (R-ME) proposed a federal feebate program, based in part on RMI's recommendations, as part of the Efficient Vehicle Leadership Act. The bill remains stuck in committee.

The oil spill in the Gulf has refocused attention on America's oil problem, and D.C. insiders believe lawmakers must deliver an oil bill before November's elections. RMI hopes its feebate proposals will be included as a way to confront oil dependence head-on by pulling radically efficient vehicles into the market while improving performance, safety, and comfort. •

*Bennett Cohen is special aide to Amory Lovins and Cory Lowe is RMI's public relations manager.*



## LIGHTWEIGHTING & FINANCING BENEFITS

**Feebates can help drive two vital directions of automotive innovation. First, feebates beautifully reinforce the rapidly emerging global trend toward lightweighting. That's the strongest way to make cars very efficient with great economics: lightweighting can be largely or wholly paid for by shrinking the powertrain to get the same acceleration.**

**Lightweighting is also the key prerequisite to making advanced powertrains (notably electrification) affordable by eliminating most of the costly batteries. (So far, Federal investments in automotive innovation have been about 100 times as big for advanced powertrain development as lightweighting and other forms of "platform fitness," though there are recent signs this may be about to change.)**

**Second, in *Winning the Oil Endgame*, RMI proposed a low-income financing innovation that would enable low-income households handicapped by inefficient and unreliable old cars to afford to buy new, reliable, warranted, and extremely efficient models. Achievable at small to negative net cost, this would greatly stimulate both poor communities (many of which lack another way to travel to jobs) and the general economy.**

**Our proposal, which included a scrap-and-replace component, would also give automakers a new million-car-a-year market from new customers who could never before afford a new car. This would help avoid the pitfalls associated with relaxing lending criteria (akin to sub-prime mortgages); instead, it would preserve loan quality and manage lending risk while achieving remarkable benefits.**

—Amory B. Lovins



The design charrette brought together a diverse and collaborative team, which included RMI's Greg Franta (center) and, to his left, *Democracy Now!* host Amy Goodman.

## Democracy Now! Goes Green

The progressive radio studio achieves LEED Platinum with RMI's help

By Ben Holland

For nearly ten years, *Democracy Now!* was based in an old converted firehouse in Chinatown, a neighborhood on New York City's lower east side. Led by host Amy Goodman, the program grew in reach and prominence, becoming one of the most respected progressive radio/TV news shows in the country.

When the landlord asked them to leave so he could do construction work, the *Democracy Now!* team began looking for a new location, eventually settling on an old printing warehouse in nearby Chelsea.

As they needed to completely renovate the space, the team wanted to go for the highest level of green certification they could achieve and hired Bogdanow Partners as their architectural and design firm, and Brooklyn Interiors as construction manager. Although their architect, contractor, and

mechanical engineer wanted to help them achieve this goal, they lacked the expertise needed to take them to the highest level. Amy Goodman interviewed RMI Chief Scientist Amory Lovins on *Democracy Now!*, and while he was there discussed their dilemma.

As is his style, Lovins asked questions about the efficiency plans for the future location, and finding areas for improvement, he put Goodman in touch with RMI's then Built Environment Team leader, the late Greg Franta, FAIA. Shortly thereafter, a design charrette was held in Bogdanow's office.

"Greg whipped up a group of experts in HVAC, building envelope, and lighting design," said Karen Ranucci, the project manager for the *Democracy Now!* build-out. "He had the immediate ability to think outside the box and to look at our problem in a holistic manner."

The charrette produced a host of aesthetic, lighting, and mechanical system design recommendations aimed at improving the existing efficiency plans. The team developed strategies to incorporate higher-performing windows, maximize the energy efficiency of their lighting plan, and to reduce the building's mechanical loads.

Franta's big focus was on the

HVAC system. *Democracy Now!* has a massive data and server room, humming day and night, producing a great deal of heat. Cooling often incurs a huge cost, so RMI immediately sought to redefine the energy needs of the system.

