Commonweater Politics, IDEAS & CIVIC LIFE IN MARGACHUSETTS





Green Power

Can it really create new jobs, curb greenhouse gases, reduce our reliance on fossil fuels, save us money – and keep the lights on?

SPECIAL ISSUE

commonwealthmagazine.org

National Grid is committed to being an innovative leader in energy management and to safeguarding our global environment for future generations.











MassINC would like to welcome the members of the newly created MassINC Associate Board, whose mission is to build a new generation of civically engaged leaders for the Commonwealth. Board members will serve as advisors to MassINC's research, journalism and civic events and programs. For more information on the Associate Board, go to massinc.org and click on RealTalk, under programs.

RealTalk is supported in part by generous contributions from Highland Street Foundation, State Street Corporation and Zipcar.

CommonWealth

EDITOR Bruce Mohl bmohl@massinc.org | 617.742.6800 ext. 105

EXECUTIVE EDITOR Michael Jonas mjonas@massinc.org | 617.742.6800 ext. 124

MANAGING EDITOR Robert David Sullivan rsullivan@massinc.org | 617.742.6800 ext. 121

SENIOR ASSOCIATE EDITOR Gabrielle Gurley ggurley@massinc.org | 617.742.6800 ext. 142

ASSOCIATE EDITOR Alison Lobron alobron@massinc.org | 617.742.6800

SENIOR INVESTIGATIVE REPORTER Jack Sullivan jsullivan@massinc.org | 617.742.6800 ext. 123

ART DIRECTOR Heather Hartshorn

CONTRIBUTING WRITERS Dave Denison, Colman M. Herman, Dan Kennedy, Neil Miller, Laura Pappano, Robert Preer, Phil Primack, B.J. Roche

washington correspondent Shawn Zeller

PROOFREADER Jessica Murphy

EDITORIAL ADVISORS Mickey Edwards, Ed Fouhy, Alex S. Jones, Mary Jo Meisner, Daniel Okrent, Ellen Ruppel Shell, Alan Wolfe

PUBLISHER Gregory Torres gtorres@massinc.org | 617.742.6800 ext. 103

SPONSORSHIP AND ADVERTISING Samantha Vidal svidal@massinc.org | 617.742.6800 ext. 147

circulation Krisela Millios kmillios@massinc.org | 617.742.6800 ext. 145

> Full contents, as well as online exclusives, are available at www.commonwealthmagazine.org

CommonWealth (ISSN pending) is published quarterly by the Massachusetts Institute for a New Commonwealth (MassINC), 18 Tremont St., Suite 1120, Boston, MA 02108. Telephone: 617-742-6800 ext. 109, fax: 617-589-0929. Volume 15, Number 3, Energy/Environment 2010. Third Class postage paid at Holliston, MA. To subscribe to *CommonWealth*, become a Friend of MassINC for \$50 per year and receive discounts on MassINC research reports and invitations to MassINC forums and events. Postmaster: Send address changes to Circulation Director, MassINC, 18 Tremont St., Suite 1120, Boston, MA 02108. Letters to the editor accepted by email at editor@massinc.org. The views expressed in this publication are those of the authors and not necessarily those of MassINC's directors, advisors, or staff. *CommonWealth* is a registered federal trademark.

Education reporting in *CommonWealth* is sponsored in part by the Nellie Mae Education Foundation.

MassINC is a 501(c)(3) tax-exempt charitable organization. The mission of MassINC is to develop a public agenda for Massachusetts that promotes the growth and vitality of the middle class. MassINC is a nonpartisan, evidence-based organization. MassINC's work is published for educational purposes and should not be construed as an attempt to influence any election or legislative action.

The CITIZENS' CIRCLE

For information on joining The Citizens' Circle, contact MassINC at (617) 742-6800 ext. 101



MassINC's Citizens' Circle brings together people who care about the future of Massachusetts. The generosity of our Citizens' Circle members has a powerful impact on every aspect of our work. We are pleased to extend significant benefits, including invitations to our private Newsmaker series, to those who join with a minimum annual contribution of \$1,000.

Anonymous (8) David Abromowitz William Achtmeyer Nicholas Alexos Tom & Marsha Alperin Joseph D. Alviani & Elizabeth Bell Stengel Carol & Howard Anderson Ronald M. Ansin Marjorie Arons-Barron & James Barron Jay Ash Richard J. & Mary A. Barry David Begelfer The Bilezikian Family Joan & John Bok Kathleen & John Born Frank & Mardi Bowles Ian & Hannah Bowles John A. Brennan Ir. Rick & Nonnie Burnes Jeffrey & Lynda Bussgang Andrew J. Calamare Heather & Chuck Campion Marsh & Missy Carter Neil & Martha Chayet Gerald & Kate Chertavian Meredith & Eugene Clapp Margaret J. Clowes John F. Cogan Jr. Dorothy & Edward Colbert Ferdinand Colloredo-Mansfeld Franz Colloredo-Mansfeld Philip & Margaret Condon William J. Cotter William F. Coyne Jr. John Craigin & Marilyn Fife Michael F. & Marian Cronin Stephen P. Crosby & Helen R. Strieder Bob Crowe Sandrine & John Cullinane Jr. Sally Currier & Saul Pannell Thomas G. Davis William A. Delaney **Richard B. DeWolfe** Gerard F. Doherty Roger D. Donoghue William & Laura Eaton

Philip J. Edmundson James & Amy Elrod Susan & William Elsbree Wendy Everett Scott D. Farmelant Juliette Fay & Bill O'Brien **Fish Family Foundation** David Feinberg Grace Fey Newell Flather Christopher Fox & Ellen Remmer Robert B. Fraser Nicholas Fyntrilakis Chris & Hilary Gabrieli Darius W. Gaskins, Jr. John Gillespie & Susan Orlean Paula Gold Lena & Ronald Goldberg Carol R. & Avram J. Goldberg Philip & Sandra Gordon Jim & Meg Gordon Tom Green Mr. & Mrs. C. Jeffrey Grogan Paul S. Grogan Kathleen Gross Barbara & Steve Grossman Paul Guzzi Henry L. Hall, Jr. Scott Harshbarger & Judith Stephenson Harold Hestnes Arnold Hiatt Joanne Hilferty Michael Hogan & Margaret Dwyer Liz & Denis Holler Ronald Homer Peter & Holly LeCraw Howe Maria & Raymond Howell Laura Johnson Philip Johnston Jeffrey Jones Robin & Tripp Jones Sara & Hugh Jones Ronnie & Steve Kanarek Martin S. Kaplan Dennis J. Kearney Michael B. Keating, Esq.

Dennis M. Kelleher William E. Kelly Tom Kershaw Julie & Mitchell Kertzman Klarman Family Foundation **Richard L. Kobus** Stephen W. Kidder & Judith Malone Deanna Larkin Anne & Robert Larner Gloria & Allen Larson Susan Winston Leff Paul & Barbara Levy Chuck & Susie Longfield Carolyn & Peter Lynch Kevin Maguire John & Marjorie Malpiede Jack Manning Anne & Paul Marcus William P. McDermott The Honorable Patricia McGovern Katherine S. McHugh Ed & Sue Merritt Dan M. Martin Paul & Judy Mattera David McGrath Peter & Rosanne Bacon Meade Mills & Company Nicholas & Nayla Mitropoulos James T. Morris Gerry Morrissev Edward Murphy & Ann-Ellen Hornidge John E. Murphy, Jr. Pamela A. Murray Paul Nace & Sally Jackson Bruce & Pam Nardella Scott A. Nathan **Richard Neumeier** Fred Newman **Elizabeth Nichols** Paul C. O'Brien Joseph O'Donnell Edward L. Pattullo & Elizabeth Pattullo Andrew Paul **Randy Peeler** Hilary Pennington & Brian Bosworth Finley H. Perry, Jr.

Daniel A. Phillips Jenny Phillips Diana C. Pisciotta Michael E. Porter R. Robert Popeo John & Joyce Quelch Mitchell T. & Adrienne N. Rabkin John R. Regier **Richard Rendon** Thomas & Susan Riley Mark & Sarah Robinson Fran & Charles Rodgers Barbara & Stephen Roop Michael & Ellen Sandler John Sasso Paul & Alexis Scanlon Helen Chin Schlichte Karen Schwartzman & Bob Melia Ellen Semenoff & Daniel Meltzer **Richard P. Sergel** Robert K. Sheridan Richard J. Snyder Alan D. Solomont & Susan Lewis Solomont Helen B. Spaulding Patricia & David F. Squire Harriett Stanley John Stefanini Mark S. Sternman Tim Sullivan The Honorable Jane Swift Ben & Kate Taylor Jean Tempel David Tibbetts M. Joshua Tolkoff Gregory Torres & Elizabeth Pattullo Thomas Trimarco A. Raymond Tye Tom & Tory Vallely E. Denis Walsh Michael D. Webb David C. Weinstein Robert F. White Michael J. Whouley Leonard A. Wilson Ellen Zane Paul 7intl



Coming this fall

The best MassINC research and journalism from the past two years. This invaluable election resource is for the informed candidate and the engaged, interested voter.





CHAIRMAN OF THE BOARD Ann-Ellen Hornidge

BOARD OF DIRECTORS

Gregory Torres, ex officio Jay Ash David Begelfer Andrew J. Calamare Neil Chayet Philip Condon Jay Curley Geri Denterlein Mark Frlich David H. Feinberg Grace Fey Robert B. Fraser Tom Green C. Jeffrey Grogan Harold Hestnes Joanne Jaxtimer Tripp Jones Elaine Kamarck Bruce Katz Paul Mattera William P. McDermott Melvin B. Miller Michael E. Porter

Dean Richlin Ken Robinson Mark E. Robinson Charles S. Rodgers Paul Scanlon Tom Trimarco Eric Turner David C. Weinstein Karyn Wilson

HONORARY

Mitchell Kertzman, founding chairman John C. Rennie, in memoriam

ASSOCIATE BOARD

Aimee Ward, ex officio Devin Cole, President of the Board Stephanie J. Anderson **Brendan Crighton** Jen Doyle Neal Glazier Daisy Gomez Tad Heuer LZ Nunn Cara Sullivan Liz Walczak

PRESIDENT Gregory Torres

EXECUTIVE VICE PRESIDENT John Schneider VICE PRESIDENT FOR DEVELOPMENT Lauren Smith Louison DIRECTOR OF FINANCE & OPERATIONS Aimee Ward ASSISTANT DIRECTOR OF OPERATIONS Krisela Millios RESEARCH DIRECTOR Ben Forman DIRECTOR OF COMMUNICATIONS & OUTREACH Marjorie Malpiede WEB & MARKETING COORDINATOR Samantha Vidal **PROGRAM ASSOCIATE** Christina Prignano

INTERNS Alison Singer, David Sloand

CommonWealth magazine is printed on FSC-certified recycled paper, manufactured with an elemental chlorine free process, using soy inks and 100% certified wind-energy credits for production.





CommonWealth

volume 15, number 3 | energy / environment 2010



ARTICLES

- 20 | THE BIG BET Massachusetts is pushing ahead with an ambitious green agenda, but there has been remarkably little debate about the scope of that agenda or alternative scenarios. BY BRUCE MOHL
- 28 SEEING GREEN With an abundance of innovators and entrepreneurs, and venture capitalists to fund them, Massachusetts is poised to do well by doing good in the clean-energy economy. But that doesn't mean green jobs will be growing on trees. BY MICHAEL JONAS
- 38 WHO IS THE REAL ENVIRONMENTALIST? There's a growing split between those willing to accept some disruption of the natural landscape to combat climate change and those who refuse to compromise. BY GABRIELLE GURLEY
- 44 ATTITUDE ADJUSTMENT San Francisco far outpaces Boston in recycling efforts, and tougher laws may be only part of the reason. BY ALISON LOBRON

DISCUSSION

50 CONVERSATION Ian Bowles is in charge of a sweeping series of energy and environmental initiatives designed to get Massachusetts off the fossil fuel roller coaster. And he's betting that the Bay State economy will benefit from the change. BY BRUCE MOHL

DEPARTMENTS

- 7 | EDITOR'S NOTE
- 8 | INQUIRIES Cheap, clean power puts Holyoke on the map; Q&A with Thomas King of National Grid; The future of nuclear power.
- 14 STATS AND MAPS Fuel for thought BY JACK SULLIVAN
- 17 | WASHINGTON NOTEBOOK Federal climate law could preempt state laws BY SHAWN ZELLER
- 57 | PERSPECTIVES Renewable power requires a major investment in infrastructure and technology. BY GORDON VAN WELIE

State's energy policy oversells the benefits of renewable power and conservation efforts. **BY JONATHAN HAUGHTON**

A low-carbon fuel standard makes sense for Massachusetts. BY JEREMY MCDIARMID AND ABIGAIL ANTHONY

Long-term renewable energy contracts should be put out to competitive bid. BY EDWARD N. KRAPELS

VISIT WWW.COMMONWEALTHMAGAZINE.ORG

THANK YOU!

MassINC would like to recognize the contributions from our sponsors whose support made the publication of this special issue possible

Associated Industries of Massachusetts Boston Society of Architects Dominion ISO New England Massachusetts Bay Commuter Railroad MassDevelopment HEFA, the Massachusetts Health and Educational Facilities Authority National Grid NAIOP New England Independent Transmission Company LLC NRG Energy



An overdue cost-benefit analysis

WHEN GOV. DEVAL Patrick signed sweeping energy legislation into law two years ago, the headline in the *Boston Globe* the next day was: "State starts a green era."

The story was strikingly positive, reflecting none of the uncertainty that has come to characterize energy policy in the United States. It simply laid out what the Green Communities Act would do. There was no discussion of alternative approaches; indeed, there were no negative comments at all. "Climate change is the challenge of our times, and we in Massachusetts are rising to that challenge," Patrick said.

In this special issue of *CommonWealth*, we try to assess how successful we've been. Our coverage focuses on what the state is doing to reduce dependence on fossil fuels and curb greenhouse gases, how much these efforts will cost, and how those costs are largely hidden from public view. We also investigate whether going green will be the economic development and jobs bonanza Patrick has promised. Other stories in the issue examine how the environmental movement is splintering in this age of climate change and why Boston takes such a hands-off approach to recycling—especially when compared to one west coast city with similar demographics.

We don't spend any time debating climate change. We assume it is real and citizens of the world need to do something about it. What they should do, and how fast they should do it, is open for debate.

The terms of that debate can change fairly quickly. Nationally, the BP oil disaster in the Gulf of Mexico is having an impact on climate change discussions in Washington. Here in Massachusetts, the talk is more about the price of fossil fuels. When the Green Communities Act was signed into law in July 2008, oil and natural gas prices were at all-time peaks and renewable power seemed very attractive. Today, oil and gas prices have fallen back to roughly half of what they were two years ago, and renewable power seems costly by comparison.

There are also strategic issues to consider. Should Massachusetts, with its strong environmental record, be leading the way to a green future even if it puts businesses here at a competitive disadvantage, at least initially?

As I struggled with these issues, I read two books that approach climate change from very different angles. In *Our Choice*, former vice president and Nobel Prize winner Al Gore says the tools exist to solve the climate crisis. He doesn't dwell on what these tools will cost and instead says what's needed is collective will.

"We can solve the climate crisis," Gore writes. "It will be hard, to be sure, but if we choose to solve it, I have no doubt whatsoever that we can and will succeed."

Robert Bryce, the author of *Power Hungry: The Myths of* 'Green' Energy and the Real Fuels of the Future, dismisses Gore's "happy talk" about wind, solar, and other renewables becoming major power sources in the near future. He says these renewables yield too little power at too high a cost in terms of dollars and real estate. He recommends using natural gas, the cleanest of the fossil fuels, as a bridge to a future filled with nuclear power.

"People in the United States and around the world are hungry for power," Bryce writes. "They want it for their cars, motorcycles, and lawnmowers, and they want it for their flat-screen TVs, mobile phones, computers, and Cuisinarts. They want power because power drives those devices and in doing so creates wealth and increases personal happiness."

Gore and Bryce represent very different approaches to climate change and very different views of the world. Gore's world view is driving much of what we are doing now in Massachusetts, but Bryce's philosophy is also reflected in that the state has dramatically shifted away from oil and embraced natural gas in the production of electricity. The green era has begun in Massachusetts. It's time now to discuss what, exactly, that means.

Bruce Moke

BRUCE MOHL

inquiries

41 munis, but no new ones since the 1920s

There are 41 municipal electric companies scattered across Massachusetts that charge, on average, 21 percent less for their power than the four investorowned utilities that serve the rest of the state. But no munis have been established since the 1920s.

The reason utilities like National Grid and NStar have a lock on the business is because they can reject municipal attempts to purchase their assets in a town even after the Department of Public Utilities sets a reasonable price for them. Legislation filed by Sen. Robert O'Leary, a Barnstable Democrat, and Rep. Jay Kaufman, a Lexington Democrat, would change that, requiring a utility to sell its assets in a community if the DPU sets a price and a town agrees to pay it.

"The point of this legislation is to create competition so that the large investor-owned utilities don't consider their service areas as God-given monopolies," says Patrick Mehr, the statewide coordinator for the Massachusetts Alliance for Electric Choice, a group pushing for the change.

Even if the bill passes, few expect a stampede of municipal takeovers. A state study of the issue found that municipalities trying to break into the power business now would incur heavy debt burdens, exorbitant startup costs, and probably end up charging higher rates. "The idea of putting enormous new burdens on the cities and towns' balance sheets...is not to be done lightly," says Philip Giudice, the Department of Energy Resources commissioner.

BY GABRIELLE GURLEY

Cheap, clean energy stirring interest in Holyoke

BY BRUCE MOHL

CHEAP, CLEAN ELECTRICITY is putting the city of Holyoke on the map.

Holyoke, one of the poorest cities in Massachusetts, hasn't attracted any significant business development in a long time. But companies are starting to show interest in the old mill town because its municipal utility has something they want: electricity that—because it's predominantly hydro and nuclear—is the cheapest in New England and largely carbon-free.

A consortium of high-profile universities and companies is planning to open an \$80 million high-performance computing center in downtown Holyoke in late 2012 that will connect to the campuses using existing fiber optic lines. The center is expected to use 7.5 megawatts of electricity initially, growing to 15 megawatts after five years, or nearly a quarter of the existing electricity load of the city of 40,000 people.

James Lavelle, general manager of the city-owned Holyoke Gas & Electric, said he can meet the computing center's initial needs with hydroelectricity from a dam and a series of locks on the Connecticut River, purchases from the Seabrook and Millstone nuclear power plants, and an existing power plant that can run on either oil or gas. To meet the center's future power needs, Lavelle said he will have to expand the city's hydroelectric capacity and probably bring on some wind power.

COMPUTING TAKES LOTS OF ENERGY

The computing center itself will produce relatively few jobs beyond the initial construction work, but city officials hope its location in downtown Holyoke will spur additional development in the area and attract additional companies interested in low-cost power.

"We're looking at it as a catalyst for attracting jobs and investment," says Kathleen Anderson, director of planning and development for Holyoke. "People want to be part of that."

Eric Nakajima, the state's senior innovation advisor, said the mere fact that big-name universities like MIT, the University of Massachusetts, Boston University, Northeastern, and Harvard want to locate an important facility in Holyoke is creating a lot of positive buzz about the city and its officials. "Let's face it," he says. "For major institutions in Boston and elsewhere, [Holyoke] wasn't even on the radar screen before."