In doing so, the team realized that the proposed system was twice as big as it needed to be. By redesigning the layout of the room, they were able to implement creative hot-and-cold-aisle techniques that cool the servers and transfer heat to a closed space behind the machines. With this, RMI significantly reduced the energy necessary to balance the heating and cooling needs of the studio's data room.

RMI also recommended using an economizer, which uses free, cold air from outside for cooling.

This past March, the *Democracy Now!* studio received LEED Platinum for Commercial Interiors, making it

*Greg whipped up a group of experts in HVAC, building envelope, and lighting design. He had the immediate ability to think outside the box and to look at our problem in a holistic manner.*

the first radio or television studio in the nation to receive the honor. It's a designation that brings the *Democracy Now!* team a great deal of pride. "It was difficult to switch gears mid-stream, with a renovation already moving forward," said Ranucci, "but in the end, we got what we were fighting for." •

*Ben Holland is RMI's outreach specialist.*



# Staff Profile: Christopher Berry

By Cameron M. Burns

Most days, Chris Berry, RMI's IT director, can be found with his face in front of a monitor, feverishly digging through some software glitch and following lines of reasoning that will bring resolution to some vexing problem.

But Berry doesn't just work in the world of machines and logical processes. He is fascinated by the unpredictability—the so-called “organized chaos”—that humans bring to all their endeavors. A considerable part of his day is spent trying to understand why and how people think, how they make decisions, and ultimately what they really want or need. To do that, he has to be willing to accept every piece of information and opinion, whether the input will contribute to a solution or not.

“One of the things I've always valued is an openness to other points of view,” Berry said. “Two people look at the same thing, and their associations or conclusions are going to be wildly different. I've always tried to see the other points of view whenever I can.”

Berry's career was influenced by several convergent factors. When he was young, his family moved to Manzanola (“little apple”), in southeastern Colorado, where his parents ran a nursery and greenhouse. He was attracted to the area's river-bottoms, and spent as much time as he could tromping the banks of the Arkansas River.

While the outdoors held sway, computers and computing also grabbed his attention. At the time, the home computer age was dawning, and although he had little access

to computers, he read everything he could about them.

In ninth grade, he was shipped off to prep school and to his delight, the school had a functioning computer. He started programming the refrigerator-sized machine and soon found that he had a knack. After a brief stint at George Washington University, he moved into IT work full time.

Although IT was a fit, Berry knew something was missing, so when he moved back to Colorado in 1987, he started studying, of all things, anthropology.

“I just thought it would give me an insight into people,” he said. “One of the things about tromping around in river-bottoms and working on computers is that you don't learn much about people. And, I felt I always was and still am a bit deficient in that. So I thought anthropology would be a road to a little bit better understanding. As well as it's just fascinating—seeing how people live.”

One of the great surprises for Berry was anthropology's lack of precision. “It calls itself a science,” he said. “But it's pretty tough to do science on people and get any kind of meaning. You have to couch it in some sort of discipline, and that's certainly there. But it's not really sci-



ence as it's normally defined. There's no real experimentation. You can do some hypothesis testing, but there's no way to do real controls. I pretty much fell into the ‘functional school,’ where things have a purpose and you can deconstruct things down to if-then statements, at least to a certain point. I found myself gravitating to that kind of tool-kit. It didn't offer all the answers, but it helped.”

In the early 2000s, Berry and his then-girlfriend (and now wife), Cherry “Buffy” Andrews, moved to Colorado's Western Slope, where, after a stint setting up the Roaring Fork Internet Users Group, the first publicly available ISP in the Roaring Fork Valley, he joined RMI in 2002 as an IT technician.

In 2004, an opportunity came up for both Berry and his wife, an architect. Longtime RMI staffers

Bill Browning and Jeff Bannon were leaving the Institute to head up the design and development of Haymount, a sustainable community in Virginia. Andrews was hired as town architect, while Berry was brought in to “wire the town—with Internet access everywhere.” Although that was just six years ago, it was one of the first communities in the nation to be designed to run on a fully integrated digital wireless system. Berry quickly learned what he’d gotten himself into: trying to smooth out a collision between the technological and human sides of community development.

“The project was about getting the vendors and players together and building this idea that hadn’t been done before,” he recalled. “Nobody had tried to do this to this level, or with this model. We were trying to build everything from telephone, cable TV, and Internet services in an integrated way, and coalesce all these data services into the town rather than spreading them among multiple vendors.”

But the new model faced big roadblocks.

“It was hard to get vendors who would accept something completely new and different,” he said. “It required people to give a little and to rethink what they did. The financial

part was challenging, too. They expected a certain profit margin based on the cheapest possible materials and labor and the highest possible price rather than good project management, craftsmanship, and the efficiencies found in good procurement practices. This is stuff that RMI has proven for years—that it’s actually cheaper to do it right. But it’s the same



old story. The attitude is, ‘It works, so why change it?’”

When Haymount fizzled in late 2005 (it hit financial difficulties and was then sold), the Berrys started planning a return to the West. Serendipitously, RMI’s HR Director David Rothstein contacted Berry and asked him to help set up RMI’s second office in Boulder. At the time, RMI was absorbing Greg Franta’s ENSAR Group, and the Boulder office was abuzz with activity.

Berry joined RMI a second time, and today works in the Institute’s Boulder office. With his knack for machinery and software, as well as a passion for understanding how humans operate, he fits well with a stable of consultants trying to piece together the puzzle of humanity and high-tech solutions. Berry “absolutely” believes in the work RMI is doing, and that efficiency, renewables, and their esoteric manifestations in thing like smart grids and plug-in vehicles are appropriate solutions.

“It’s a human enterprise,” he said. “And as such it’s a little imperfect and it’s going to go in fits and starts and people are going to try and carve out their parts of it. If you could conceive of things like this *and* implement them without that friction and the overhead that comes with human interaction, it would be great, but it’s just

not going to happen. I think we are muddling through. We see more and more people starting to understand that this is where a lot of our energy goes and a lot of it is being wasted. Soon we’re going to wake up and find we’ve gotten through, and the world has changed.” •

*Cameron M. Burns is RMI’s senior editor.*

## 2010 Micropower Database

RMI’s newest publication is our “2010 Micropower Database” (2010-06; see [www.rmi.org/rmi/Library/2010-06\\_MicropowerDatabase](http://www.rmi.org/rmi/Library/2010-06_MicropowerDatabase)). Assembled by RMI’s Amory Lovins and his former Special Aide Bennett Cohen, the database presents a clear, rigorous, and independent assessment of the global capacity and electrical output of micropower (all renewables, except large hydro, and cogeneration), showing its development over time and documenting all data and assumptions. With minor exceptions, this information is based on bottom-up, transaction-by-transaction equipment counts reported by the relevant suppliers and operators, cross-checked against assessments by reputable governmental and intergovernmental technical agencies. For most technologies, historic data from 1990 through 2008 or 2009 are available, as well as forecasts through 2013. The information includes global annual capacity additions and output, global cumulative capacity, and capacity factor. The database’s methodology is included. RMI’s 2008 Micropower Database is also available at [www.rmi.org/rmi/Library/E05-04\\_MicropowerDatabase](http://www.rmi.org/rmi/Library/E05-04_MicropowerDatabase).





Norman Smith

Reserve Bank of New Zealand

## While America Sleeps, RMI is Delivering Energy Savings Down Under

By Norman Smith

When announcements are made, often news' origin carries as much import as the announcement itself—1600 Pennsylvania Avenue, for example. In Wellington, New Zealand, when policy emerges from Number 2, The Terrace, Kiwis take note. Number 2 is the home of the Reserve Bank, New Zealand's equivalent of the Fed, and when the bank's Governor Alan Bollard speaks, the country listens.

Currently, Number 2 is on track to become one of New Zealand's most energy-efficient buildings, thanks to RMI Senior Adjunct Associates

Norman Smith and Rob Bishop. Since 2003 Smith and Bishop have represented RMI, including bringing Amory Lovins to New Zealand to meet with senior government ministers, and generally promoting RMI's work.