Lavelle said Holyoke will sell power to the computing center at the industrial rate of 8.4 cents per kilowatt hour, the lowest in New England and less than half of what it would cost in Boston and Cambridge. Price is not the only selling point. Lavelle says the municipal utility produces on average 100 pounds of carbon dioxide for every megawatt hour of electricity it gen-





erates; the New England average is 10 times as much, or 1,000 pounds per megawatt, he says.

The high-performance computing center is designed to help researchers who need massive computing power to do complex calculations, like modeling climate change. Universities across the state are facing growing demand from more and more academic disciplines for powerful computing capability at a time when the cost of providing that capability is rising quickly.

Claude Canizares, vice president for research at MIT, said the university was starting to run out of computing space two years ago when it began reviewing its options. It came across Holyoke and liked the fact that the city offered cheap, clean power, had access to fiber optic lines, and was located at a New England crossroads, the intersection of the Massachusetts Turnpike and I-91.

When the economy went south, MIT's computing center almost went with it. But MIT began talking to other universities and the state and what started out as a single-university effort quickly grew into a joint venture of five universities, two companies (EMC and Cisco), and the state. Each university is contributing \$10 million, the two companies are chipping in a total of \$5 million, and the state is adding \$25 million. The group has established a nonprofit called the Massachusetts Green High Performance Computing Center and is recruiting an executive director.

Canizares said the universities are looking at ways to configure their computers at the center so they consume less energy. They are also trying to find ways to have the computers work together, an academic version of what he called cloud computing.

The university collaboration in connection with the

center is now expanding into other areas. MIT and UMass, for example, worked together on an application for a major Department of Energy grant and other joint projects are in the works.

"They're learning how to work together," Nakajima says. "If we get it right here, then it gives us the possibility for much greater endeavors down the road."

Bill Ennen, program director for development assistance at the Massachusetts Technology Collaborative, another state agency working on the project, said the computing center should pay big dividends for Holyoke. But he said it also represents a big opportunity for the universities and the state to do a better job of competing for federal research grants that have become the lifeblood of the economy.

"This is one of the best economic development stories we've run into," he says.

8 questions for Tom King, president of National Grid-US

BY BRUCE MOHL

cw: Why does National Grid make a portion of your salary contingent on meeting a company carbon-reduction target?

KING: National Grid is committed to taking a leadership role in addressing climate change and ensuring emissions management is integrated into all operational decision-

making. We believe in it and want to lead by example.

cw: What's the company's carbon-reduction goal this year and how much of your salary is riding on meeting that goal?

KING: As a company, we have a goal to reduce our carbon emissions by approximately 8.7 million metric tons of CO2 this fiscal year. Our company-wide goal is to reduce 80 percent of our carbon footprint by 2050, and we are currently at roughly a 40 percent reduction achieved. The percentage of my compensation at risk if we fail to reach our annual carbon reduction targets is 5 percent.

cw: Does the carbon-reduction mentality at work spill over into your private life?

KING: Yes. Everything from switching out incandescent light bulbs in favor of compact fluorescents to energy demand reduction to having my family's entire carbon footprint measured, including home, cars, air travel, etc. Once calculated, I then purchase carbon offsets to ensure my family's carbon footprint is offset completely. This provides funds to support renewable energy, energy efficiency and reforestation.

cw: Do you favor a national tax on carbon?

KING: To help us effectively reduce our carbon emissions, as well as help drive investment in new and cleaner technologies, we do need a cost on carbon. Some believe that a carbon tax may be the best way to introduce carbon cost. We prefer a legislative solution that incorporates a market-based system to reduce carbon emissions that is fair and equitable for our customers.

cw: The power you want to buy from Cape Wind is a lot more expensive than the current cost of electricity. Why do you think the deal is a good one?

KING: We cannot keep relying only on a fossil or a carbon-fueled economy. The Gulf oil spill is a reminder of that. We negotiated what we believe was the best possible price for this project. It is not the lowest cost renewable resource, but it also is not the highest either. Large-scale projects can't get financed without long-term contracts. The Cape Wind project has many attributes that are extremely attractive from the perspective of the environmental and other non-price objectives: (1) it places Massachusetts in a leadership role, (2) it will be the first

When you think of the region's power grid, remember this name: ISO New England.

ISO New England operates the region's power grid reliably, makes certain that New England's wholesale electricity markets are fair and efficient, and manages power system planning to ensure the region's consumers have the electricity resources needed today—and in the future. Created in 1997, the ISO is an independent, not-for-profit corporation located in western Massachusetts.



<u>new eng</u>land

For more information, please visit our Web site at www.iso-ne.com





project of this scale, and (3) it will place Massachusetts with a formidable source of lower-carbon energy, creating significant carbon credits that will create value under a carbon tax or a cap and trade mechanism.

cw: Why does National Grid deserve an annual fee worth 4 percent of the Cape Wind contract just for signing the deal?

KING: Utilities will have to hold the contracts for a long term, creating contract risk as energy markets fluctuate, and the accounting rules require that we place the contract on our balance sheet as a liability, increasing our risk profile. The Legislature recognized this and specified this remuneration in the law to address this risk and make it more attractive for a utility to put its balance sheet at risk to ensure large resources of renewables are developed.

cw: Massachusetts is implementing most of its energy initiatives through investor-owned utilities and paying for those initiatives with charges on customer bills. Do you think your customers are aware that a growing chunk of their bills is going to pay for these state policies?

KING: I am not confident that all customers understand all aspects of the bill. Utility bills are complicated, and we need to do more to ensure customers understand bills; we do need to simplify them. National Grid's costs are but a fraction of the bill, with the larger part comprising commodity cost and other energy policy-related costs. As an example, on our electric bills, RECs (environmental certificates) and RGGI (carbon trading) costs are not listed in detail, and are environmental costs in energy or power supply costs. In contrast, we do show the energy efficiency charge—and as you know these costs are changing due to implementation of new, consolidated, comprehensive statewide programs—so that customers can see how they are paying for energy efficiency. Each utility's bill structure is derived through regulatory direction, so to improve the bill structure and understanding we need to work on this together with all stakeholders.

cw: Do you think states like Massachusetts should be leading the fight against climate change, or should they wait for the federal government to set national policy?

KING: Absolutely, we should lead. It's inspiring to see Massachusetts in a lead role. We don't have federal energy and climate legislation, so it's right that individual states move forward in this area. We really can't afford to wait.

Nuclear: Obama on board but not Patrick

BY GABRIELLE GURLEY

PRESIDENT BARACK OBAMA and Gov. Deval Patrick see eye-to-eye on most energy issues—except nuclear power. Obama is on board, but Patrick isn't in any hurry to catch up.

Nuclear power received the White House seal of approval earlier this year when Obama backed federal loan guarantees to the tune of more than \$8 billion for Southern Co., one of the country's largest power generators, to build two reactors in Georgia. If constructed, they would be the first nuclear plants constructed in the United States in more than three decades.

Splitting atoms to generate electricity is moving up the clean energy charts because nuclear plants do not emit carbon dioxide, which has been fingered as the major culprit in climate change. Nuclear power also offers the prospect of reliable, base-load power, in contrast with renewable energy, which depends on intermittent wind or solar conditions. A March Gallup poll found that 62 percent of Americans supported nuclear energy.

Richard Lester, head of MIT's nuclear science and engineering department, says reducing carbon emissions will require building more nuclear power plants. "There seems to be almost no possibility, in my view at least, of being able to achieve these very ambitious carbon reduction goals without a significant increase in nuclear power nationally," he says.

But even as nuclear power gains respectability nationwide, concerns about safety, siting, and costs continue to dominate the flip side of the conversation. A 2009 Gallup poll found that 42 percent of Americans thought nuclear plants were not safe. Those strong reservations are reflected in New England, where there is no enthusiasm for building new nuclear plants. Nuclear power accounts for about 30 percent of the region's electricity, and 14 percent of the power in Massachusetts.

Gordon van Welie, president and chief executive officer of ISO-New England, which operates the region's power grid, says the memories of the grueling permitting process and high construction costs associated with first generation plants like the New Hampshire-based Seabrook Station, which drove its original owners into bankruptcy, are still fresh. "New England burned its fingers rather badly last time around," van Welie says. "People haven't forgotten any of that."

Fears about the dark side of nuclear landed on Patrick's doorstep with a thud earlier this year when tritium leaks were discovered at the Vermont Yankee nuclear plant in Vernon near the Massachusetts border. Traces of the deadlier cesium-137 were also discovered in the soil around the plant. Those problems led the Vermont Senate to vote overwhelmingly earlier this year not to renew the license of the Green Mountain State's sole nuclear plant, when it expires in two years. (Vermont is the only state in the country where lawmakers weigh in on licensing.)

Patrick asked the US Nuclear Regulatory Commission to consider "extensive testing" for both tritium and other radioactive substances at Vermont Yankee and the Pilgrim Nuclear Power Plant in Plymouth, which are owned by the same company, Entergy. His top environmental official, Ian Bowles, subsequently visited the Plymouth plant and came away satisfied with its operations and supportive of its bid for relicensing. Bowles, however, urged the plant's owners to expand their air and water monitoring efforts.

Compared to coal and natural gas plants, the capital cost of building conventional nuclear plants is astronomical, running in the tens of billions of dollars. Nuclear plants can also take more than a decade to go through the federal permitting process. The industry is trying to develop smaller, cheaper reactors that could be built in factories and transported by tractor trailer to their ultimate destination, but the design hasn't been tested yet. "Nuclear as it's currently constituted—that is, plants that people know how to build—is not a climate solution," says Seth Kaplan, vice president for climate advocacy at the Conservation Law Foundation in Boston.

Van Welie says nuclear power will figure in New England's future, but he says any rebirth of the industry will probably take place elsewhere. "In the long run, I think nuclear does make sense. [But] I don't expect anything will be built in the next 10 years," he says.

Energy efficiency drives reinvention of Bay State company

BY PHIL PRIMACK

THE ROOTS OF East Walpole-headquartered Hollingsworth & Vose Co. extend back to the 18th century and to a product as basic as rag paper. But today, this old-line manufacturing firm is going through another reinvention of itself as it taps into the growing global demand for more energy-efficient products. H&V has become one of the world's leading producers of specialized filtered media papers, which, despite their dull label, improve the efficiency of products as diverse as batteries in hybrid cars and the ventilation systems that help keep laboratory "clean" rooms clean.

"My family has been involved with this company since the 1790s," says Val Hollingsworth, president and CEO of the firm, which employs about 250 people at operations in East Walpole and West Groton. The company also has manufacturing plants and research centers in Mexico, Europe, and Asia. "We have survived because we continually bring out new products. Energy efficiency and environmental factors are going to be two of the biggest drivers of our business going forward because the products we develop and manufacture can serve a range of customers looking to filter air and liquid in ways that use less energy."

One thing this old company no longer really produces is, well, basic paper. "That

NEW PRODUCTS ARE KEY TO SURVIVAL

is, well, basic paper. "That paper filter in your coffee maker doesn't look anything like what we're talking about here," says H&V Vice President and

General Manager John Madej. Take, for instance, the company's "battery separator" products. While the firm has been making materials that separate the cells in car batteries since 1980, its R&D efforts have led to a new product and a potentially major market.

With the European Economic Union requiring reduced carbon dioxide output beginning in 2012, car makers are seeking ways to cut exhaust emissions without harming energy efficiency. Because many hybrid cars use "startstop" technology—to reduce idling, the engine turns itself off when the vehicle is in neutral and turns it back on when driving resumes—their batteries face heavy stress and wear. H&V's battery separators allow the battery's electrical chemistry to function more efficiently, thus enhancing performance.

inquiries

BMW, Mercedes-Benz, Volkswagen and other car makers have already adopted this technology in their European fleets. And if the United States gets more serious about requirements to reduce car emissions here, demand for H&V battery separators could jump, which would keep this old Massachusetts manufacturer working through another century. "We've been trying hard to keep jobs in Massachusetts mills that have been running for more than a 100 years," says Hollingsworth.

Hollingsworth's family ties to the firm go back to a Quaker ancestor, an apprentice paper maker from Delaware, who found work in a mill in Neponset near Quincy that dated back to 1728 and which made rag paper. "He had the wisdom to marry the boss's daughter," says Hollingsworth. "To help find work for two of his sons, he bought the Revere copper works in Braintree and converted it to a paper mill. In 1843, those two brothers ran out of money and could no longer buy rags from which to make paper." They turned to other products, and the company was born.

Over the decades, the firm developed different paper products, such as the paper-like material used to wrap wiring in old houses. In the 1940s, wartime demand moved the company into filtration products, setting the course for the battery separators and other product lines being developed and sold today.

H&V is not the only old-line Massachusetts manufacturer responding to new energy markets. Madico Inc. began in 1903 by manufacturing leather postcards. The company later developed and made products such as tinsel and wrapping paper and, in the late 1960s, began producing the window film treatments used to reduce energy consumption in hot climates. Today, Madico manufactures film materials and advanced laminates used in a variety of safety and energy products, including the solar panels that power the firm's manufacturing and distribution headquarters in Woburn. Madico now has the world's largest market share of the protective sheets used to help protect solar panels and other photovoltaic products against weather and other conditions.

Such adaptations have helped companies such as H&V and Madico get through a very hard recession. As Madico President and CEO John Connelly put it, such firms must "select products that are technologically advanced and offer higher returns than those built by competitors." Bay State manufacturers have always faced such economic Darwinism, surviving through product and technology evolution, constantly identifying and adapting to new markets. Once, that meant producing rag paper for a burgeoning printing industry and tinsel to meet a fresh consumer demand. Today, an energy-conscious era is creating new opportunity to sustain not just the environment, but an old industrial sector.



Devens. Opportunity lives here.

With a wealth of innovative businesses in an active community setting, Devens can open doors for you. Companies such as Bristol-Myers Squibb, Integra Companies, and Xinetics, and amenities like nature trails and Red Tail Golf Club are just a few reasons Devens is bursting with energy. So if you're interested in joining a thriving community with great business opportunities at every corner, Devens presents the perfect solution. Contact Mika Brewer at 978-784-2906 for more information or visit www.devenscommunity.com.



33 Andrews Parkway Devens, Massachusetts 01434 800-445-8030 www.devenscommunity.com

The built environment shapes the world the world shapes our ideas our ideas shape the built environment



An ideas magazine published by the Boston Society of Architects/AIA For subscription information, write architectureboston@architects.org

Fuel for thought

BY JACK SULLIVAN

POWER. IT IS, to turn a phrase, the fuel of our economy. For centuries, we have relied on fossil fuels to generate the power we need for our daily lives. Fossil fuels run the cars we drive and the appliances in our homes. But they come with a hefty price, both for our pocket books and the environment. We've put together some graphics to show how Massachusetts compares to other states on a variety of energy yardsticks.

HIGHEST COSTS OF ELECTRICITY (CENTS PER KILOWATT HOUR)

HAWAII	24.58
CONNECTICUT	17.55
NEW YORK	15.62
ALASKA	14.76
RHODE ISLAND	14.40
MASSACHUSETTS	14.34
NEW HAMPSHIRE	14.27
NEW JERSEY	14.05
DISTRICT OF COLUMBIA	13.66
VERMONT	13.07
NATIONAL AVERAGE	9.52
Source: US Energy Information Administration, as of Feb. 2010.	

INCREASES IN CO2 EMISSIONS NATIONALLY BETWEEN 1990 AND 2007



Source: US Environmental Protection Agency

FUEL MIX

There's a near 50-50 chance the television you're watching is running on natural gas. That's the main source—49 percent—for generating electricity for Massachusetts consumers while most of the country relies on coal. But those are just two of the fuels ranging from nuclear to wind used to generate the current that connects nearly every aspect of our daily lives.

Source: US Environmental Protection Agency

A QUIET REVOLUTION: TOP U.S. MARKETS FOR HYBRIDS

NEW HYBRID REGISTRATIONS FOR 2009, TOP 5 STATES REGISTRATIONS PER 1,000 RESIDENTS

DISTRICT OF COLUMBIA	3.79
CALIFORNIA	1.54
WASHINGTON	1.53
VERMONT	1.42
MASSACHUSETTS	1.32
NATIONAL AVERAGE	0.87

Source: Hybridcars.com and R.L. Polk & Co.

Harnessing the energy buying power of nonprofits.

With the deregulation of electric and natural gas industries, PowerOptions[®] was formed to help nonprofits consolidate their energy buying influence. The first energy consortium of its kind, PowerOptions[®] quickly grew into the largest and most influential energy solutions partner in Massachusetts. With over 500 members throughout the Commonwealth spending more than \$200 million annually on their energy commodity, PowerOptions[®] has the leverage to negotiate advantageous contracts and savings for its members. Our mission is founded on one simple premise—to bring energy predictability, dependability and cost savings to nonprofits.

To learn more about PowerOptions® visit www.poweroptions.org

The Massachusetts Health and Educational Facilities Authority created PowerOptions® to enable nonprofit organizations to benefit from the deregulated electricity and natural gas industries.

WASHINGTON NOTEBOOK

Grass is greener

A federal climate change law would likely pre-empt state rules, worrying Massachusetts officials and environmentalists BY SHAWN ZELLER

LIKE THE HEALTH care bill before it, the fate of a new federal climate change law rests with the Senate. John Kerry is navigating a political minefield, with Republicans uniformly opposed to any effort to restrict carbon emissions and coal-state Democrats wary of moving legislation that could hurt businesses at home in an election year.

As with health care, the House has already acted. It passed a bill last year sponsored by another member of the Bay State delegation, Rep. Edward Markey of Malden, that would establish the first federal cap-and-trade program, capping the level of greenhouse gas emissions at 17 percent below current levels by 2020 and 83 percent below current levels by 2050, while requiring businesses to pay for the right to pollute. Utilities would also have to supply more of their power from renewable sources.

Kerry's approach is different. His bill would first subject electric utilities to a cap-and-trade program and then tackle other industries in future years. It would also seek to revive nuclear power and increase research into clean coal technologies. It's going to be a tough sell, as evidenced by the defection of Kerry's lone Republican partner in the Senate, South Carolina's Lindsey Graham, back in April.

But for Massachusetts, which in 2009 began implementing a regional initiative to cap greenhouse gas emissions and has long maintained tough vehicle emissions standards, a new federal program of either variety could be a very good thing. It could protect Massachusetts from regulatory arbitrage by businesses trying to escape state rules, and it could open up new opportunities for the state to win additional federal funding.

It would also make clear how big the regulatory window is for future state action. That is now up in the air, since a new federal law would likely preempt at least some state authority. And just how far a federal law would go in that direction is the biggest risk, so far as Massachusetts policymakers and environmentalists are concerned, since it could mean reduced revenues from the state's regional greenhouse gas initiative and less authority to pursue future regulation.

Markey and Kerry prefer to look at the best possible scenario. Kerry, for example, argues that the green jobs that a federal law will create will benefit states, like Massachusetts, that have strong research sectors. "This energy transformation is huge for our economic future in Massachusetts," he says. "The jobs this bill creates, the investments we have in research and development, our investment in clean energy production —all these things will be a huge economic boon to the state."