Smith and Bishop each run their own energy management consultancies, collaborating when complementary skills are needed. The Reserve Bank building (which houses the country's money) was such a project.

By the late 1990s, as result of government policy and a 1997 energy audit, the 274,267-square-foot (25,480 m<sup>2</sup>) structure was outperforming the building industry's energy-efficiency benchmark by 30 percent. In early 2008, Smith suggested a new audit, and pulled in Bishop to make recommendations. In late 2008, Smith and Bishop co-led a half-dozen commercial-building specialists through a process in which they "played around" with data simulating the implementation of energy-efficiency devices and systems. The team's attitude, according to the Energy Efficiency and Conservation

Authority (EECA), was to reexamine everything, and, regardless of how efficient a building might be, expect to find considerable energy savings—the kind of approach to continuous commissioning RMI uses in all its built environment work. Eventually, the specialists chose and adopted 28 different optimization opportunities.

Now, the results are rolling in. In the first year, the building achieved a 22 percent energy savings (natural gas use was down 35 percent and electricity for cooling was down 54 percent), and similar savings are projected for 2010–11. The results and the process were recently featured in a case study published by the EECA ([www.eecabusiness.govt.nz/sites/all/files/continuous-commissioning-promises-continuous-gains-reserve-bank-1-10.pdf](http://www.eecabusiness.govt.nz/sites/all/files/continuous-commissioning-promises-continuous-gains-reserve-bank-1-10.pdf)) and presented at the 2010 conference of the New Zealand Energy Management Association.

"Watch this space during the next two years," Smith said. "We believe the best is yet to come." •

*Norman Smith, an energy consultant based in New Zealand, is a senior adjunct fellow at RMI.*





Dave Bowden, SustainableMedia.net

Colorado Renewable Energy Society's (CRES) 2010 President Thom Johnson presents the Larson-Notari to Amory Lovins.

## RMI's Amory Lovins Wins CRES's 2010 Larson-Notari Award

On June 19, RMI's Amory Lovins won the Colorado Renewable Energy Society's (CRES) 2010 Larson-Notari Award. Named in honor of Dr. Ronal Larson and Paul Notari, two founding members of the Colorado Renewable Energy Society, the award "annually recognizes individuals who have made significant contributions to the field of renewable energy, energy efficiency, and sustainable buildings." Lovins was presented with the award at CRES's 15th Annual Conference in Montrose, Colorado, June 18–20, where he made a brief presentation about Reinventing Fire. •

## Keeping Up-To-Date on "Everything RMI"

Track our progress in profitably moving the world off fossil fuels

Recently, Rocky Mountain Institute launched two new tools to keep you informed about our game-changing work.

The first is an electronic newsletter, *Spark*. *Spark* is sent directly to your inbox every two weeks, and it offers up-to-date information on RMI's projects, coverage of RMI's work, videos by and about the Institute, and upcoming RMI-related events.

For daily updates on the Institute, we also now have an RSS feed that will feature headlines from *rmi.org*, our blogs, our press releases, and recent Institute publications. By subscribing to this feed, you can stay abreast of developments in a variety of sectors, from renewables to green buildings.

We encourage everyone who supports RMI to subscribe to both *Spark* and the RSS feed. Current subscribers include RMI colleagues, National Solutions Council members, peers in a variety of sectors, and friends and family around the globe.

You can subscribe to *Spark* by visiting [rmi.org/spark](http://rmi.org/spark). And, don't forget to add our RSS feed into your favorite reader. Just look for the RSS icon on *rmi.org*. •





# Stories to Check out Online

With the Institute's move to both electronic and printed versions of our *Solutions Journal*, we plan to keep readers abreast of stories in both formats. Our spring *eSolutions Journal*, published online in late May 2010, includes the following:

**“Using Military Might for a Cooler World.”** This article describes RMI's most recent efforts to influence the military via a recent article in *Joint Force Quarterly* (the magazine of the Chairman of the Joint Chiefs of Staff).

In the longer term, RMI's efforts with two Defense Science Board task forces have reportedly helped shift DoD thinking. The Department's February 2010 Quadrennial Defense Review (which sets "...a long-term course for the DoD") includes, for the first time ever, an energy section, driven by the DSB's and RMI's work."

**“The Answer is Growing in the Wind.”** In this piece, Virginia Lacy, a senior consultant with RMI's electricity practice, describes recent trends in analyzing wind energy and how "size and height really do matter." Wind turbines have continued to increase in size, in terms of swept area and in height. Today's modern turbines regularly approach hub heights of 80

to 100 meters, which has a significant impact on wind energy potential. "Typically, the higher the altitude, the faster the speed of the wind," she writes. "Intuitively, it makes sense that a faster wind speed will generate more energy, all else being equal.



However, the impact is not simply linear. The amount of energy that can be extracted from wind increases with the cube of the wind speed. In other words, a 10 percent increase in wind speed equates to 33 percent increase in available energy.... At hub heights of 80 to 100 meters, U.S. wind capacity potentials actually increase dramatically."

**“Right-Time Retrofits.”** One of RMI's initiatives under the umbrella of Reinventing Fire is RetroFit, with which RMI hopes to spur the "deep" retrofit of at least 500 buildings within five years. In this article, Caroline Fluhrer, a senior consultant with RMI's built environment practice, and Rebecca Cole, RMI's online editor,

explain that timing is critical when planning a deep retrofit. "Energy efficiency measures are almost universally less cost effective when done as stand-alone projects," they write. "However, when the principles of 'integrated design' and 'piggybacking' are applied to major capital investments in a building, energy efficiency measures can become highly profitable."

Other articles in the spring *eSolutions Journal* include a profile of Sam Newman, a consultant with RMI's electricity practice, and an article on former staffer Lisa Delaney, who corralled RMI's 1998 *Green Developments* into the definitive green-building tome for the era.

Additionally, be sure to check out our electronic winter edition. There, you'll find

an important article by RMI's Lena Hansen and Amory Lovins regarding baseload electricity ("**Keeping the Lights On While Transforming Electric Utilities**"), as well as Lovins's commentary "**Climate: Eight Convenient Truths**" (originally in *Roll Call* magazine), pointing out that what we do about energy matters more than political opinions about climate and other issues.

To browse the above mentioned articles and older editions of *Solutions Journal*, and its predecessor, *RMI Solutions*, please visit [rmi.org](http://rmi.org) and look for "Solutions Journal" under "Resources" in the main menu.

—The Editors

# Greg Franta's Book *Cooling the Warming* Goes to Press

*"Attitude is the biggest driver to successful high-performance projects; set higher goals and believe in the possibility of creating a high-performing building without enduring heavy costs."*