Markey argues that the state will benefit from a national cap-and-trade program because it would broaden Massachusetts's existing program, which covers only electric utilities. "With a national system that is more comprehensive, there will be a larger pool of revenues from polluters to use for clean energy programs," he says.

But there are also powerful interests pushing back against Massachusetts's best-case scenario. The businesses willing to go along with federal legislation insist that any federal law pre-empt state authority over emissions so that businesses have one clear standard to adhere to, rather than a patchwork of state rules. In their view, a federal law should replace regional cap-and-trade programs (like the Regional Greenhouse Gas Initiative of which Massachusetts is part), set a national vehicle emissions standard, and even restrict states' ability to set permitting rules for power plants or set standards governing the type of fuels used within their borders.

Though Markey's bill would not go nearly that far, it would place a five-year moratorium on the RGGI and any other state or regional programs. After that, states could revive their programs if they believed the federal law was providing insufficient environmental protection. But the provision has environmentalists worried that it could stall state innovation. In passing a federal law, "you're essentially making a bargain, trading away the ability for states to regulate in exchange for federal regulation," says Seth Kaplan, vice president for climate advocacy at the Conservation Law Foundation, a Boston–based environmen-

talist group. In that scenario, Kaplan adds, "If you are trading that for federal regulation that doesn't go far enough, that's what is known as a bad deal."

That's not to say that activists like Kaplan

believe the states can go it alone. Climate change is a worldwide problem, and regional and state efforts alone won't solve it. The regional program in Massachusetts, they admit, hasn't forced industry or consumers to feel much pain. With a generous carbon cap of 188 million tons of carbon dioxide emissions, covering only electric utilities, everyone agrees that the program is a modest one.

That modest scale has ensured that the program hasn't stirred up much opposition, even on the part of the utilities — who paid just \$2.91 per ton of emissions in 2009—or consumers, who faced a less than 1 percent increase in their electricity bills as a result of the initiative, according to a February report by the group Environment Northeast. But such a generous cap has also limited the RGGI's environmental impact.

Environmentalists like Kaplan say participating states were too cautious in setting the cap, assuming that electric sector emissions would grow at approximately 1 percent annually, as they usually had in the past. In reality, emissions slowed considerably last year, the result of the weak economy and plummeting natural gas prices. Those low prices prompted more use of natural gas, which is a lower-emitting fuel than oil or coal. As a result, Environment Northeast found that emissions in the region fell approximately 25 percent to 30 percent below the RGGI cap in 2009.

Even so, environmentalists believe that federal regulation will work best in combination with state efforts, with the states driving the federal government to adopt more ambitious requirements as the states succeed with them. In essence, they want the federal government to set a minimum standard that states could exceed, which is a deal-breaker for industry advocates. **STATE LEADERS TAKE** pride in what they have achieved and are reluctant to cede too much authority. Last year, even given their modest ambitions, the RGGI member states —Massachusetts, along with Connecticut, Delaware, Maine, Maryland, New Hampshire, New Jersey, New York, Rhode Island, and Vermont—became the first places in the nation to put a price on carbon emissions, auction off licenses to pollute, and reduce emissions. "We've shown that you can have a carbon market and auctions that work," says Laurie Burt, commissioner of the Massachusetts Department of Environmental Protection.

And for all their criticisms of the program's limited scope, environmentalists say that the RGGI has had an

Massachusetts is already pushing the envelope.

impact, both in modestly reducing emissions and in discouraging the development of new coal-fired power plants.

"It's a good demonstration program, and I think they did what they set out to do," says Judi Greenwald, vice president of innovative solutions at the Pew Center on Global Climate Change in Arlington, Virginia. By proving that it's possible, Greenwald says, Massachusetts has emboldened states in the Midwest and West to go farther. Multistate efforts in each of those regions are still in the design stage, but they are likely to be more ambitious, encompassing all industries (not just utilities) and setting a tighter emissions cap.

Absent any federal interference, RGGI member states may also up the ante beyond the 10 percent reduction in power sector emissions that the group originally set as its goal for 2018. A review process is built into the initiative in 2012, and Burt expects some mid-course corrections at that time—possibly even an expansion of the cap and trade system to cover the transportation sector. Environmentalists are hopeful that the participating states will also eliminate pollution permits that do not sell for a minimum price, thereby making those that remain more expensive.

Already, Massachusetts is pushing the envelope further than its fellow RGGI states. A 2008 state law requires greenhouse gas emissions to fall by at least 10 percent by 2020, and a report issued by Gov. Deval Patrick's administration earlier this year indicates the state is on target for a nearly 19 percent drop without any change in existing policies. Patrick's secretary of energy and environmental affairs, Ian Bowles—a former president of MassINC, the think tank that publishes *CommonWealth*—can raise the target to as high as 25 percent by year's end.

Burt says state leaders don't want to rest on their laurels.

They are working this year on developing a plan for a state low carbon fuel standard. It could require that gasoline distributors bring in alternative fuels with lower carbon footprints than gasoline, such as corn or sugarcane ethanol, to replace oil. Any federal requirement that got in the way of such "state complementary programs" would be a bad thing, she says.

With that, environmentalists wholeheartedly agree. "Anyone who looks at climate science with any degree of rigor can see that the gap between what science tells us we need to do and what is politically possible in Washington is a chasm," says Kaplan of the Conservation Law Foundation. What's needed, he says, "is federal greenhouse gas regulation that has the maximum effect it can and doesn't eliminate the states' ability to regulate."

But all that could be thrown into turmoil if federal legislation were to pre-empt state authority over greenhouse gas emissions. And Massachusetts businesses worry that the state could also lose control over the \$100 million it took in last year selling pollution permits. The state has worked with industry groups to ensure those funds have gone into energy efficiency and green jobs programs and not into the general fund, assuaging business's concerns about the regional program. By contrast, "in a national program, if we start sending money to the federal government, we need to make sure we get money back and that it's not just going into the federal coffers," according to Robert A. Rio, senior vice president of the Associated Industries of Massachusetts, a business trade group.

Markey and Kerry say such speculation is ill-founded and that they will fight hard to ensure their bill protects the state's interests. Markey argues that under the bill the House passed last year Massachusetts would be well positioned to pick up as much as \$200 million in additional funds, with half going to replace the RGGI funds and another \$100 million in federal research money that would be awarded to eight "clean energy innovation centers" selected on a competitive basis.

Kerry feels the same. "I know we can do it in a way that rewards what Massachusetts has already done," he says. But at the same time, Kerry says it's important to keep an eye on the ultimate goal of combating global warming. "It's impossible for states to go it alone in the long run, given the ultimate goal of a cleaner environment," he adds. "We need a national pollution reduction, carbon reduction mandate that brings the rest of the country up to New England's high standards."

The big bet by the second seco

scope or what might undermine it.

BY BRUCE MOHL

THE SOUTH SHORE community of Milton is planning to borrow \$6 million to build a large wind turbine on town land. Normally, a project of that magnitude in such a small town would be studied endlessly, but it whisked through town meeting in less than an hour because it's such a no-brainer.

Town officials expect the wind turbine to reduce the region's reliance on fossil fuels, curb greenhouse gas emissions, bolster the state's clean tech sector, and, most important of all, start turning a profit in its first year of operation. Over the course of 20 years, the town expects the turbine to return nearly \$8 million to municipal coffers.

This amazing confluence of financial and environmental gains is made possible by the Green Communities Act of 2008, which allows Milton to sell the electricity from its wind turbine back to its local utility, NStar, and collect roughly twice what other generators of electricity are paid for their power. The extra subsidy for Milton's wind project will be paid by all of NStar's ratepayers.

Fueled by similar subsidies, green projects are springing up all across Massachusetts. Falmouth has two wind turbines up and running and is preparing to add another. Cape Wind wants to put 130 turbines in Nantucket Sound. National Grid is installing a solar facility at its gas storage tanks in Dorchester. MIT is investing heavily in energy technology research and companies across the region are pursuing alternatives to coal, oil, and natural gas.

Bit by bit, project by project, Massachusetts is pushing ahead with an ambitious and well-coordinated green agenda that is essentially a bet on a future in which carbon emissions are costly, fossil fuels are increasingly scarce, and clean tech jobs are up for grabs. It's a bet that could very well pay off. But there has been remarkably little debate about the overall size of the bet or about alternative scenarios, particularly breakthroughs in the search for natural gas that could lead to plentiful domestic supplies at reasonable prices.

Most consumers are unaware of the green subsidies they are paying because they don't see them. They are

Most consumers are unaware of the green subsidies they are paying because they don't see them on their bills

hidden in plain sight on electric bills, tucked inside charges for power distribution and generation, the two main components of the bill. No one has calculated the full cost, but it is likely to exceed several billion dollars over the next three years and rise substantially in future years as green energy targets are ratcheted up and state officials follow through on plans to address greenhouse gas emissions from cars and trucks.

State officials say the cost of the energy investments will be offset by savings from lower electricity consumption and lower electricity prices, as well as reductions in world-threatening greenhouse gas emissions. But those savings are premised partly on assumptions about the pace of technology development and the future price of oil and natural gas. Gordon van Welie, president of ISO-New England, the region's power grid operator, likens Massachusetts to a car buyer trying to choose between the all-electric Chevy Volt and the gasoline-powered Toyota Corolla. The Volt, which is expected to debut this year, will cost more than twice as much as a Corolla, but its cost-per-mile driven and its carbon dioxide emissions will be far less.

Van Welie says Massachusetts, through its energy programs, is essentially choosing the Volt, betting that more costly green investments now will pay off in the future as the price of fossil fuels keeps rising. Will the bet pay off? "It's easier said than done," van Welie says. "It's clear it's going to cost a great deal of money in the short and medium term to address these issues."

THE MASSACHUSETTS PLAN

If the state of Massachusetts is betting on a green future, Ian Bowles is the one rolling the dice. The state's secretary of energy and the environment is convinced Massachusetts can reduce its energy use, curb greenhouse gas emissions, and ramp up the use of renewable power in a way that saves consumers money and creates jobs.

"We think the clean energy revolution will be the next American Revolution, run out of Boston and New England," he said at a Boston conference on climate change earlier this year.

The revolution, financed by utility ratepayers through assessments on their bills, has two major goals: Reduce energy usage, thereby avoiding the cost of constructing new power plants, and tilt the electricity fuel mix toward renewable forms of energy like wind and solar, which hopefully will displace higher-polluting fossil fuels.

The foot soldiers in this revolution are the Massachusetts investor-owned gas and electric utilities, which are heavily regulated by the state. "The state is using the utilities as a vehicle to move policies forward," says Janet Gail Besser, vice president of regulatory strategy and policy at National Grid. "We're happy to step up to the plate to do that."

The biggest initiative is a \$2.2 billion, three-year energy efficiency effort. Utilities hope to reach 2.4 million customers with energy audits, lighting and appliance rebates, retrofits, and even social-networking programs that let neighbors see how their energy use compares to each other. State officials say the three-year effort will reduce electricity usage across the state by 1.4 percent in 2012 and create or maintain 4,000 jobs.

Penni McLean-Conner, vice president for customer care at NStar, says the energy efficiency programs for the most part build on what the utilities have been doing for years. "There are no new innovations here per se," she says. "It's about doing more and packaging it better."

Other initiatives are more experimental. Utilities, for

Hidden in plain sight

Most of the state's green initiatives are paid for through assessments on customer electric bills, but few of the charges are broken out separately on the bills.

Jane Doe 123 Electric Avenue Downtown, MA 12345

Utility Charges

Delivery Services	Customer Charge					6.43
	Distribution	.04697	Х	401	KWH	18.83 —
	Transition	.00685	Х	401	KWH	2.75
	Transmission	.01487	Х	401	KWH	5.96
	Renewable Energy	.00050	Х	401	KWH	0.20
	Energy Conservation	.00250	Х	401	KWH	1.00 —
	Delivery Service Total					35.17
Supplier Services	Generation Charge					
	Basic Service Fixed	.08880	Х	401	KWH	35.61
	Total Cost of Electricity					70.78

RENEWABLE ENERGY

Set charge that goes to the Clean Energy Center, which hands out loans and grants to promote clean tech. Raises about \$23 million a year statewide.

ENERGY CONSERVATION

This charge is collected by utilities to finance energy efficiency measures. Expected cost \$120 million this year, \$365 million by 2012.

GENERATION CHARGE

Regional Greenhouse Gas Initiative Generators of electricity make payments for every ton of carbon dioxide they produce. The cost of the payments, generally less than \$3 per ton, is rolled into the price the generators charge for their power, although it's not clear if the entire amount gets passed along to consumers. The payments themselves flow to the states participating in the initiative, with most of the money allocated for energy efficiency initiatives. Massachusetts is expected to receive \$62 million this year and a total of \$171 million by 2012.

Renewable Energy Certificates Renewable power generators are issued one REC for each kilowatt hour of electricity they produce. Companies that sell power to customers in Massachusetts must purchase these certificates to prove a portion of their electricity is coming from renewable sources. The requirement is 5 percent this year, rising one percentage point a year. Prices of the RECs have been hovering around 2 to 3 cents, but state officials say the cost will likely settle in around the cap of 6 cents. Power sellers must also buy a small portion of their RECs from Massachusetts-based solar power generators. The price of the solar RECs is set at a minimum of 30 cents a kilowatt hour and a maximum of 60 cents.

DISTRIBUTION

Energy Efficiency Reconciliation Charge If utilities encounter a shortfall in running their energy efficiency programs, they will be able to collect the shortfall via an assessment on all customers. Estimated at \$126 million this year, \$620 million by 2012.

Net Metering Utility pays customers generating their own electricity the retail rate for power instead of the wholesale rate. The cost difference is paid by all the utility's customers. No cost estimates available.

Smart Grid pilots Testing equipment to improve operation of the electric power grid and to make pricing more transparent to consumers so they will have an incentive to conserve. NStar is running a pilot that will cost \$15.5 million, half paid by federal government and half by NStar customers.

Utility solar National Grid is building five, one-megawatt solar installations at a cost between \$26.4 million and \$35.7 million. Ratepayers pick up the tab.

Decoupling Program compensates utilities who see their sales drop because of energy efficiency measures. Cost borne by all ratepayers. No estimates available.

Long-term renewable energy contracts Utilities are encouraged to sign long-term contracts to purchase electricity from renewable power developers to help them gain financing for their projects. The best example is National Grid's proposed contract for half of the power from Cape Wind. The cost is \$3 billion over 15 years. By National Grid's estimate, that price is 42 percent to 50 percent more than it would be if the utility purchased power on the open market. The above-market charges for Cape Wind power will be included in National Grid's distribution charge while the marketlevel portion of the contract will be included in the generation charge.

example, are launching smart grid pilot projects in a handful of communities to improve their delivery networks and to open two-way communication with customers. The goal is to reduce power demand during peak times by conveying real-time pricing information to customers so they run dishwashers and other appliances when electricity is plentiful and costs are low. During peak-demand times, the utility could even turn down customer thermostats to cut energy usage.

The regional power grid is also encouraging energy efficiency by essentially treating power generation and conservation the same. Instead of just paying power generators to produce more electricity, the market is also paying large consumers of electricity to cut their energy usage permanently or sharply reduce their usage during peak demand periods. These sorts of initiatives to reduce demand account for 9 percent of the region's electricity capacity.

To reduce greenhouse gas emissions, Massachusetts and nine other northeastern states are participating in a cap and trade system that sets a limit on overall electric utility carbon dioxide emissions. Under the system, utilities are required to buy allowances at regular auctions for each ton of their emissions. The emission targets have been set fairly high, so the price of allowances has stayed low (less than \$3 per ton) and the emission reductions haven't been very large. That could change if the targets are tightened or the federal government establishes a national cap and trade system.

The state has a lot of initiatives to promote renewable energy. All of them funnel subsidies to companies, municipalities or individuals to produce renewable power that would otherwise not be competitive under current market conditions. Federal tax breaks and subsidies supplement the state initiatives.

The broadest state subsidy program is the renewable portfolio standard, which requires a percentage of the state's electricity to come from new renewable sources. The requirement is 5 percent this year, rising 1 percentage point a year until it hits 15 percent in 2020.

Under the program, renewable power developers are paid like any other generator but they also receive special certificates for each kilowatt hour of electricity they produce. The certificates are as good as cash because companies selling electricity to customers in Massachusetts have to buy certificates equal to 5 percent of their sales. The price of the certificates fluctuates with supply and demand, but state officials expect it to hover for many years around the state-set cap of 6 cents per kilowatt hour.

Starting this year, Massachusetts electricity sellers are also required to buy a small portion of their renewable energy certificates from in-state solar power generators. The solar carve-out mandates a much higher subsidy of at least 30 cents a kilowatt hour and a maximum of 60 cents a kilowatt hour. (For comparison purposes, the wholesale price of power is about 5 cents per kilowatt hour and the retail price that consumers pay is about 9 cents.)

A number of other initiatives subsidize renewables in different ways. One is the net metering program that Milton plans to tap. Another directs utilities to enter into long-term contracts with renewable power developers to help them obtain financing for their projects. The most prominent example is National Grid's \$1.8 billion, 15-year contract to buy half of Cape Wind's electricity.

Utilities are also building their own solar facilities, a back-to-the-future initiative since utilities were forced by the state to divest all their energy businesses in the late 1990s. National Grid is currently building five, one-megawatt facilities on company-owned land, including an open area near the gas tanks along the Southeast Expressway in Dorchester. The company says its five installations will cost somewhere between \$26 million and \$36 million and generate electricity with an average price of 30 cents per kilowatt hour.

National Grid is fully committed to the state's green agenda. Edward H. White Jr., the company's vice president of customer strategy and sustainability, said in an affidavit filed with the company's solar proposal that the project is not cost effective under current market conditions, but should be built anyway.

"It is not possible to say today when solar generation will be less costly than the market price of electricity from the prevailing fossil-fuel driven market," White said. "But what is most important is taking initial steps to utilize new technologies that prepare us for a cleaner energy future, and solar can be an important part of that societal preparation."

THE COSTS

At a February climate change summit in Boston, hundreds of government officials, environmental advocates, and clean tech executives gathered to discuss how businesses can succeed in a low-carbon economy. Speaker after speaker extolled the virtues of going green. Then Robert Rio, a senior vice president at Associated Industries of Massachusetts, the state's largest business group, stepped to the microphone.

Rio said he was as green as the next guy, but had a question that no one seemed to be able to answer. "I just want to know what it costs," he said, referring to the state's green agenda. He said he was troubled that so many of the items on the agenda seemed to be focused more on making money or creating jobs instead of addressing environmental problems. "There's only a one-letter difference between green and greed," he said. The reason Rio hasn't been able to get an answer is because no one knows for sure. Many of the state's programs are just getting underway and their cost, relative to existing fuels, hinges on a number of variables, including the pace of technology breakthroughs, demand for electricity, and the future price of natural gas. There is little consensus on any of these variables.

ISO-New England, for example, is forecasting that electricity demand in Massachusetts will rise an average of 1.1 percent a year between 2010 and 2019, but Bowles says it will go down because of the state's energy efficiency measures.

The Patrick administration in April estimated the cost of solar carve-out subsidies at \$75 million a year for the next 10 years, or a total of \$750 million. An earlier report estimated an even higher annual cost. Bowles says neither forecast is accurate, predicting solar power will be price competitive in five years and need no additional subsidies.