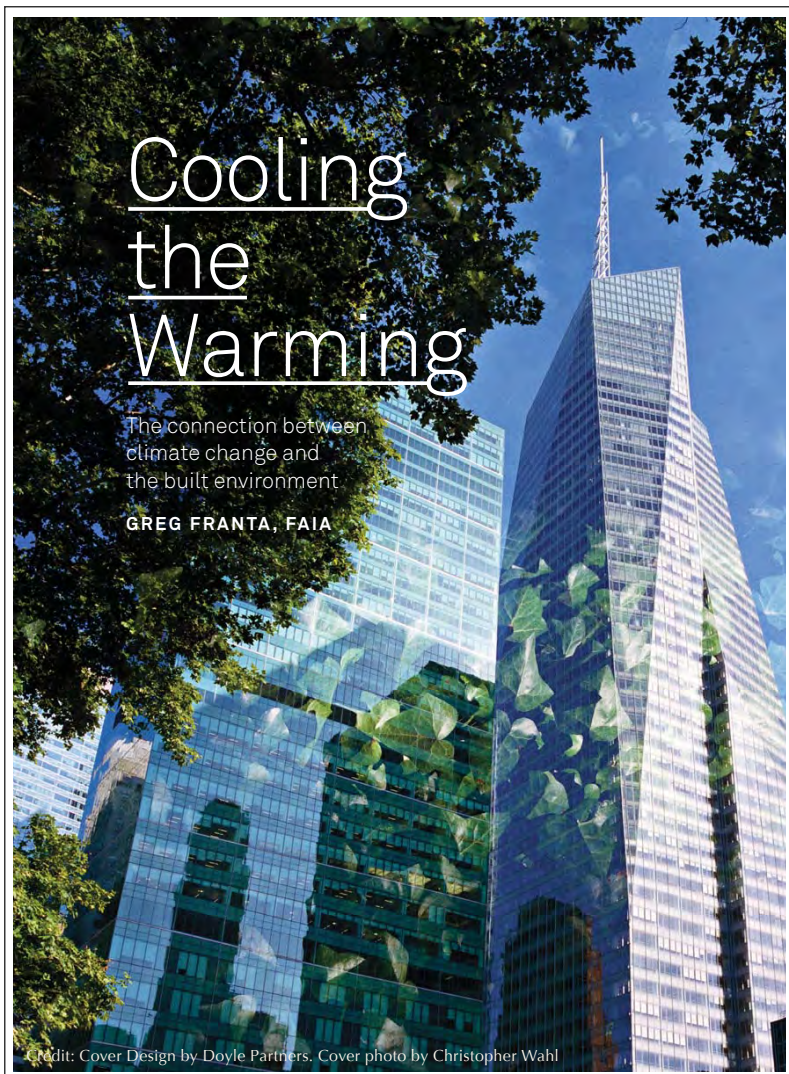
—Greg Franta, FAIA

**"I**f I have seen far it is because I have stood on the shoulders of giants."

This often-repeated quote from Sir Isaac Newton captures the spirit of RMI Principal Victor Olgyay's introduction to Greg Franta's book *Cooling the Warming*, which is being released by RMI this summer.

At the time of the car crash that took Franta's life in February 2009, Franta had been working on a comprehensive book about climate change and the built environment. Not content to examine only buildings, Franta sought to connect buildings, homes, land use, utilities, transportation, and consumer choices to energy use and carbon emissions. This comprehensive look at energy is now the major focus of Reinventing Fire, RMI's initiative and book of the same name that aims to get the nation off fossil fuels by 2050.

Franta was passionate about writing about and teaching integrated design, and at long last RMI has published Franta's book, albeit a much more modest version than he had imagined. The 68-page book, the full title of which is *Cooling the Warming: the Connection Between Climate Change and the*



**The Bank of America Tower in New York City, designed by Cook+Fox Architects and developed in 2009 by the Durst Organization, is the first newly constructed skyscraper to achieve LEED Platinum from the U.S. Green Building Council.**

*Built Environment*, is composed of Franta's introductory chapter of his original work, Olgyay's introduction, a preface by President William J. Clinton, and an appreciation of Franta written by RMI Chief Scientist Amory Lovins. Franta's essay describes how we arrived at our current state of climate crisis and lays out a vision for how decisions we make about our built environment can help solve the climate crisis.

President Clinton's preface describes his experience with Franta and RMI on greening the White House in the mid-1990s and on greening his home. It is an appreciation for Franta and an endorsement of Reinventing Fire and RMI's vision for the future.

"Greg did a lot of good in his all-too-short life, and he left us inspiration for the challenges that remain," Clinton wrote.

Franta was indeed a giant, and his ideas have never been more important. For a copy of the book, please visit RMI's online bookstore at [rmi.org](http://rmi.org), where it is available for the cost of shipping. •

—Molly Miller



# Contributions to RMI in the past year, as of June 30, 2010

## HEROES

### \$1,000,000 and above

Nationale Postcode Loterij  
Robertson Foundation  
Alice & Fred Stanback

## GAMECHANGERS

### \$500,000–999,999

Rachel & Adam Albright

## VISIONARIES

### \$100,000–499,999

Ayrshire Foundation  
William & Flora Hewlett Foundation  
Schmidt Family Foundation  
Foster & Coco Stanback  
Anonymous

## PATHFINDERS

### \$50,000–99,999

Mary Caulkins & Karl Kister  
The Concordia Foundation

## INNOVATORS

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("A Mighty Wind," continued from p. 9)

were viewed as possible opportunities for advanced systems to minimize wind damage. And, as RMI's Amory Lovins points out, it is often cheaper to bear structural loads with tension (e.g., using cables) than with mass and stiffness. However, the practicality of these concepts is uncertain.