National Grid's proposed contract with Cape Wind may include the most detailed analysis of a green initiative's cost. The utility estimates its 1.2 million electric

Most of the subsidy money for renewable energy is flowing out of state to suppliers in Maine, New York, and New Hampshire

customers in Massachusetts will pay somewhere between 42 percent and 50 percent more for Cape Wind power than they would if that power was purchased from conventional sources. That's \$734 million to \$885 million extra (in 2013 dollars) over the life of the 15-year contract. And it doesn't include an extra 4 percent fee (\$70.6 million in 2013 dollars) that National Grid will collect for doing the deal.

Consumers are also in the dark about the cost of the state's green initiatives. Virtually none of the subsidies they are paying are broken out on customer utility bills. There's a small charge for renewable energy, which goes to fund the state's Clean Energy Center, and a charge for energy conservation, but the cost of the other initiatives is being rolled into the distribution and power generation sections of the bill.

State and utility officials say it would be impractical to break out each environmental initiative on a customer's bill, but Robert Bryce, the author of *Power Hungry: The Myths of "Green" Energy and the Real Fuels of the Future*, says the lack of disclosure is leading many consumers to conclude that renewable energy is essentially free. "It ain't free and nobody is talking about the cost," he says. "The tax from all this green business is being hidden from the public because it's being put on their utility bill and not on their taxes."

Some potentially big, green bills loom on the horizon. Massachusetts policymakers have focused their attention on electricity and largely ignored the transportation sector's use of fossil fuels. That may change, particularly with the BP oil spill in the Gulf of Mexico dramatizing the nation's reliance on hard-to-get oil. Following the lead of California, Massachusetts and a number of other northeastern states are exploring the possibility of reducing the carbon content in fuels that power our cars, trucks, and buses, which could increase the price of gasoline.

ISO-New England says tapping bountiful wind resources in Maine and purchasing hydro and nuclear power from Canada could significantly boost the region's renewable energy supplies. But the agency says bringing that wind power to market in southern New England where it is needed would require the construction of new transmission lines at a midrange cost of \$10 billion. There is no consensus yet on who would pay for those lines, but in the past transmission costs have been divided among states in the region based on consumption, which would mean 46 percent of the tab would be paid by Massachusetts residents.

State officials say green investments will pay big job dividends, but most of the money that Massachusetts electricity customers are paying to subsidize renewable energy is flowing out of state. In 2008, electricity sellers in Massachusetts obtained only 11 percent of their renewable energy certificates from companies inside the state. Most of the certificates came from biomass, landfill gas, and wind projects in Maine (31 percent), New York (28 percent), New Hampshire (13 percent), and Canada (12 percent).

Massachusetts regulators are trying to steer more of this ratepayer money to in-state projects, but those efforts were challenged in court in April and most of them were subsequently set aside. TransCanada, a Canadian energy company that operates a wind farm in Maine and sells electricity in Massachusetts, says the Massachusetts-only policies violated the interstate trade provisions of the US Constitution. Mike Hachey, a top official at TransCanada's office in Westborough, says the goal of state renewable energy programs should be to find the best possible resources at the cheapest prices no matter where they are. "Otherwise, at the end of the day, the loser will be the customer," he says.

ALTERNATIVE SCENARIOS

Dexter-Russell, a Southbridge company that makes fine cutlery for food service professionals, is aggressively trying to cut its energy costs and carbon emissions. The company is installing new energy efficient lights, switching from oil to natural gas, and even considering building a hydroelectric project on the Quinebaug River that runs by its plant.

Yet Alan Peppel, Dexter-Russell's chief executive, says he sometimes feels like the company is running in place, cutting power usage but seeing little impact on its energy bills. He worries that state-backed investments in more expensive wind and solar power will only make it more difficult for Massachusetts to attract new businesses and for his company to compete against rivals in China and Brazil.

"The cost structure they have is very different from what we face," he says.

Peppel's concern raises an interesting policy question: Does it make sense for Massachusetts—a state with the sixth-highest electricity rates in the country and one of the best environmental records—to be leading the way on so many costly green initiatives?

Massachusetts already uses energy more efficiently and cleanly than almost every other state. It ranks 48th out of 50 states and the District of Columbia in energy consumption per capita. It ranks 29th in terms of overall greenhouse gas emissions, 47th when those emissions are adjusted for economic output.

The nation as a whole saw its carbon dioxide emissions rise 19 percent between 1990 and 2007, with emission levels in fast-growing states like Arizona and Colorado going up 62 percent and 52 percent, respectively. By contrast, carbon dioxide emissions in Massachusetts actually fell over that time period by 4.6 percent. Even more remarkable, state officials last year projected that emission levels in 2020 would show no increase over 1990 even if no new efforts were made to reduce them.

Massachusetts emission levels are relatively low because our economy has shifted away from manufacturing to lower-polluting service industries and because the state has dramatically changed the way it generates electricity, which accounts for about a third of all emissions.

In 1990, the state relied on oil and coal for two-thirds of its electricity generation, but by 2008 natural gas had displaced oil to become the dominant fuel. Natural gas burns more cleanly that the other two fossil fuels, producing half the carbon dioxide of coal and far fewer other greenhouse gases. Combined, natural gas and nuclear power now account for two-thirds of the state's electricity generation, with coal representing another quarter of the fuel mix.

Although Massachusetts has benefited environmentally from this shift in fuels, state officials argue that renewable sources of energy need to be developed to reduce reliance on electricity produced with natural gas. "We're tied to the fossil fuel roller coaster," says Bowles, the state's secretary of energy and the environment. "We're tied to the natural gas price, and getting off that roller coaster is important for pure economics."

Yet right now Massachusetts consumers are riding that fossil fuel roller coaster down. Retail prices for electricity are down about 30 percent compared to where they were two years ago when natural gas prices were at an all-time peak. Bowles says the current low prices for natural gas won't last, pointing to the steep up-and-down gyrations in the market over the last 10 years. He says projections about the future price of natural gas are notoriously wrong.

But there is growing evidence that natural gas may be an important fuel of the future. New drilling techniques developed in Texas have made it possible to economically tap gas trapped in shale rock formations that was once considered out of reach. Drillers fracture the rock with a mixture of chemicals and water, allowing the gas to seep out and be captured. While environmentalists have raised concerns about the process, it's a technique that has suddenly transformed the gas industry into the energy industry's hottest play. Industry officials say they are now sitting on reserves big enough to supply 100 years of consumption at current levels.

Big Oil is taking an interest. Royal Dutch Shell PLC agreed to pay \$5 billion in May for a Pennsylvania company that controls drilling rights in a promising shale area that stretches from West Virginia to New York. And last December, Exxon Mobil paid \$41 billion for XTO Energy Inc. of Houston, a major shale gas player. The industry activity is fueling speculation that natural gas could displace significant amounts of coal in electricity generation and even be viable as a transportation fuel.

For Massachusetts, a state that has already embraced natural gas as its primary fuel for electricity generation, the downward trend in prices and the brightening supply picture is both good and bad. The lower price of natural gas means electricity is cheaper, but it also means that wind, solar, and other forms of renewable energy will continue to need hefty subsidies to remain competitive.

The sudden resurgence of natural gas is a reminder that change happens quickly in the energy business and the state's bet on a green future is no sure thing.

"Public discussion is a political duty; this should be a fundamental principle of American government" –JUSTICE LOUIS BRANDEIS

Join the discussion @ the new massinc.org.

Visit our new website to participate in the pressing issues of the day. Weigh in on the politics and policies that support families, workers, businesses, and neighborhoods: jobs and economic security; strong communities; and government accountability. Receive our latest research, sign up for a MassINC event, and read our new blog INCSPOT.

Join the discussion at www.massinc.org and let us know what's on your mind.

Seeing Biographic Strategy With an abundance of innovators and entrepreneurs, and venture capitalists to fund them, Massachusetts is poised to do well by doing good in the clean-energy economy. But that doesn't mean green jobs will be growing on trees.

BY MICHAEL JONAS

THE AIR WAS thick with anticipation as US Secretary of the Interior Ken Salazar stepped to the microphone, even though the news he was about to make had already leaked out. With reporters jammed into the room at the Massachusetts State House and a bank of television cameras lined up against the back wall, Salazar announced that he was granting the final federal approval needed for the Cape Wind project.

After nine years of regulatory hurdles and fierce opposition from some on Cape Cod, the controversial wind energy project, which calls for 130 turbines to be anchored five miles off the Cape in Nantucket Sound, looked like it was actually going to happen. It would be the first offshore wind farm in the United States and would represent a major milestone for the US

renewable energy industry and a big victory for Gov. Deval Patrick, who has been a vigorous advocate for the project.

Standing behind Salazar at the late April press conference, Patrick had an understandably satisfied look. So much so in fact that, if it bothered him, he never let it show when Salazar twice referred to him as "Governor Deval." When it comes to clean energy, context is everything, as Patrick made clear when asked about the name flub a few weeks later. "He can call me just about anything when he comes with news like that," he says.

That's because the news Salazar delivered was the single biggest development yet in Patrick's all-out effort to position Massachusetts as a national—and global—leader in the drive to develop alternative energy. "America needs offshore wind power, and with this project Massachusetts will lead the nation," Patrick said in his remarks that day. He then invoked what has become his mantra, a line he started using during the 2006 campaign and one he seems to repeat at every opportunity. "If we get clean energy right, the whole world will be our customer," Patrick declared.

There is a lot going on in Massachusetts and the emerging clean energy sector that would support Patrick's lofty vision. But exactly what does it mean to get clean energy "right?" The state is investing in clean tech companies, rolling out hefty subsidies, and trying to grow jobs and support manufacturing in a global economy that can be harsh in sorting out winners and losers. There are a lot of moving parts and things that could go wrong. But it's also clear that you can't win if you don't play.

POWERFUL STORY

The clean energy movement—and the effort in Massachusetts to play a big role in it—is being propelled by an underlying narrative, which touches on everything from climate change to national security. From that context it is easy to argue that we need a radical break with our prevailing energy habits, and we must be willing to bear some of the cost of getting to that better energy future. That makes it very different from other recent technology waves, such as the computer boom of the 1980s. There was an overwhelming technology and market-driven logic behind the computer industry's explosive growth. Companies kept delivering higher performing computers at lower costs, creating an entirely new way to communicate and process information, touching on virtually every aspect of modern life.

The effort to shift the course of our energy future is being driven by a far more complex and challenging set of conditions. To begin with, it does not herald an entire new way of life as much as it represents an attempt to transform an existing \$6 trillion global industry by replacing some of its basic building blocks. "In order to succeed, you have to be competitive and you have to match the quality and reliability of the offerings that are already out there, provided by big, powerful, incumbent firms that have had decades to optimize their operations," says Richard Lester, director of the Industrial Performance Center at MIT and head of the university's department of nuclear science and engineering. "This makes innovation in the energy sector really a tough business."

The transformation of our energy world will depend ultimately on the technological innovation behind cleaner energy sources, but the momentum needed to support that innovation requires broad acceptance of a set of basic assumptions. The most prominent of these is that the world faces a whole host of impacts from climate change caused by the use of fossil fuels that will, if unchecked, prove catastrophic. There are also important national security concerns about the military and human costs of protecting oil interests in the Middle East. Finally, there is tremendous uncertainty about the long-term costs of energy and the supply of fossil fuels, with worldwide energy use projected to double by 2050. Layered on top of all that are the economics of renewable energy technologies like wind and solar power, which are not yet competitive with fossil fuels, a situation that requires a heavy governmental hand to stimulate and subsidize the clean energy sector.

Not everyone finds the narrative to be compelling. At a recent conference in Boston of clean energy entrepreneurs, conservative contrarian George Gilder was part of a panel considering whether the industry was vulnerable to speculative economic bubbles. "Clean tech, as far as I can see, is worse than a bubble; it's a boondoggle," said Gilder, who doubted the dangers of rising carbon dioxide levels in the atmosphere and dismissed the sudden embrace of "worthless medieval technologies like windmills."

To market purists like Gilder, the clearest proof of the folly of it all is the involvement of government in boosting almost every facet of the emerging clean energy sector. "Anything that needs to be subsidized by government is likely to be perverted and it's likely to yield far less than it costs," he said.

Most policymakers and energy industry leaders, however, think it's imperative that we develop alternative energy and lower our carbon emissions. That message was delivered during a visit this spring to Cambridge by no less of a fossil fuel spokesman than the CEO of Eni, a \$159 billion Italian oil and gas company that ranks 17th on the Fortune 500 list of largest global corporations. Paolo Scaroni was at MIT for the dedication of a solar energy research center, funded with part of the \$50 million that Eni has pledged to support energy research at MIT. "Oil one day will be finished," he said at the dedication of the center. That day is not imminent, perhaps 100 years off, but preparing for it is imperative, he said.

WITS AND WIDGETS

In sounding the call for energy innovation, Scaroni also endorsed the view that big breakthroughs will come from places like MIT. "If only 10 percent of what I've seen will materialize, it will change the world," Scaroni said of the several days he spent at the Cambridge campus.

The combination of world-renowned research universities and an investment and entrepreneurial culture eager to tap cutting-edge innovation are formidable assets that position Massachusetts to play a big role in the nation's energy future. As Ian Bowles, Patrick's secretary of energy and environment, framed it at a Boston University energy forum this spring, "Massachusetts should be a disproportionate beneficiary of the transition to a clean energy future."

Last year, Massachusetts ranked second in the amount of venture capital money invested in clean energy companies. Its \$389 million of investments put it behind only California, which saw \$2 billion invested, according to Cleantech Group, an energy investment research firm. The state also stands out in the race for energy-related research dollars. In last year's initial round of funding for a federal Department of Energy program supporting cutting-edge energy research, Massachusetts led the way, with its firms awarded 22 percent of the total outlay of \$151 million. California was second with 14 percent.

While the state's entire cluster of technology-oriented universities, which includes the University of Massachu -

setts Lowell and Worcester Polytechnic Institute, is key to our clean-energy success, MIT is clearly the flagship when it comes to research that is making its way into commercial applications.

Five years ago, soon after taking office as MIT president, Susan Hockfield committed the university to playing an even greater role in energy research. In an interview, Hockfield says the interlocking issues of climate change and reducing the use of fossil fuels represent "this era's greatest challenge."

In 2006, the university launched the MIT Energy Initiative, a university-wide effort that draws on expertise from across the campus to take on the challenge. Fully one-quarter of MIT faculty have participated in one way or another. And in a sign of the intellectual enthusiasm for the issue, more than 2,000 students have joined the MIT Energy Club, which sponsors everything from lecture series to a monthly "energy happy hour."

Hockfield has emerged as a leading spokeswoman for more federal spending on energy research. A neuroscientist by training, she points to the enormous strides in the treatment of AIDS and other conditions that have resulted from substantial federal support for biomedical research. Hockfield says we have failed to devote anywhere near the level of federal support needed to tackle the energy challenge the world is facing. In 2006, at the time the MIT energy initiative was started, the federal government was spending \$1 billion less on energy research and develop-

ment than it had a decade earlier.

MIT is certainly pulling its own weight, however, when it comes to energy research and tech-transfer—the crucial process of converting of research findings into commercial applications. "I often say that MIT was founded with tech-transfer in its DNA," says Hockfield.

MAKING IT IN MASSACHUSETTS

A123 Systems is one of the results of that DNA coding. The Watertown–based battery and energy storage company, started in 2001 with a \$100,000 grant from the federal Department of Energy, is an example of the promise of clean tech to the state's economy as well as the challenges the sector faces.

The company has made huge strides in the design of rechargeable lithium ion batteries, improving their safety, lifespan, and the power they can deliver, objectives that have often been technologically incompatible. The work is the brainchild of Yet-Ming Chiang, a materials science and engineering professor at MIT. In 2001, Chiang shared his ideas with Bart Riley, an engineer he knew who had more than a decade of experience applying research breakthroughs in industry. They joined with Ric Fulop, who Riley calls a "serial entrepreneur," to found the company. "We came about as a result of this start-up 'ecosystem' in the Boston area," says Riley. "He was the idea guy," Riley says of Chiang. "I was the make-it-real guy, and Ric was the business guy."

By 2009, the company was flying high and went public in an initial stock offering that raised \$378 million. Last year, A123 won a \$249 million grant from the US Depart ment of Energy to develop an advanced production facility in Michigan that will make batteries for plug-in hybrid and all-electric cars, part of a \$2.4 billion federal effort to support innovation in the US auto industry. The company also received generous financial incentives from Michigan to locate the plant there. But Massachusetts has not lost out entirely.

In April, A123 announced plans to develop a unit in Hopkinton to produce large-scale storage batteries that connect to the power grid. These huge, trailer-sized battery units will become increasingly important for storing electricity from wind and solar projects, which generate power intermittently. The state gave the company a \$5 million loan that will be forgiven if it follows through on its promise to add 250 new jobs in Massachusetts.

It's the kind of investment state officials say is critical to ensuring a robust clean energy sector in Massachusetts. Over the last several years, the state has invested more than \$33 million in companies through the Massachusetts Clean Energy Center. Mass Development, a quasi-public state agency, has awarded an additional \$27 million in loans, grants, and other forms of aid.

Although A123 officials say they are determined to have a manufacturing presence in the US, most of their manufacturing to date has taken place in Asia, at production facilities in China and South Korea. That highlights a major challenge facing the clean tech industry, and a perennial one faced by companies in the technology-oriented Massachusetts economy: While brainpower and entrepreneurial know-how make this a fertile environment for innovation, the manufacturing jobs that successful innovation can give rise to often end up elsewhere.

One of the main reasons why A123's first manufacturing plant was in China, says Dave Vieau, the company's chief executive, is because "98 percent-plus of lithium ion batteries were being produced in Asia." On top of the low capital and labor costs in Asia, it simply made sense to set up shop in a place where the relevant manufacturing processes were already well established.

That is a big problem facing US industry in general and the clean energy sector in particular, say Gary Pisano and Willy Shih, Harvard Business School professors who study economic competitiveness. They authored an article last year in the *Harvard Business Review* that lays out the danger as more and more manufacturing by US firms takes place overseas. The problem, they argue, is that a lot of the ongoing innovation that takes place with products occurs in the manufacturing process itself, a phenomenon that explains how virtually the entire rechargeable battery industry, which once had a significant presence in the US, migrated over time to Asia.

"Once manufacturing is outsourced, process-engineering expertise can't be maintained, since it depends on daily interactions with manufacturing," they write. "In the long term, then, an economy that lacks an infrastructure for advanced process engineering and manufacturing will lose its ability to innovate."

It's a view that A123's board chairman, Desh Deshpande, shares wholeheartedly. "The thinkers and the doers have to be together," says Deshpande, a co-founder of the IT company Sycamore Networks who donated \$20 million to launch the Deshpande Center for Technological Innovation at MIT. Deshpande says manufacturing can only thrive in Massachusetts through advanced processes that drive down the "labor content" of products. "If our standard of living is four times that of the average in China, every worker [here] has to be four times more productive," he says.

Konarka Technologies, a Lowell–based solar company with roots at that city's UMass campus, found fertile ground in Massachusetts not only for its innovation and start-up but for manufacturing as well. But it may be more the exception than rule.

An economy that lacks an infrastructure for advanced process engineering and manufacturing will lose its ability to innovate

Last year, the company, whose products include a lightweight solar film that can be embedded on backpacks and café umbrellas, opened a manufacturing facility in a former Polaroid production plant in New Bedford. Because of the significant overlap between Konarka's solar film processes and those used by now-shuttered Polaroid, the company has been able to adapt and reuse 80 to 90 percent of the existing equipment at the plant. What's more, the initial 25 employees hired at the facility include a core group of 13 former Polaroid workers, who had years of experience with the plant and its workings. "We had a ready-made, trained workforce that's ready to go," says Rick Hess, Konarka's CEO. Hess says those serendipitous circumstances, plus the low cost of the print-based manufacturing process Konarka uses, made for an unusually favorable climate to pursue manufacturing in Massachusetts. "I don't think there will be a ton more companies that will be as fortunate or be in as good a position to do that," he says.

A report issued in April by the state's Clean Energy Center comes to a similar conclusion. "Although the state should seek to attract and retain manufacturing where possible," it says Massachusetts is unlikely to host large-scale clean tech manufacturing and should therefore "mainly focus on extending its leadership as a hub of research breakthroughs and innovation excellence."

LEVELING THE PLAYING FIELD

In May, the New England Clean Energy Council, an industry advocacy group formed in 2007, organized a trip to Washington, DC for leaders of the region's clean energy firms to meet with elected officials. At a clean tech forum in Boston prior to the trip, the council's co-chairman, Nick d'Arbeloff, was asked what he thought the group's top three priorities would be.

"The price of carbon, the price of carbon, and the price of carbon," he replied.

D'Arbeloff was referring to legislation that has been stalled in the Senate to create a national policy to address climate change by imposing costs on emitters of heattrapping gases that scientists say are the main cause of global warming. The principle behind levying a cost on carbon emissions comes from the economic concept of "externalities," the idea that fossil fuels have harmful effects that are not accounted for in the costs incurred by the emitters of such greenhouse gases.

"People are beginning to realize that many companies use the sky as their dumping ground, and there is a huge price ultimately that society is going to have to pay," says Edward Markey, the Massachusetts congressman who is co-sponsor of the Waxman-Markey climate legislation that passed the House of Representatives last year.

Attaching a cost to carbon emissions is crucial for the clean energy sector because raising the cost of burning fossil fuels would make renewable energy sources like wind and solar power more competitive and strengthen the economic argument for investing in energy efficiency measures.

"We can't let fossil fuels be priced as if they caused no harm," says d'Arbeloff. Those trying to develop the clean energy economy "are not looking for a handout or a thumb on the scale," he says. "They are simply looking for an even playing field."

Lester, the MIT Industrial Performance Center director, thinks we need a significant change in our patterns of energy use within the next 30 to 40 years to stave off the most catastrophic effects of climate change. He says innovation that lowers the cost of renewable energy will ultimately have to drive that change. But "economic incentives created by the play of market forces alone won't be enough to drive energy transformation on the scale and in the timeframe required," Lester wrote in a paper this spring.

That is the rationale for recalibrating the market by attaching a price to carbon dioxide emissions and for other public policy steps to support clean energy. Massachusetts has been a leader in state-based efforts to do that, with such moves as its membership in the Regional Greenhouse Gas Initiative, a consortium of 10 northeast states that has applied a modest tax on major carbon-emitting power plants. Patrick has pursued a very aggressive policy agenda in his first term, winning passage of three sweeping pieces of energy legislation that, among other things, set standards for use of renewable energy sources by utilities, steer money from utility-bill surcharges to support energy efficiency work, and provide grants, loans, and other incentives to clean energy companies.

Taken together, the various initiatives are having the effect of "goosing the market," says Kevin Doyle, a local consultant who studies workforce needs in the clean energy sector. "It's no secret that the growth of clean energy is completely tied up with appropriate government policies," he says. "Until renewables are the same or cheaper on the pure market, government policy is an essential driver for whether or not people will create jobs, build businesses, and have a reasonable rate of return on their investment."

SOLAR SYSTEMS

One state initiative to directly stimulate the market is a subsidy program that has spent \$135 million in state and federal funds to underwrite the cost of installing solar panels on residential and commercial properties.

Dan Leary, who served as a captain in the US Army in Kuwait before heading to business school at UMass Amherst, put together a business plan for his final class that involved taking advantage of state incentives for renewable energy. Nexamp, the company he founded in 2006, has quickly grown from four employees to close to 60. Leary says the company is on track to do about \$30 million of business this year, installing solar and wind-power equipment as well as conducting energy audits that identify savings through lighting redesign and other efficiency measures.

Ido Eilam is reaping the benefits of Nexamp's work and the generous subsidies that are fueling the company's growth. A founder of SunSetter, a Malden company that makes retractable patio awnings, Eilam contracted with Nexamp last year to install 616 solar panels on the roof of Sun-Setter's 64,000 square-foot facility, which houses the firm's manufacturing operations and offices. Nexamp also overhauled the company's lighting system. State subsidies covered roughly half the cost of the \$750,000 project, while a federal incentive program underwrote another quarter.

Eilam says the company's electricity purchases from his local utility decreased by 32 percent in January compared with the same month in 2009 and by 41 percent in February. For April, he says, the bill was zero and SunSetter actually received a credit on its electric bill. Through a system known as net metering, customers like SunSetter that are able to generate their own power can direct any excess electricity back into the power grid and get paid for it.

Eilam refers to "the circle" created by the project, since SunSetter's awnings are designed to keep homes cool in the summer by blocking the sun and reduce the electric-

> Clean tech firms are not looking for a handout or a thumb on the scale. They are simply looking for an even playing field.

ity demand on air conditioners. "We're using the good part of the sun, which means the ability to generate electricity, to make a product that protects people from the bad part of the sun, which is the heat and the UV rays," he says.

Would he have closed the circle without the huge subsidy? "The honest answer is, maybe no," says Eilam. He says it would have been very hard to finance the full cost of solar panels, which would take 10 to 12 years to recoup in electricity cost savings compared with the three- or four-year payback period with the deep subsidies he was able to tap.

More than 95 percent of Nexamp's business relies on state or federal incentive programs. The state adds 10 percent to the subsidy for projects that use solar components made in Massachusetts, something Nexamp is able to do for most installations. Leary calls the subsidies an "interim kick-start" that is spurring development of an industry until it "can drive itself."

Pat Cloney, the director of the state's Clean Energy Center, says Massachusetts is looking for ways to kickstart every dimension of the industry, from incentives for promising start-up companies to getting products moving into the market. "How do we spur innovation and then, on the complete other end of the spectrum, how do we create markets?" he asks.

One big development the state hopes will spur both innovation and markets is taking shape along the edges of the Mystic River in Charlestown. The state won \$27 million in federal funding to help build the largest wind turbine testing facility in the country. When construction is finished next year on the football-field-size site, the center will be able to test turbine blades as large as 90 meters. The facility will lease testing time to companies developing new turbines, and state officials hope it will eventually lead to turbine manufacturing in the area.

Firms like 1366 Technologies say they are on track to bring the cost of solar power down to the point where it can, in Dan Leary's words, "drive itself." The Lexington– based start-up has developed a way to dramatically increase efficiency in the processing of silicon, the main component of most electricity-generating solar panels. With the innovation that is taking place in the industry, the cost of solar panels is dropping by about 10 percent per year, says 1366's president, Frank van Mierlo. At that rate, solar power will become cheaper than coal-generated electricity by 2020, an achievement that he says will "completely change the world when it happens."

It's an exciting prospect, but not one that Patrick and state leaders think we can sit idly waiting for if we hope to be a player in the industry. "Europe is so much farther ahead because government played a role in subsidies. That created a market for solar," says Patrick. "I'm a capitalist. I believe in markets. But I'm not a market fundamentalist. I don't think the market always gets it right, and the job of government is to create conditions that foster productive investments."

Some are concerned that the government doesn't always get it right, either. Patrick has long pointed to Evergreen Solar, a Marlborough–based solar panel manufacturer, when promoting the state's clean energy economy. A package of state grants, loans, and incentives worth more than \$76 million helped convince the company to build its first US manufacturing plant in Massachusetts. When the plant opened in the summer of 2008, the *Boston Globe* reported that Patrick called it "a symbol of the future."

But a year-and-a-half into that future the company, battered by steep price decreases caused by a decline in solar demand due to the global recession and increased competition from China, announced it was shifting its solar panel assembly work to China. Evergreen will continue to produce the solar wafers and modules that makeup the panels in Massachusetts.

Evergreen and state officials are quick to point out that, despite the announcement, the company has more than made good on its pledge to create 350 jobs in Massachu setts. It employs a total of 700 here. Michael Goodman, a professor of public policy at the University of Massachsuetts–Dartmouth, sits on a state economic development board that approved a tax-incentive award to Evergreen. "In retrospect, it's clear that the prospects for growth that appeared promising at that time didn't materialize," he says. "It underscores how quickly this energy environment and marketplace can change."

GREEN JOBS FAIR

A big part of the promise of the clean energy economy, and justification for all the state subsidies, is jobs. But it's not easy to determine just how many green jobs exist, never mind forecasting how many might be generated going forward. "Whatever numbers we see are probably not correct," says Lester, the MIT professor. In part that's because there is no agreed upon definition of what constitutes a clean energy job. Under a broad definition used in a recent US Commerce Department report, green jobs included bicycle sales, long-distance charter bus tours, and even trucking firms that handle hazardous waste

The US Bureau of Labor Statistics is currently developing standards for a new employment category that will allow for the tracking of green jobs.

A state study in 2007, based on surveys of companies, government agencies and universities, showed 14,400 jobs in 556 different clean tech "entities." The report projected growth of clean tech jobs of 20 percent per year, far outpacing any other sector, and said clean energy jobs were poised to become the tenth largest sector in the state, overtaking textiles and apparel. But this was before the recession hit in 2008. The state's Clean Energy Center is now updating the study and its findings are due to be released in August.

A report last year from the Pew Charitable Trusts counted 1,912 green businesses in Massachusetts with a total of 26,678 green jobs. The disparity in the job numbers from the two reports highlights the difficulty of assessing clean tech employment without uniform criteria.

If there's a single person responsible for generating big hopes for lots of green jobs it is Van Jones. The Oakland, California–based activist has heavily promoted the idea that we can solve the energy challenge and employment crisis, especially for the urban poor, in one fell swoop. It's an appealing idea, but one that sometimes looks more plausible at 30,000 feet than when brought down to street level.

Jones is author of *The Green Collar Economy* and briefly served as a special White House advisor on green jobs until forced out last year over a controversial petition he signed about the 9/11 terrorist attacks. He was the subject of a profile last year in *The New Yorker*, and part of the story was reported from Massachusetts. After addressing a group of high school dropouts in New Bedford, Jones

paid a visit to the city's mayor, Scott Lang, who told him that a solar manufacturer was opening a factory in New Bedford, and that it might eventually hire as many as hundred people.

"Jones brightened," wrote the *New Yorker*'s Elizabeth Kolbert, who goes on to describe how Jones pressed Lang to try to help connect some of the young dropouts to these green jobs. But the plant Lang referred to was Konarka's new manufacturing facility, where former Polaroid workers with years of experience in photographic process manufacturing, not unskilled dropouts, were being hired.

There clearly are jobs being created in the clean energy economy, but there may not be as many as some believe and they won't necessarily be there for the taking for those without skills who are on the employment margins.

Jim Hunt, Boston's chief of environmental and energy services, is sipping coffee and talking about the opportunities to change our energy practices and stimulate the economy. "Look out here at these three-deckers," he says, pointing out the window of a Dorchester Avenue café to the neighborhood's signature three-family houses, most of them built in the late 1800s and early 1900s. "Virtually all were constructed pre-World War I with no insulation and no thought given to energy prices," he says, noting that lots of energy efficiency savings are possible here by simple measures such as installing insulation and better windows. "These are labor intensive projects that can't be sent overseas," says Hunt.

One morning a few days later, a group of 15 men are listening attentively to Jason Taylor inside the handsome brick building that served as the Mattapan library in Boston before a new branch was opened last year. The bookshelves in the surplus city-owned building are stocked with rolls of insulation batting and spray cans of polyurethane foam sealant. Taylor, wearing a blue jumpsuit with a respirator mask dangling around his neck, is holding court at a four-day weatherization training "boot camp" run by the ABCD, a Boston anti-poverty agency that oversees weatherization projects at the homes of low-income city residents.

ABCD was enlisted to run a series of these sessions until the fall. That's when seven community colleges across the state are scheduled to take over the training programs under a \$1.8 million state initiative to promote green jobs. Another \$1 million each is going to agencies that focus on training low-income unemployed or underemployed residents of the state's Gateway Cities and the state's vocational technical high schools.

The New England Clean Energy Council produced a report last year that projected the

workforce needs of the Massachusetts residential weatherization sector from 2008 to 2012. The report concluded that, between federal funding and a huge infusion of state money for weatherization that is coming from surcharges on customer utility bills, full-time jobs for residential

A lot of energy efficiency savings are possible in aging three-deckers and those projects can't be shipped overseas.

weatherization work will increase from roughly 800 positions in 2008 to 2,700 by 2012. The "market will be a good job supporter, but not phenomenal," the report concluded. Moreoever, it said, "many jobs will go to incumbent workers at contractors in the field or those in the building trades who migrate to these jobs."

A coalition of local and national labor and community groups that is pushing for good wages and benefits in weatherization jobs issued a report projecting 6,000 new weatherization jobs in the state, a figure that includes work in both the residential and commercial sectors.

Bruce Ledgerwood, the ABCD official coordinating the boot camps, worked on the residential workforce report.

"They talk about being able to sop up all the unemployed construction workers and all the chronically unemployed," he says of the idea Jones and others have popularized. "In my opinion, the expectations for the number of jobs that are going to materialize is overstated, and that creates tension with some who see energy efficiency as the salvation that's going to lift everybody up."

Kevin Doyle, the energy workforce consultant who served as the main author of the report, says it's important to avoid the inflated job projections that often accompany studies of the casino industry, for example. "Once you start projecting larger than realistic numbers, you're just setting yourself up for someone to want to throw money at you and someone else to attack you," says Doyle.

He also says that jobs shouldn't be the single yardstick by which we assess these efforts. "The environmental community is rightly concerned that if there isn't this tsunami of jobs predicted by certain activists, will that potentially turn people off from funding energy efficiency for its own sake, for the climate change benefits, the cost savings, and the effect of getting us off fossil fuels?" he asks.

In other words, it all comes back to the context.

That broader perspective is what Patrick invariably brings up when asked about the muscular moves he is making to promote the state's clean energy economy. The federal approval of the Cape Wind project in April was followed by the announcement by National Grid, the state's largest electric utility, that it plans to sign a long-term contract to purchase half of the power generated by the project. Because the company will pay much more for the wind-generated power than it would cost to buy the electricity on the open market, the deal will mean an average increase of \$1.50 on the monthly electric bill of National Grid's residential customers. That's exactly the sort of premium for clean energy that critics say makes it a bad deal and a threat to the state's economic competitiveness.

Patrick is quick to point out that the average household bill is \$20 less today than two years ago, a function of decreasing demand in a sluggish economy and increased supplies of natural gas, the main fuel used to generate electricity in the state. He says those bills could easily jump by \$20 again if there is a big increase in the price of natural gas.

"The real comparison is between a buck-fifty and twenty dollars," says Patrick. "I think most people would choose a buck-fifty for the next 20 years. I think it's a pretty darn good deal."

And it's the kind of deal, he says, that isn't just a good one when it comes to Cape Wind. "It's true of this whole industry," Patrick says. "We have to take the long view. We have to break our dependence on foreign oil, on hydrocarbons, and to secure our energy future. The folks who are smart about that are the winners, and that's what we are trying to do."

GATEWAY

Going for Growth

A MassINC policy brief series profiling smart, evidenced-based strategies to tap the potential and promise of Gateway Cities in the Commonwealth's 21st Century economy.

Visit gateways.massinc.org to download the first two reports:

- » Going for Growth: Promoting Business Investment in Gateway Cities
- » Going for Growth: Promoting Residential Reinvestment in Gateway Cities

Who's the real environmentalist?

There's a growing split between those willing to accept some disruption of the natural landscape to combat climate change and those who refuse to compromise

BY GABRIELLE GURLEY

THE ELEGANT, LAZY motion of wind turbines once appealed to Eleanor Tillinghast. Generating energy takes a heavy toll on the natural world, so it stood to reason that Tillinghast, a committed environmentalist, once thought wind farms were a good thing, even though she knew little about them. The Hoosac Wind project, the 20-turbine wind farm proposed for the tiny hill towns of Florida and Monroe in the Berkshires, changed her mind.

After careful study, Tillinghast concluded the environmental cost of wind power was too high. She isn't just upset that the turbines would spoil mountain views; she fears that building access roads, transmission lines and related buildings would destroy wetland habitats and level mountain ridgelines, not to mention posing risks to birds and bats. All for a minuscule amount of electricity that she believes does not begin to address the state's electricity needs.

"I've become more and more conservative about the environment," says Tillinghast, president and co-founder of Green Berkshires, a regional environmental advocacy group that has backed court challenges to Hoosac Wind over the past six years. "Leave it alone is the way I'm looking at it. Find other ways of solving the problem before you destroy the environment."

Tillinghast is in many ways a classic environmental activist, a product of the movement unleashed by Rachel Carson's 1962 book *Silent Spring*, which documented the toxic effects of pesticides on birds and other living things. Green Berkshires may be a tiny outpost not known outside western Massachusetts, but it follows in the tradition of national land conservation groups like the 118-year-old Sierra Club and the Natural Resources Defense Council, which was founded shortly before the first Earth Day 40 years ago to fight pollution battles in court.

Where those groups once operated with an "us-againstthem" mindset as they fought to protect open spaces and battled corporate polluters, Tillinghast and her group are operating in a world where climate change blurs the lines between us and them. Many policymakers and environmentalists now believe some disruption to the natural landscape is an acceptable cost in seeking dramatic reductions in carbon emissions, which they consider a more ominous immediate threat to the planet.

President Obama, who won the support of environmental groups by promising to champion legislation designed to dent climate change, is supporting the development of carbon-free nuclear power plants, even though no one has yet solved the problem of radioactive waste disposal. Gov. Deval Patrick, meanwhile, wants to scatter wind turbines across Nantucket Sound and the Berkshires as part of an effort to produce 20 percent of the Bay State's electricity with renewable sources.

Henry Lee, who directs the Environment and Natural Resources Program at the Belfer Center for Science and International Affairs at Harvard's Kennedy School of Government, sees a growing split within the environmental movement between the advocates who see climate as the dominant issue and those who subscribe to land conservation as their guiding principle. "You've got this tension," he says, "between organizations that focused on pollution in the '70s, '80s, and '90s, and now on climate, and the land organizations who are saying, 'We don't want to see our mountain tops with windmills, we don't want to see our coastline with thousands of energy-generating facilities either with wind or tidal power.""

In a state like Massachusetts, which is determined to become a national leader in green jobs and clean technologies, land conservationists like Tillinghast increasingly look like they are going down the up escalator. Their rigid stance is out of sync with efforts by other environmental groups trying to find common ground in the fight against climate change. "Being an environmentalist means having a real capacity to think about complexity," says Laura Johnson, president of the Massachusetts Audubon Society, which backs Cape Wind and has offered conditional support for the Hoosac Wind project. "There are lots of gray areas and tough choices."