#### • Exploiting Wind Loads

New horizontal wind turbines mounted just inside the edge of a conventional roof can convert wind to electricity while reducing wind forces on photovoltaic racks placed toward the center of the roofs.

A great deal of work remains to determine how much these ideas can contribute to cost-competitive and scalable PV systems. Ongoing analysis and testing will be required, and we certainly won't see changes right away. Perhaps the single most important challenge will be keeping a whole-system perspective, precluding a solution that could improve the effectiveness of one portion of the solar value chain while compromising the effectiveness of others. As RMI continues to promote the exchange of ideas, broaden perspectives, and push cutting-edge thinking, we hope to see considerable progress in what the industry believes is possible. •

*Kelly Vaughn is RMI's public relations specialist.*



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## September – November 2010

**Autovation 2010—Austin, TX, September 12 – 15**  
[www.utilimetrics.org/Events/Automation.aspx](http://www.utilimetrics.org/Events/Automation.aspx)

Autovation 2010 is an educational forum that will attract utility executives from around the world looking for new ways to optimize their operations through automation technologies.

**Utility Scale Solar—San Diego, CA, September 13 – 15**  
[www.infocastinc.com/index.php/conference/utility10](http://www.infocastinc.com/index.php/conference/utility10)

The Utility Scale Solar Summit is the business hub where decision-makers (project developers, technology providers, utilities, investors, lenders, EPC contractors and other influential industry players) who are rapidly expanding the utility-scale project pipeline, come to work out how to push these projects across the finish line.

**SJF Summit on New Energy Economy—Durham, NC, Sept. 14 – 15**  
[greeneconomynow.org/sjf-2010-summit-on-the-new-green-economy](http://greeneconomynow.org/sjf-2010-summit-on-the-new-green-economy)

This year's dynamic gathering of 500 will focus on Accelerating Growth and Impact and will feature national keynotes and speakers, a central Cleantech CEO Panel, business and community success stories, tips on developing key strategic partnerships, structured networking, and practical strategies attendees can implement in their own businesses and communities.

**23rd Annual E SOURCE Forum—Denver, CO, September 19 – 23**  
[www.esource.com/forum2010](http://www.esource.com/forum2010)

Amory Lovins will present Reinventing Fire. The Forum brings together more than 300 representatives from utilities and other energy service providers as well as government representatives and others involved in improving and redefining how energy is delivered, purchased, and used.

**Opportunity Green 2010—Los Angeles, September 22 – 24**  
[www.opportunitygreen.com](http://www.opportunitygreen.com)

Opportunity Green inspires a collaborative culture of new thinking and unconventional ideas that pushes change in unexpected ways, facilitating the movement to transform business for good, through advancing change and market transformation by providing open-minded professionals with unprecedented approaches to sustainability that are bankable and exciting.

**West Coast Green 2010—San Francisco, September 30 – October 2**  
[www.westcoastgreen.com](http://www.westcoastgreen.com)

West Coast Green is a feast of innovations, ideas and opportunities designed to expand your business, widen your vision, and stimulate your thinking with the latest best practices and key players in building, business, and design.

**Clean Tech Forum—New York, October 11 – 13**  
[events.cleantech.com/newyork](http://events.cleantech.com/newyork)

The Cleantech Forum New York addresses innovation in key clean technology resource-efficiency categories—energy efficiency, transportation, smart grid, and water, among others—but from a finance angle.

**Green Festival—San Francisco, November 6 – 7**  
[www.greenfestivals.org/san-francisco-fall/news](http://www.greenfestivals.org/san-francisco-fall/news)

Green Festival is the nation's largest green consumer living event offering a wide array of speakers, ideas, workshops and exhibits to show ways that everyone from corporations to the individual can go green on a tight budget.

RMI Event Calendar