POWER PLAY

On a crystal clear March day at a lookout point in the mountains above North Adams, the wind is blowing strong enough to push you around a bit. It's easy to see why the developers of Hoosac Wind, named for the mountain range that lies at the northern end of the Berkshires near the Vermont border, selected this area as the site for their 30 megawatt wind farm. After offshore locations, the northern Berkshire peaks are some of the windiest places in Massachusetts, making them prime targets for commercial wind developments.

> Hoosac Wind's developers want to put up 20 turbines on two hills in one of the most rural and sparsely populated areas of the Bay State

The region is one of the most rural and sparsely populated areas of the Bay State. The rolling green hills, mountain streams, and trails attract people who like to ski, hike, fish, and hunt. The villages that run along the ridges have a "blink or you'll miss it" quality, with only a few homes, a town hall, a post office or a volunteer fire station visible from quiet, two-lane roads.

The wind project's developers propose to put up nine turbines on Crum Hill, which spans the towns of Florida and Monroe. Another 11 turbines would be located on the Bakke Mountain ridge in Florida. The turbines and plant buildings would be located on a combination of private and municipal lands. In addition, areas in Monroe State Forest along the proposed transmission line would have to be cleared of vegetation.

The turbines would stand nearly 340 feet high from the base to the tip of a vertical blade (the blades themselves are more than 250 feet in diameter), or 60 feet lower than the height of each of the Harbor Towers buildings along the downtown Boston waterfront. Six of the turbines are required by the Federal Aviation Administration to have lights.

While the turbines will dramatically change the look of the two hills, environmental concerns have focused primarily on the damage caused during construction of the wind farm. According to a state document, roughly 73 acres of forested land would have to be cleared and graded for construction staging areas, vehicle turnarounds and turbine delivery and assembly areas. The plant would also include two permanent meteorological towers and a maintenance building. Some four miles of roads would have to be built capable of accommodating heavy construction equipment.

The litigation that has tied up the project in court has focused on wetlands permits and the harm to plants and wildlife caused by stream crossings. At press time, the case was on appeal to the Supreme Judicial Court.

While the lawsuit was filed by local residents backed by Green Berkshires, the wind project has overwhelming support in Florida and Monroe. About 70 percent of Florida residents attending a town meeting supported the proposal in 2005. State Sen. Benjamin Downing, who represents the region, says where people have had the chance to vote on wind power projects in the Berkshires (the towns of Savoy and Hancock are also considering industrial wind farms), they've supported them. Downing, a Pittsfield Democrat, says residents hope the projects will eventually lead to lower electricity prices and spur economic development.

Ownership of the Hoosac project has changed hands several times, but the current developer, the Spanishowned Iberdrola Renewables, one of the world's largest producers of wind power, plans to spend roughly \$106 million building the wind farm. There will be only a handful of permanent jobs, but Florida and Monroe expect to receive ongoing payments from the project. The company projects that the plant will generate enough electricity to power about 13,000 average Massachusetts homes and cut annual carbon dioxide emissions by nearly 72,000 tons.

Kristen Goland, Iberdrola's senior permits manager, says she has never seen such strong support from a state or a community. One of the project's supporters is Jim Pedro, who manages the Whitcomb Summit Resort in Florida, which has a spectacular view of Crum Hill. Pedro doesn't want a "zillion" turbines, but says a "few here and there" would look better than a traditional fossil fuel plant. "I'm totally pro-wind," he says.

GREEN IS GOOD

The slogan "think global and act local" sums up the popular view of the environmental movement. For Ian Bowles, the secretary of energy and environment, acting locally means putting up wind turbines in the Berkshires to help reduce the use of fossil fuels and curb greenhouse gases on a larger scale.

He also says it's a matter of fairness, since most of the state's fossil fuel power plants were built a generation ago, generally in poorer parts of the state like Fall River, Salem, Everett, Sandwich, and Holyoke. Those plants, he says, have driven down property values in those communities and contributed to higher rates of pediatric asthma. By contrast, Bowles says, the impact of a "modest wind farm" in the Berkshires is "negligible."

Bowles notes Hoosac Wind has the support of local residents as well as state environmental officials who have reviewed the project looking for evidence of significant environmental harm. He says building wind farms in the Berkshires and in Nantucket Sound is part of a sound environmental strategy, one that's supported by most environmentalists.

"I don't think of anti-wind advocates or activists as being environmentalists," he says. "I think of them as being special issue, basically NIMBY, folks."

NIMBY or not, the litigation around Hoosac Wind and Cape Wind hasn't helped the state's bid to attract clean energy companies. Paul Gaynor, the president of First Wind, a Boston–based company that develops, owns, and operates wind farms in Hawaii, Maine, New York, Utah and Vermont, says renewable energy companies see the potential for a "very litigious experience" in Massachusetts. By contrast, he says, "you can be welcomed with arms wide open in Texas." (Only now is First Wind in the very early stages of considering a site in Brimfield.)

To set up statewide siting standards and streamline the appeals process, Bowles is pushing legislation that would reduce project permitting times to nine to 18 months. Facilities that produce two megawatts of electricity or less could move even faster. The bill, which passed the Senate and was awaiting action in the House when this issue went to press, has the support of many of the state's leading environmental organizations, including the Massachusetts Audubon Society, the Conservation Law Foundation, the Appalachian Mountain Club, the Nature Conservancy, the Environmental League of Massachusetts, and Environment Massachusetts.

Johnson, the Mass Audubon president, says New England's largest conservation organization occupies a

middle ground on most siting issues. She says the organization supports establishing safeguards to protect local habitats and wildlife while allowing appropriate renewable projects to move forward. After years of avian studies, for example, Mass Audubon gave its support to Cape Wind. It has also expressed conditional support for the Hoosac project, but has called on the developer to address issues such as how it plans to monitor bird and bat populations after construction.

Younger environmentalists, alarmed by climate change, seem to have less patience for the siting battles. Alyssa Pandolfi, in her third year of environmental science studies at Northeastern University, is a member of the Husky Energy Action Team, which looks for ways to get students and university departments to reduce their energy usage. She gets frustrated with environmentalists who are more concerned about blocking wind farms than they are about greenhouse gases, acid rain, or the chronic diseases that affect people in coal mining states like West Virginia and Kentucky. "What's a wind turbine on the horizon if we are killing people [with] our current energy system?" she asks.

Craig Altemose, a graduate student at Harvard and the coordinator of Students for a Just and Stable Future, lobbies on Beacon Hill for a task force to research how the state can move toward 100 percent clean energy statewide in the next decade. He believes that there is no legitimate way to oppose wind projects based on their impact on the environment.

"Every place that you try to preserve today is going to be a different place a hundred years from now if we don't stop putting carbon and other greenhouse gases into the atmosphere," he says.

WIND CHILL

Eleanor Tillinghast began thinking of herself as an environmentalist 25 years ago when she moved to Mount Washington, a small town in the southwestern corner of the state, from Washington, D.C., where she worked in public relations. When we meet in a Friendly's parking lot in Lee before setting off to look at some of the proposed wind farm sites, the brown-haired, 53-year-old is dressed in black and driving a Jeep Cherokee. She apologizes for the SUV, admitting that she uses the car for hauling sports gear and bad winter weather driving. "I [also] drive a Prius," she says, smiling. "I don't do it to be politically correct. I do it to cut down on my impact."

Tillinghast grew up in Brookline and visited Mount Washington on family vacations, but it wasn't until development threatened her new community that she began to feel protective about the region. Hearing about a proposal in the late 1980s to build a destination resort in the Mount Washington State Forest, she rallied the town to block it. In 2004, she went on to found Green Berkshires with her husband, Morgan Bulkeley Jr., and several others. Tillinghast declines to say how much money she has contributed to the organization over the years, other than to say "a lot."

Tillinghast fears the state's push for 2000 megawatts of wind will ruin vistas in the Berkshires along with a significant amount of forest habitat

She also cofounded the Massachusetts League of Environmental Voters and serves as a corporate trustee of the Trustees of Reservations. In 2008, she was named Sportswoman of the Year (marking the first time ever a woman received the award) for her conservation work by the Berkshire County League of Sportsmen. Despite her public profile, she refused to be photographed for this story, an acknowledgement that her anti-wind stance isn't popular with everyone in the area.

Doug Foy, the state's former top environmental official and a past president of the Conservation Law Foundation, joined forces with Tillinghast nearly a decade ago on several campaigns in western Massachusetts, including a fight to prevent the construction of the Greylock Glen resort at the foot of Mt. Greylock. She later served on the foundation's Massachusetts board for five years. Foy says Tillinghast's advocacy for local interests makes her a textbook example of why a local environmentalist is a force to be reckoned with. "She is tough as nails and she takes no prisoners," he says.

Although Tillinghast is known for her opposition to the Hoosac project, she doesn't object to wind turbines for residential, farm or business use like the ones at Jiminy Peak Mountain Resort in Hancock or at the Williams Stone Co., an East Otis building materials company. She also believes wind farms are appropriate on the wind-rich plains of the Dakotas.

But she fears most of the 2000 megawatts of wind power the Bay State wants to build will be located in the Berkshires, including some on public lands. She says Berkshires vistas would be ruined, along with a significant amount of forest habitat. Hoosac Wind, she points out, would negatively affect 12 mountain streams by killing protected plant life and endangering the native brook trout that depend on streams to be "cold and clean." In short, she says, the proposed stream crossings would completely change the wildlife habitats of those wetlands.

For Tilllinghast, the wind project's environmental cost is far greater than the economic and environmental benefits. By her own calculations, Massachusetts could save more electricity by sending every household an energy efficient light bulb than could be produced by all of the state's proposed wind projects in the Berkshires.

The Green Berkshires president dismisses Bowles's characterization of opponents of wind farms as NIMBY activists. "Ian Bowles has made it a career for the last few years of minimizing the importance of this project and trivializing the concerns of the people who are involved," she says. "I have a lot of respect for a lot of the things he's done," she adds, "but we have an honest disagreement on the significance of these [wind] projects and the impacts on the environment."

But Tillinghast's position on wind is also at odds with a number of Bay State environmental groups that back legislation to speed up wind siting. According to Tillinghast, the legislation sidesteps both local control and state environmental laws and is a backdoor maneuver to open up public lands to wind farms. For her, the wind siting bill exemplifies a growing divide between environmental groups like Green Berkshires and what she calls "the Beacon Hill" environmental groups. "They don't represent the issues that we focus on most at the local level," she says.

The *Berkshire Eagle* has sided in editorials with Tillinghast on issues like cleaning up the polluted Housatonic River. "She is a committed environmentalist," says Bill Everhart, the newspaper's editorial page editor. But he seems to struggle with a way to characterize her stand on Hoosac Wind, which the paper has strongly supported. "Even though she is not a NIMBY, she is doing the work of NIMBYism, perhaps inadvertently. That is exactly what I think her wind stand amounts to."

Such criticism, whether from newspapers or her fellow environmentalists, doesn't faze her. For Tillinghast, there aren't any climate change tradeoffs that will make her a wind power booster, at least not where the forests and the wildlife of the Berkshires are concerned. "We are destroying mountains in West Virginia, so we should be destroying mountains up here?" Tillinghast asks. "I don't agree with that."

San Francisco far outpaces Boston in recycling efforts, and tougher laws may be only part of the reason

Attitude adjustment

AFTER HIS FAMILY moved from Massachusetts to San Francisco in 2008, Will Anastas noticed a big change in his trash. The family of four went from producing five bags of trash per week to one or two, says Anastas, a manager at Forrester Research Inc., who used to live in Newburyport and Charlestown. He gives credit for the reduction to the city of San Francisco—its culture, its people, and its recycling policies—and thinks he never would have changed his environmental habits if he still lived in Boston.

Boston is a lot like San Francisco. They both are small, hilly cities surrounded by population-dense suburbs; both are rich with history, culture, and educational institutions; both tend to attract young, left-leaning, well-educated transplants. Yet when it comes to recycling, Boston lags light years behind its West Coast counterpart.

In San Francisco, recycling is required by law. An impressive 72 percent of the city's waste is diverted from landfills, which is the highest rate in the nation among

major cities, according to most surveys. Residents must pay a flat monthly fee of approximately \$30 for trash and recycling pick-up, but if they reduce how much trash they generate, they may see discounts of up to 50 percent on their monthly bill—meaning they have a financial incentive, as well as a legal mandate, not to toss soda cans into the trash. Similarly, if a household makes more trash than can fill a 32-gallon container, it will be charged twice the monthly rate and given a larger container.

In the fall of 2009, the city took its recycling efforts to a whole new level. Food composting, which previously had been optional, became mandatory. Residents were required to remove all food waste from their trash and set it out in a separate container for pickup. Only one other major US city, Seattle, offers curbside food composting. (The Massachusetts town of Hamilton launched curbside composting in March; the state Department of Environmental Protection says the town may be first on the East Coast to do so.) The new policy in San Francisco nearly doubled the amount of food waste the city processes, from 300 to 500 tons. Officials say the cost of composting is comparable to trash disposal, and its environmental benefits are significant: It reduces the amount of methane emissions from landfills, and the resulting fertilizer can be used to improve the quality of soil at northern California's many farms, golf courses, and vineyards.

When it comes to waste diversion, Boston isn't in the same league as San Francisco. Recycling in Boston is optional and, as of 2008, only 13 percent of the city's waste was recycled, compared with the 72 percent figure in San Francisco. Boston's rate is also one of the worst in Massa chusetts; neighboring Brookline and Cambridge both recycle at rates nearly three times as high. The cost of trash pick-up in Boston is hidden as a part of taxes (rather than paid for by each household according to use), so residents are rarely made aware of how

Boston's recycling rate, at 13 percent, is one of the worst in Massachusetts, while San Francisco diverts 72 percent of its waste from landfills

much garbage they produce. Although 132 other communities in the Bay State offer financial incentives to make less trash, the capital does not. The city's approach to recycling has focused primarily on making it more convenient. In the summer of 2009, Boston rolled out "single-stream recycling"—meaning residents no longer need to separate cans from plastics from newspapers and has since seen a 15 percent reduction in overall trash tonnage, but some neighborhoods still do not have access to the new single-stream carts.

Some environmental enthusiasts in Boston say it's easy to forget about recycling because the city demands so little of residents. Bill Perkins, who lives in Jamaica Plain, offers community workshops on how to reduce waste pro-

San Francisco's new garbage trucks, which display three-dimensional images of a typical truck's contents, are just one way the city encourages residents to be aware of the waste they produce.

Recycling changes everything.

duction and once ran an informal recycling coalition in his neighborhood. "I think there are a lot of people who don't know very much about recycling at all," he says. "You can put just about anything on the curb and have the city take it away. It's pretty nice for the homeowner, but for the environment, it's not. People need to be a little more cognizant of what effect they have."

Susan Cascino, Boston's recycling director, says she would like to make recycling mandatory and to offer food-composting service. "We would like to do everything San Francisco does," she says. But she could not give any timeline for change nor say which policies were likely to be put in place. She said the city is "investigating" financial incentives, but that Boston's many multi-unit buildings make that type of approach a challenge.

KEEPING UP WITH THE NEIGHBORS

San Francisco became an environmental leader using financial incentives and mandates, but it's helped by what newcomer Will Anastas calls "an environmentally friendly culture," where people would no more toss cans in the trash than they would light a cigarette on an airplane. So it can be difficult to tease out whether policy dictates culture, or vice versa. Does recycling work so well in San Francisco because of mandates and incentives, or does San Francisco have mandates and incentives because people are environmentally minded to begin with? Michelle McCauley, a professor at Middlebury College who studies the psychology of environmental behavior, thinks it's a little of both.

"If you want long-term attitudinal behavioral change, you need people to 'buy in,' so they aren't doing it because you tell them to, but because they believe it," says McCauley. "It's easy to get people to do things, but those behaviors don't generalize into other areas. We can say, 'You must recycle bottles and cans,' and if you make it convenient, most people are likely to do it. But it doesn't mean they'll generalize into turning off light switches and other proenvironmental behavior."

Technically, tossing a soggy hamburger bun into your black trash bin instead of your green compostable bin could result in a fine of up to \$100 in San Francisco. But Mark Westlund, a spokesman for the city's Department of the Environment, says his office isn't trying to catch scofflaws and hasn't issued any fines. "We hope we never have to implement fines," he says. "We hope that people will participate correctly."

Westlund says the city did direct its service provider, Recology, to issue warnings when collectors spot violations, but not to go digging through anyone's trash looking for errant pizza boxes. According to a Recology spokes man, collectors have issued approximately 8,500 "friendly reminder" warnings since December 1, 2009, 10 percent of which went to repeat violators.

That figure suggests 850 households out of 340,000 are repeatedly flouting the policy.

"I think probably why San Francisco works so well is that it is mandated, but there's not a heavy hand behind it," says McCauley. "People have a sense that [recycling] is a community value. I think if you said, 'We're going to give you tickets,' people would start investing energy in how to trick the system," she says.

The fear of social pariah status, says McCauley, is a much bigger motivator for most people than is the threat of a fine. "People are really sensitive to what their neighbors do, but in our individualistic culture, we deny that to ourselves," says McCauley. "So if you ask people what they base a decision on, they never say it's because someone else is, they come up with all these other reasons." In other words, she says, research shows that if you ask people why they recycle, they'll talk about global warming and pollution, but in fact, the thing that got them to change their behavior was seeing bright blue carts in all their neighbors' driveways.

That kind of group reinforcement is difficult to legislate, but it's worth noting that it exists in a city that also uses financial incentives. And it's financial incentives that have been proven to work in Massachusetts, despite Boston's reluctance to adopt any. Outside the capital, more than a third of Bay State municipalities now use what's known as a "pay as you throw" system. Typically, in a pay-as-youthrow system, residents must purchase official trash bags or stickers, and only designated bags are collected curbside or accepted at transfer stations. The thinking goes like this: If people get charged, they become aware of how much trash they make, but if they never see a bill or have to pay for the service, they never think about it.

"Pay-as-you-throw is the single most effective way to increase recycling," says Brooke Nash, who manages municipal waste reduction programs for the DEP. Of the 50 Massachusetts communities with the highest wastediversion rates, 40 of them use pay-as-you-throw systems. Some communities do have high recycling rates without charging for trash, but they tend to be the Bay State's most affluent communities, where residents are more likely to be educated about the environment. As Nash notes, "studies have shown that higher income and educational attainment correlate to higher rates of recycling participation." Lexington, Hingham, and Wellesley all divert more than 50 percent of their waste without a financial incentive.

Kristen Haviland, who lives in San Francisco's Noe Valley neighborhood, thinks that when recycling is optional, as in Boston, it becomes a kind of "latte liberal" luxury. But if you're worried about putting food in your kids' mouths, you might not take the time to rinse out your milk carton, especially when you have no financial incentive to do so. "I can see how it would not be a priority if other parts of my life were harder," says Haviland. So while peer pressure and environmental knowledge may be enough in communities where people have more leisure time, pay-as-you-throw works across a wider swath of the population. Worcester, a diverse city with many multiunit buildings, boasts a diversion rate of 43 percent (more than three times as high as Boston's) using pay-as-youthrow.

The DEP's Nash did not address the reasons why Boston hasn't adopted incentives, but she says charging for trash

is often a "political hot potato." People get accustomed to thinking of trash service as free even though it is, instead, simply "an invisible cost," she says, in which the price of collecting, transporting, and incinerating trash is tacked onto taxes rather than a monthly trash bill. Cities and towns that do adopt pay-as-you-throw often see significant savings in the cost of disposing of trash, freeing money up for other municipal needs. Malden, for example, reduced its trash tonnage by 50 percent in its first year. More typical, says Nash, is a 25 percent to 40 percent reduction.

Of the 50 communities with the highest recycling rates, 40 use some version of pay as you throw

Yet Boston's leadership remains reluctant to adopt these successful models, perhaps fearing the political fallout. Dot Joyce, a spokeswoman for Mayor Thomas Menino, says the administration doesn't want to add a new fee for city residents. "While I know recycling advocates believe in it, with the economy in the shape it's in, a lot of people would see it as a punitive move," she says.

Joyce's comment illustrates the huge divide between San Francisco and Boston as far as the importance of environmental sustainability. While the mayor's office here assumes Bostonians would resent a mandate, residents of San Francisco see their policies as a declaration of civic identity.

"Here, everybody recycles. It's just the way you do things," says San Franciscan Kristen Haviland. She adds that while people drawn to live in San Francisco are often environmentally-conscious from the get-go, the blend of mandate, social expectations, and recycling containers everywhere you look means people act on those values more than they might elsewhere. "My sister, who lives in New York City, is a well-educated, environmentally-conscious person, but she throws everything in the trash," says Haviland with a laugh. "She says, 'It's hard to do it here, so I don't do it. The city doesn't make it easy.' But I get frustrated because I think she has no excuse."

Haviland, 35, says she wasn't always this way. When she lived in Philadelphia in her twenties, she recycled only those cans and bottles that carried a deposit. Now, she says, "If I can't find a bin to recycle a soda can, I'll carry it home."

WE'RE LEAVING IT BETTER THAN WE FOUND IT.

Our commitment to the environment is helping create cleaner and greener communities.

-m-

ecosystem goes well beyond our financial established conservation groups. Environmental investment in science and technology. It also stewardship is something that runs throughout takes on a personal touch. Like our employee our company. And you can see it at work every volunteers who donate thousands of hours each day. To find out more about how we're putting year to conservation efforts. They pitch in to our energy to work for the environment, visit refurbish nature trails, build outdoor classrooms,

At Dominion, our dedication to a healthy clean up streams and parks, and assist www.dom.com, keyword: foundation.

Power portfolio

Ian Bowles is in charge of a sweeping series of energy and environmental initiatives designed to get Massachusetts off the fossil fuel roller coaster. And he's betting that the Bay State economy will benefit from the change.

If power on Beacon Hill is measured in terms of share of the state budget, Ian Bowles is a nobody. The state's secretary of energy and environmental affairs oversees agencies that represent less than 1 percent of the overall state budget, and their funding has been shrinking. The budget for his environmental agencies has been cut nearly 20 percent over the last three years.

But Bowles's clout is not measured just in terms of tax dollars. He is overseeing a sweeping series of energy and environmental initiatives that will cost billions of dollars over the next three years—paid for mostly through a series of assessments on customer utility bills.

It's a job that requires good political instincts, a flair for economic development, and strong environmental credentials. The 44-year-old Bowles has strengths in all three areas. His resume includes degrees from Harvard and Oxford, a job with an environmental organization creating a four-million-acre nature reserve in Suriname, posts in the Clinton administration, an unsuccessful run for Congress, and the top job at MassINC—whose duties include serving as the publisher of *CommonWealth*— prior to joining Gov. Deval Patrick's cabinet in 2007.

Like Patrick, Bowles sees energy as an opportunity, not as a drag on the state's economy. He believes Massachusetts can cut its energy usage, reduce carbon emissions (by shifting to wind, solar, and other renewable forms of energy), and build a thriving clean tech industry—all without harming the state's economic competitiveness. He downplays the cost of these efforts, saying the state will come out ahead as the price of wind and solar fall and the cost of fossil fuels continues to rise.

It's a message that resonates with the public. It's also in perfect harmony with the energy policies of President Barack Obama, who reportedly considered Bowles for the top job at the Environmental Protection Agency at the start of his administration. One key difference is that Obama supports the development of a new generation of nuclear power plants as a way of producing large amounts of carbon-free power. Bowles says he supports the president's position, but he shies away from the politically explosive issue of a new nuclear power plant in New England. He says he supports the relicensing of the Pilgrim nuclear power plant in Plymouth, however.

Over the last three years, Bowles has enjoyed remarkable success implementing the state's energy policies. The agencies he oversees approved a massive energy efficiency program and created a regulatory framework for the development of renewable energy and carbon taxation. Cape Wind, which he strongly supports, cleared key federal and financial hurdles this spring. The much smaller Hoosac Wind

CONVERSATION

project in western Massachusetts has been delayed by court challenges, so Bowles is pushing for legislation on Beacon Hill that would make it easier for developers to site wind farms. He's also being sued by TransCanada, an energy company with a wind farm in Maine that says Bowles's efforts to steer solar and renewable energy subsidies to in-state companies discriminate against out-of-state suppliers.

During our interview inside his office at 100 Cambridge Street, Bowles made a persuasive case for the state's policies, but like any good politician he tends to play up the positives and downplay any negatives. For example, he defended the state's solar subsidies by noting that US Energy Secretary Steven Chu

says solar power won't need any subsidies in five years. When I asked his staff for documentation, they pointed me to a federal projection that solar would reach "grid parity" (a price of 10 cents per kilowatt hour) with other forms of electricity by 2015. But that same projection went on to say that grid parity "is not good enough for massive use of solar power." It said solar's price needed to drop to 2 cents per kilowatt hour for that to happen, "and that bold goal requires basic research and resultant disruptive technology."

What follows is an edited transcript of our conversation. — BRUCE MOHL

COMMONWEALTH: In 2008, the state approved the Green Communities Act, the Green Jobs Act, the Global Warming Solutions Act, and the Clean Energy Biofuels Act. What's been your overall vision as you've gone about implementing these initiatives?

BOWLES: Three things. We're trying to make clean energy a core part of our state's economic strategy and create jobs and economic growth potential for Massachusetts. We have every reason to be the disproportionate beneficiary of the clean energy transformation that's going on already around the world. We've got the highest educational attainment in the nation. We've got MIT, UMass, and intellectual property generation unparalleled in our country. We have the second biggest venture capital cluster and over 600 firms in this area. So there's enormous economic opportunity.

Second, we're making concerted, cost-effective reforms to reduce greenhouse gas emissions. The analysis we put

out recently shows that we can get to 18.6 percent below 1990 levels based on existing policies that we've already adopted without exercising any greenhouse gas regulatory authorities. It's the significant environmental challenge of our time. States can lead the way and show how significant reductions in greenhouse gas emissions are possible in a cost-effective basis.

Third is the foreign oil and fossil fuel roller coaster. If you look at the last 10 years of electricity prices for Massachusetts consumers, the message is variable and rising. [He produces a chart showing average annual consumer electric bills in Massachusetts over the past decade.] What the chart shows you is a lot of volatility. We're tied to the fossil fuel price roller coaster, which provides unpredictability for our residents and businesses alike. We don't have long-term, stable-priced generating assets. We're tied to the natural gas price, and getting off that roller coaster is important for pure economics. Then you've got our dependence on foreign oil and what that means for our national foreign policy.

cw: Would you say the policy you're pursuing is among the most aggressive in the country?

BOWLES: Yes, but I would also call it the most strategic. California has maybe five different significant power centers that do what this office does. These are five different significant bureaucracies, each coordinating at the level of the governor and each pursuing their own different programs in a way that I don't think is anywhere near as coordinated as what we're doing. For example, they've tackled greenhouse gas emissions from a largely top-down regulatory approach through the California Air Resources Board. We've tackled it from a much more nuts-and-bolts, from-the-ground-up type of approach, each time asking ourselves whether what we are doing is cost-effective.

cw: How do you determine whether what you're doing is cost-effective?

BOWLES: We recognize that we're 2 percent of the nation's population, so it doesn't make sense for us to take on very costly greenhouse gas reduction measures unless we can get the rest of the nation moving with us. We don't want to disadvantage ourselves. California is a larger market, but they've taken a more regulatory approach. We've done a lot of pretty common sense reforms and kind of block-and-tackle measures that needed to get changed. We've got dozens of things we've put in place, but I think each one stands up on its own as a sensible policy that's tied to a specific goal. We've been judicious but aggressive.

cw: It sounds like you're in a competition against California. How do we stand?

BOWLES: They're resting on their laurels out there.

cw: Is there a danger for a state like Massachusetts, with some of the highest electricity prices in the nation, being too far out in front of the pack?

BOWLES: When we took office, the message from a small sliver of the business community was, "You can't do a regional greenhouse gas initiative. The sky will fall." Three years later, the sky has not fallen. In fact, the contribution of the regional greenhouse gas initiative, in my view, is predominantly architectural. We've basically said, "Here's how you do this." We're not making dramatic curbs in greenhouse gas emissions. We are making modest cuts. We're taking \$60 million to \$70 million a year on the power part of your bill and then dumping it back into energy efficiency rebates. I would say the cost-benefit of every-thing we've done together yields greater savings than it does costs.

cw: Can you put a price tag on the costs?

BOWLES: Each of the things we're doing stands on its own. The solar credit program is one that some—some—in the business community have raised questions about [in terms of] the potential costs. But even the projection we made [a \$75 million annual solar subsidy] doesn't really capture the projected decline in solar costs. To be clear, solar costs more than conventional power. There's no doubt about it. But the benefits really accrue to the states that have created significant markets. So we've had a real reduction [in the cost of solar] because we have four times more solar installers than when we got started. They compete with each other and that produces a cheaper product for installing solar. Panels have come down 50 percent. US Energy Secretary Steven Chu will tell you we're five years away from grid parity for solar. Once you get to grid parity you don't need subsidies at all.

cw: Do you view yourself as a guy placing bets on energy futures?

BOWLES: The governor and the Legislature were the ultimate architects. The governor had a vision that if we get clean energy right, the whole world will be our customer. That's been his refrain since he was a candidate and three years on the job. He's given me the latitude to fill that out and say, "Here's our strategy to pursue this." I'd say the Legislature has been an amazing partner. They were absolutely the statutory architects for what we've done. We've certainly taken specific approaches to wind and solar in terms of aspirational targets based on feasibility, rate of growth, and cost. Certainly some states have much more aggressive solar goals than we do. We have a 10-year, 250-megawatt solar goal. We're confident we can reach that.

cw: Still, the bet on solar is pretty big. Why solar?

BOWLES: Do I really think [the solar subsidy] will cost that much? No, I don't. All the data suggest the opposite, that costs will continue to come down, as they have already, and the states that move first will have the most significant cost advantages because they've helped stimulate the market. Is \$75 million a reasonable bet to put on solar technology, given that prices are coming down dramatically each year, given all of the significant employment benefits in the state, and given that it's a technology that has the potential to be ubiquitous? I think it's a reasonable bet. As fossil fuel prices continue to rise, we'll look back and say we made a smart bet.

cw: All of the state's initiatives are premised on the cost of fossil fuels continuing to rise over the next 20 years. What if that doesn't happen? Many say new techniques for retrieving natural gas may keep prices low for a long time.

BOWLES: Even in the depth of the worst recession in any of our lifetimes, oil is trading at \$80 a barrel today. It's pretty hard not to read that as the marketplace is baking in sustained high prices for fossil fuels. So I guess I feel comfortable with the basic idea that we need to diversify. As long as we're doing it in an intelligent way that's creating jobs in our state and plays to our state's competitive

economic advantage and is judicious in terms of risk and reward, then, yeah, I think we're on the right track.

cw: Many of your renewable initiatives funnel subsidy money from electricity customers in Massachusetts to projects outside the state. Officials in Connecticut are so concerned about this wealth transfer that they're thinking about scaling back their support for renewable energy. You're being sued for trying to steer a portion of the Massachusetts subsidy money to Massachusetts companies. What's your priority, clean energy or the jobs that come from it?

BOWLES: The idea that we would not want to buy any renewable power from any of our neighboring states is not one that I subscribe to. From a cost basis, as we make this major transition to a lot cleaner power-generating sources, we need competition from a northern Maine wind project, a small hydro project in upper New York state, sustainable biomass in New Hampshire, and solar in East Boston. I think that's fine and it's good. Our market is open. That promotes competition. In a few cases, the Legislature said to give some added incentives for instate power generation. So the long-term contracts provision on a pilot basis tells utilities to provide some more financing certainty for in-state projects. Same with solar. We're doing that. With energy efficiency we're doing that as well. I have not felt the pressure that my counterparts in Connecticut have felt. I think that's shortsighted in terms of what's happening in Connecticut. But Connecticut has a legislature that changes its energy laws every session. I don't think that provides stability for the investment community.

cw: You've struggled to win support for Cape Wind and battled an environmental group opposed to the Hoosac Wind project in the Berkshires. That's why you're pushing legislation that would make it easier to site wind farms. I get the feeling you feel some environmental damage is acceptable in the state's effort to deal with climate change.

BOWLES: I grew up in Woods Hole, with parents in the science community there, thinking about ecosystems. So I think I was exposed to some of the early research on climate change, maybe earlier than some. I spent a lot of my career in biodiversity conservation. I spent five years working on a four-million-acre park that's pristine in Suriname, the former Dutch Guiana. I don't yield my land conservation stripes to anybody. But the idea that we're going to misuse our environmental laws to render judgments about aesthetics, I'm not for that. I think it's wrong.

Today, the power plants in the Commonwealth are built predominantly in the cities—Fall River, Salem, Everett, Holyoke. These are the places where our fossil-fuel-burning power plants are. Those were decisions made a generation ago, and if you live near one of those power plants you probably have higher rates of pediatric asthma and lower property values. So [I have trouble with] the idea that a town in western Massachusetts [votes for] a modest wind farm, we give it all the permits, it doesn't conflict with any park or any endangered species or any environmental issue—and then we're going to have a group of opponents who don't even live in the town tie it up for five years with appeals of the same wetland permits. That's not environmentalism. That's NIMBY. That's just saying I

> Fundamentally, environmentalism shouldn't be about saying no. It should be about protecting the environment in all its forms

don't want to look at this stuff and I'm going to use the Commonwealth's well-intentioned environmental laws to tie a project up in knots. I'm not on board with that. Fundamentally, environmentalism shouldn't be about saying no. It should be about protecting the environment in all its forms.

cw: You've stressed the need to address climate change, but unlike President Obama you seem reluctant to push for nuclear power, which offers the promise of a lot of power with no greenhouse gases.

BOWLES: Nuclear power is going to be part of the solution to address greenhouse gases. There is a next generation of reactors that hold promise to not have the long-term waste issues that the current generation do. I would say, given the siting controversies with them, the likelihood is that the first set of those reactors is not going to be in New England. But as the next generation proves itself out, New England will be an excellent candidate for them because we've got relatively high electricity prices. The thing I would have reservations about is: How big a public bet do you want to put on nuclear power from the perspective of the federal government? What other industry has comprehensive liability relief? I can't think of any.

It has some enormous insurance and other benefits and still, for 30 years, none have been built. There are some economic questions about how much of a bet to put in that area, but directionally speaking I think the president is correct. It will be part of the mix.

cw: The governor sent the Nuclear Regulatory Commission a letter in February after radioactive tritium was discovered in ground water surrounding the Vermont Yankee nuclear plant, which is owned by the same company that owns Pilgrim. The governor asked that the relicensing process be put on hold at Plymouth until questions about testing for leaks of radioactive tritium can be answered. Anything new on that?

BOWLES: I went down [to Pilgrim] after the Vermont incident because I wanted to understand their tritium testing protocols. So I went and spent a half a day at the Pilgrim plant and walked away feeling comforted by the level of environmental monitoring. We've had some discussions with them about doing additional environmental monitoring. Pilgrim has had some greater capital upgrades in the last 10 years than the Vermont facility. So on the basis of the assurances that I got when I was there, I'm comfortable with them being relicensed.

cw: Do you feel like there is broader acceptance of environmental policies today, by individuals and corporations alike?

BOWLES: That's an interesting observation. I hadn't really thought of it in those terms. I think you're correct there's a lot more consensus around the need to address some of the significant environmental challenges. Kids grow up today with a lot more of this in their curriculum than they did when I grew up, in terms of recycling and learning about the rain forest or forestry or climate change or whales or whatever it is. Kids coming out of college are very up-to-speed on a lot of these issues. That's been a big change in a generation. At the corporate level, there's a lot more commitment to worrying about that element of the supply chain. You see Wal-Mart, which has gone from being an environmental black-eye bad actor to trying to drive the market through their supply chain. At the national level, though, you still have this very balkanized parochial debate about which industry gets advantaged and which industry gets disadvantaged. One of the things that's remarkable about our Global Warming Solutions Act is it makes no special deals for any industries. That is the simplest, most transparent, least-cost way of doing any of this - to focus on the environmental quality outcome and find the cheapest way to do it. That was a piece that was missing in the state dialogue before Gov. Patrick

took over.

cw: What kind of car do you drive?

BOWLES: I have a state car that's a plug-in hybrid Prius. It's retrofitted with an A123 battery. [A123's headquarters is in Watertown.] You take a regular hybrid and you put in a much bigger battery in the wheel well in the back. It essentially means you can drive your first 40 miles on purely battery power. I can get over 100 miles a gallon. I plug it in downstairs. I leave it here since I live in Charlestown.

cw: I interviewed Gordon van Welie, who heads ISO-New England, the organization that manages the region's power grid, and he likened the state's support for renewable energy to what a car owner does when trying to choose between a Corolla and an all-electric car like the Chevy Volt. He says the car owner has to decide whether gaso-line prices will go up enough over time to make paying the higher upfront cost of the Volt worth it. Do you agree with that analogy?

BOWLES: Remember, the ISO-New England's job is to keep the lights on. So they've never met a power plant or transmission line they don't like. That's a threshold thing to know about them. Gordon is a smart leader of that organization, but organizationally, dispositionally, they discount energy efficiency. Their job is to be super conservative. Their job is to avoid the once-every-three-decades one-day blackout because that's the thing they have to make sure doesn't happen. I think they, as an organization, have not yet begun to build into their scenarios the level of energy efficiency that states are making happen. I don't think they've done enough to look at the end-use energy efficiency in their medium-term trends because they're still predicting load growth in New England. I think that load will go down in New England based on end-use energy efficiency.

cw: How long do you think it will be before homeowners start to have to pay attention to their utility bills the same way they do to their cable and cell phone bills?

BOWLES: In a 10-year time horizon I think there's a good possibility of that. It really depends on price signals. The level of disinterest of the average consumer in their water, gas, heating oil, and electric bills...is kind of stunning. I think that's a lack of innovation and market signals in that utility space, and that's because they are regulated monopolies and they're not fast moving. No one has come to me as a consumer to say, "I will save you 35 percent on your heating and electric bill if you do the following 10

things—insulate your home, update your oldest appliances, address your heating and cooling, buy a real-time meter, run your dishwasher at 9 p.m." It will not be hard, in my mind, for consumers to see that level of savings once market participants come and offer that type of pricing plan. We're not far. A company like EnerNOC has come from nowhere to be a \$1 billion capitalization company selling negawatts. It's a great business model, and those guys have done very well. I think that will happen for the consumer and the marketplace.

cw: How come we're not seeing the installation of smart grid meters that will tell consumers to adjust usage based on price?

BOWLES: The prices for smart grid meters are still too high from where I sit for us to make a statewide bet on them. The federal stimulus is putting out \$10 billion for the purchase of smart meters all around the country. That will drive the unit cost down and when that unit cost goes down then I think it would make sense for state regulators to require it across the rate base. But right now, absent the strong retail supplier presence, absent the plug-in cars, absent a more snappy delivery of energy efficiency services

> GATEWAY CITIES

Seizing the unrealized opportunities Massachusetts has in its regional cities will require new thinking, cross-sector collaboration, and long-term focus. MassINC's commitment to support this work stems from our deep conviction that strong communities build the middle class. Read about our strategies for renewal in Massachusetts Gateway Cities at:

massinc.org

to the home, I don't think the comprehensive smart meter thing makes sense. But in five to 10 years it will.

CW: Do you have any concerns about the state's investorowned electric utilities, which are your partner in this effort?

BOWLES: The cards you get dealt are the cards you play. Changing fundamentally the delivery channel of the utilities for things like energy efficiency is an example of a battle that I didn't think was worth it. The utilities, some of them particularly, have the motivation and the consumer contact channel to be the best partner in this line of work. Vermont has created Efficiency Vermont, an energy efficiency utility. That's their delivery channel. That takes a huge amount of heavy lifting to create that channel. My view of it was the utilities are a necessary partner in this enterprise.

cw: The electric utilities, no matter what the policy, seem to be held harmless financially. Even in negotiating a long-term contract for renewable power, they get 4 percent of the value of the contract as a negotiating fee.

BOWLES: This Department of Public Utilities has held the utilities accountable in a way that hasn't been seen in 20 years. NStar asked for \$30 million for the CSI [customer savings initiative] case, and the DPU gave them zero. That was based on a review on the merits. In the National Grid case, they got nowhere near what they asked for. For 16 years, the utilities didn't have much oversight in the Commonwealth, since Gov. Dukakis was there. Gov. Patrick put in a more consumer-friendly DPU, and we've heard some squawks from the utilities about that. Some of the utilities look at what's happening right now and see demand erosion, energy efficiency, and things like solar ownership, and they're saying, "I'm going to be a different type of entity in five years. I'm going to be more of a full-service energy supplier than a passive energy pusher," which is what their role was for about a century, pushing energy to people because they make more the more energy you use. Now with decoupling, least-cost procurement, solar ownership, long-term contracts, their world has changed a lot. I would say we've got some of the nation's best utilities in terms of being well run—the big ones, at least, anyway -and having the capacity to see that shareholder opportunity to go out and do a good job in this area. Now are they going to move at the velocity that the governor and I want in all circumstances? No. If we went in thinking they would, then we would be unrealistic. We knew going in that they were going to be a key partner for us and we needed to sort out how to provide them with incentives and encouragement for fulfilling this vision.

Catching the wind

Renewable power has tremendous potential, but only with a serious investment in infrastructure and technology BY GORDON VAN WELLE

MORE THAN 10 years ago, New England set out on the road to develop dynamic, competitive wholesale electricity markets that would create incentives for private investment in diverse sources of supply, transmission improvements, and new technologies to make the region's electric system more efficient and its resources more cost-effective.

Electric industry restructuring prompted a tremendous amount of economic activity. Billions of dollars in private investment in new, cleaner, more efficient power plants has boosted the region's supply by more than a third; new transmission lines have improved the flow of power throughout the region; and entrepreneurs have taken advantage of the resulting opportunities to launch "green" businesses and create jobs.

By most measures, the system today is more competitive, efficient, and environmentally friendly than when the region started this journey in the late 1990s.

The six New England states are now setting a course that could guide policy for decades to come, emphasizing the power of natural resources in the form of wind, water, and the sun to reshape how electricity is produced and delivered, while providing numerous incentives to change the way electricity is used.

Ten New England and mid-Atlantic states, including Massachusetts, have formed the Regional Greenhouse Gas Initiative, a market-based compact that mandates a 10 percent reduction in carbon dioxide emissions by 2018. In addition, Massa chusetts and four other New England states approved Renewable Portfolio Standards, setting individual goals for how much electricity should come from renewable sources. Each state has different targets and deadlines, but generally they mandate that between 20 percent and 30 percent of the region's projected total electricity demand be met by renewable sources and energy efficiency

by 2020.

The objectives of these initiatives are twofold: to provide environmental benefits and to diversify the sources of fuels used to produce electricity. The latter effectively creates a hedge

against volatile fossil fuel prices, which are the key influence on the region's electricity prices.

It's an ambitious agenda, and it brings us to an important crossroads.

NEW ENGLAND HAS tremendous potential to develop native wind power. In addition, opportunities abound to import clean energy from hydro, wind, and even potential nuclear sources in Canada. But the region will need to undertake an extensive expansion of the power grid to ensure these new resources can be fully deployed. This will require a large, upfront investment in resources, infrastructure, and technology-investment to build the wind farms that will produce the power, investment to expand the transmission system that will deliver it to consumers, and investment in new technologies to foster implementation of a smart grid so that system operators can integrate renewable energy reliably while giving consumers greater control over their electricity use.

For policymakers making a decision about our region's energy needs, this situation is similar to the choice that consumers face when purchasing a car. Should the driver consider a plug-in electric vehicle or a gasoline-powered, but fuel-efficient, compact? Electric cars require a higher outlay of cash up front compared with gasoline-powered ones. But over time, depending on the direction of gasoline prices, the fuel savings could even out the higher price tag. In addition, the non-quantifiable environmental benefits may be worth the cost differential to many consumers.

To help inform policymakers, the ISO conducted a study at the request of the six New England governors to determine how much infrastructure would be needed to develop and integrate varying amounts of onshore and offshore wind power—and how much it would cost. The analysis, published in the fall of 2009, showed that higher concentrations of renewable wind energy could result in lower wholesale electric energy prices and emission reductions, but the cost to build the transmission needed to deliver these resources to market would be significant.

Because the best sites for wind development are located far from the region's population centers, a large amount of wind resources would require a new "backbone" transmission loop running through five of the six New England states. The cost estimates for developing various amounts of wind power, from 2,000 megawatts to 12,000 megawatts, range from \$1.6 billion to \$25 billion. Access to a combination of in-region and nearby Canadian wind power would meet approximately 15 percent of the region's energy needs with clean resources and would require approximately \$10 billion in new transmission investment.

Family Financial Skills

MassINC's Family Financial Skills program examines new pathways to help families navigate the complex financial decisions increasingly tied to major milestones of American life. From paying for college to purchasing a home, middle class families shoulder dramatically more financial risk and responsibility today than in the past. This new initiative explores emerging opportunities to advance the marketplace for family financial products.

To learn more visit: www.massinc.org

The governors also wanted to know whether it would be more cost-effective to build wind power here in New England or have it built in the Midwest and transported here. Development of transmission to deliver and integrate equivalent amounts of energy from large-scale wind projects located in the Midwest to the Northeast could cost an estimated \$20 billion to \$47 billion. In addition, the region would lose the economic benefits of local construction investment and the "green" jobs that come with building and operating native wind farms.

This sizeable, upfront investment would cause anyone to pause, but it leaves policymakers with some complex economic evaluations to make. And to further complicate the picture, there are key inputs into that equation that are still unknown.

For one, there is still no resolution over the creation of a national energy policy. The fate of legislation in Congress is unclear, leaving uncertainty about the levels of renewable resources that will be required, carbon emission limits, and transmission funding mechanisms.

There are also key questions yet to be resolved locally. One is the cost of renewable power compared to electricity produced by more conventional resources. Are New England consumers willing to pay more in the short-tomedium run for potential longer-term economic and environmental benefits?

There also remains the issue of how to pay for the transmission build-out that is being envisioned. New England has a well-tested funding mechanism for transmission projects that improve the reliability of the regional system. The costs for these projects are shared throughout the region. But the region currently doesn't have a similar funding mechanism for transmission investments that facilitate the integration of wind resources, although developers are proposing to bundle the cost of transmission and renewable energy together, thereby passing transmission costs onto the buyer of renewable power.

The New England states are farther down the road than most other regions when it comes to setting and implementing policy to foster development of renewable resources and encourage conservation. But the region has reached a critical juncture. Before we can proceed, several moving parts need to come together—guidance in the form of federal energy policy, a regional plan that is responsive to federal and state policies, and a willingness by consumers and their elected representatives to support the upfront investment that will be necessary to build a system that will meet the region's energy and environmental goals. In other words, are consumers ready to make the investment in that electric car?

Gordon van Welie is president and chief executive of ISO New England Inc., the region's power grid operator.

Wishful thinking

The state's energy policy oversells the benefits of renewable power and conservation efforts by JONATHAN HAUGHTON

THE TRADITIONAL FOCUS of energy policy was on ensuring inexpensive and reliable supplies, but now, driven by concerns about anthropogenic climate change, there is pressure to rein in emissions of greenhouse gases, especially carbon dioxide.

The problem is that existing measures to address carbon dioxide emissions are ad hoc and incoherent, and so are more expensive, less effective, and more unfair than they should be. The tragedy is that it need not be so. Introducing a tax on carbon in return for lower taxes on income, coupled with sweeping away the patchwork of existing emissions-reduction measures, would represent a huge improvement. This is not merely the idealistic vision of an academic scribbler: British Columbia has introduced a robust version of this idea, and Sweden and Finland have had carbon taxes for almost two decades.

Where does Massachusetts energy policy go wrong? The Renewable Portfolio Standard (RPS) requires a rising proportion—currently 5 percent -of electricity to be derived from "new renewable sources." Utilities currently pay about 2 cents more per kilowatt hour for new renewables than they do for conventional energy, a market-driven premium that is capped at 6.1 cents. Beyond this, the Commonwealth's major electricity utilities are being pressured to sign long-term contracts with renewable producers such as Cape Wind, which recently negotiated an initial contract price of 20.7 cents per kilowatt hour. These numbers are not as benign as they look: The wholesale cost of conventional electricity in Massachusetts in the year through March 2010 was 5.1 cents per kilowatt hour. So new renewable supplies are substantially more expensive, and power from Cape Wind is more than three times as expensive as conventional sources.

The relevant question is whether subsidies of this magnitude are justified. In a recent study of wind power in Massachusetts, I argue that, given the under-pricing of fossil fuels and the low emissions produced by wind turbine generators, a ratepayer subsidy of about 1.1 cents per kilowatt hour for wind is appropriate. The implicit subsidy to Cape Wind is over 10 times as high, and it represents a cost of more than \$700 per ton of carbon emissions averted, an astonishingly costly way to mitigate climate change.

BUT THERE IS worse. In January 2010, the Massa - chusetts Department of Energy Resources (DOER) unveiled a program touting energy efficiency as "our first fuel." We are promised that "a cadre of

energy specialists, HVAC contractors, weatherizing experts, and other technicians will deliver dramatic improvements in building performance and comfort across the state," using "a tried and true approach" that is nonetheless "new,

unprecedented," and "groundbreaking," and "is designed to yield unparalleled savings for consumers" via energy savings, or "negawatts." We are asked to believe that \$2.1 billion in costs incurred between 2010 and 2012 will yield savings of \$6 billion.

This is wishful thinking; returns this large would attract a rush of entrepreneurs and would not require a helping hand from the state. The problem is that DOER's diagnosis is wrong: It turns out that energy savings do not come cheap. As early as 1992, Paul Joskow and Donald Marron, in a paper titled "What Does a Negawatt Really Cost?" that appeared in the Energy Journal, showed convincingly that the actual electricity savings from utility conservation programs were no more than 30 percent to 40 percent of the projected, engineering-based savings. Their words still ring true: "the free banquet with caviar and champagne that the public is often promised is not likely to be achievable with current practices." This is especially true now that most of the low-hanging fruit of energy conservation have been picked.

Federal policy is no better. In the name of pro-

moting renewable energy, the federal government provided \$4 billion in biofuel subsidies in 2008 in the form of a tax credit. As a result, a quarter of the US corn crop in 2009 was used to produce ethanol—pushing up food prices while replacing just 2 percent of the gasoline used in the country. Given that corn-based ethanol uses four

units of energy for every five units it delivers, this represents a cost of about \$1,800 per ton of carbon emissions avoided. Congress may now be having second thoughts; it has yet to renew the tax credit, which expired at the end of 2009.

Grassroots actions, however well-meaning, can also be silly. Some activists are calculating "food miles"—the distance food has to travel from producer to dinner plate and are urging us to go locavore. Unfortunately, this analysis is incomplete, because it ignores production costs. Remarkably, it takes less energy to raise sheep in New Zealand and ship the meat to England than to raise the sheep in England.

In short, we are over-subsidizing wind power, undercharging for fossil fuels, and overselling the benefits of conservation.

With a carbon tax in place, there will be no further rea-

For more information call 617.742.6800 x101 or go to www.massinc.org son to subsidize wind power or weatherization or solar panels or biofuels—or to introduce CAFE or other regulatory standards. Such measures are redundant if fossil fuels are correctly priced. Then, if Cape Wind still cannot compete with electricity from (taxed) coal and gas, it should not operate, because it would represent an expen-

The case for a carbon tax may be stronger in principle than in practice.

sive way to reduce greenhouse gas emissions. And if the Massachusetts DOER cannot persuade households and businesses to pay for its advice on how to save energy, it should get out of that business.

The case for a carbon tax may be stronger in principle than in practice. The biggest operational difficulty is determining how large the tax should be. William Nordhaus, an economist at Yale University, makes a strong case that the optimal tax would be about \$33 per ton of carbon equivalent to 8.8 cents per gallon of gasoline—rising to \$48 by 2020. There is, of course, enormous uncertainty in these estimates. We do not know how quickly atmospheric concentrations of carbon dioxide will continue to rise, the degree to which this will lead to global warming, or the extent to which global warming will even cause harm.

Yet practical policymaking cannot wait for scientific certainty. Finland led the way when it introduced a carbon tax in 1990; it is currently levied at a rate of \$26 per ton of carbon dioxide. The tax in Sweden now stands at \$150 per ton of carbon, although a rate half this high is applied to fuel used by industry.

Perhaps of more interest to Massachusetts is the case of British Columbia, which introduced a carbon tax in 2008 at a rate of \$38 per ton of carbon. The rate is set to rise gradually until 2010, at which point it will be equivalent to 28 cents per gallon of gasoline. All of the carbon tax revenue is being used to reduce provincial income taxes.

A carbon tax in Massachusetts would impel us to economize on the use of fossil fuels, while the benefits would accrue almost entirely to free riders in the rest of the world. But perhaps others in the herd will follow if we take a lead. Even if they do not, a transparent and simple carbon tax would be a coherent and efficient replacement for our current crazy-quilt of energy policy measures.

Jonathan Haughton is a professor of economics at Suffolk University and a senior economist at the Beacon Hill Institute of Suffolk University.

An unsustainable status quo

We need a market-based policy to break our dependence on imported and polluting fossil fuels by JEREMY MCDIARMID AND ABIGAIL ANTHONY

ABSENT THE ABILITY to peer into a crystal ball, no one knows what kinds of fuels the cars and trucks of the future will run on. Many of us have high hopes for a world where cars are fueled by electricity generated from renewable wind energy, or by natural gas recovered from landfills, or by biofuels grown from algae. But no scientist, engineer, policymaker, or science-fiction writer has yet discovered the ultimate elixir for our ailing transportation system.

What we do know is that the status quo is unsustainable. We must do better if we want our environment and economy to thrive for generations to come. Today, our cars and trucks are heavily dependent on mostly imported, highcarbon petroleum to make them go, and as a result the transportation sector causes more than one-third (36 percent) of all global warming pollution in the Northeast. In Massachusetts, we spend more than \$10 billion a year on transportation fuel, nearly all of which we import from other regions and countries. Whatever form our transportation future takes, we have to break from our dependence on imported and polluting fossil fuels.

And so it comes as a welcome ray of hope that a bipartisan collection of Northeast and mid-Atlantic governors, led by Gov. Deval Patrick, has begun establishing a low-carbon fuel program for the transportation sector that will help us move toward a more sustainable transportation system. This is a timely policy to reduce the carbon content from our cars and trucks as both a climate mitigation and regional economic strategy.

The program, known to policy wonks as a lowcarbon fuel standard, or LCFS, is a policy that helps bring cleaner, often indigenous fuels to market by limiting the carbon content, or carbon intensity, of our fuels. The program works by requiring an overall decline in the amount of global warming pollution in our fuels over time.

The states will set an overall target for carbon intensity—say, a 10 percent reduction over 10 years—which fuel producers will have to meet. How they do so will be up to the fuel producers, or, really, the market. One of the primary benefits of this program is that it is fuel-type neutral. By setting a numeric goal of lower carbon, the market—not lawmakers or anyone else—picks the winners through technology innovation, effectiveness, and cost competitiveness. Each type of fuel is assessed a score based on carbon emit-

ted per unit of energy, factoring in all direct and significant indirect lifecycle emissions from production to consumption. The standard sets an overall limit on average carbon content that declines over time, gradually shifting the fuel pool toward cleaner fuels. This is a significant departure from past policies that have relied on counterproductive subsidies and volume requirements for specific fuels and technologies.

Each fuel producing

company must meet the standard based on an overall averaging of the carbon content of the fuels they sell (e.g., gasoline, diesel, ethanol). For example, in order to reduce the carbon intensity of their product, petroleum refiners could: blend lower-carbon biofuels, such as cellulosic ethanol; sell low-carbon biofuels such as E85 for use in flex-fuel vehicles; or reduce emissions from the refining process itself. Selling natural gas for use as a transportation fuel is yet another possibility.

Similar to other cap-and-trade programs, a system of tradable credits will be created to help make the program work. Those with an average better than the standard will earn credits that they can sell to providers that come up short. For example, gasoline suppliers might purchase credits from utilities selling clean electricity to power electric vehicles. **UNDERSTANDING THE ECONOMIC** costs and benefits of this program will be essential to its ultimate success. That is why the 11 states are conducting a comprehensive analysis this year of what economic impacts the program may have. Transitioning to a low-carbon transportation system will require upfront investments made by individuals, businesses, and governments, particularly when different vehicles or different infrastructure are required. To be sure, there will be costs associated with electric-charging infrastructure, natural gas refilling stations and the higher upfront costs for alternative-fuel vehicles. In evaluating the economics of the program, our states must look at these costs compared to the costs of inaction—of a continued overreliance on petroleum.

Shifting away from reliance on petroleum products

will also bring economic benefits. California conducted an analysis of economic impacts of its own LCFS and concluded that, assuming the price of oil rises modestly from \$66 to \$88 per barrel over 10 years, fuel cost savings will offset the upfront investments in fuel technologies and infrastructure. The study examined how different combinations of ethanol, electricity, natural gas, hydrogen, and

biodiesel could be used to meet the standard and concluded that the displacement of gas and diesel with lowcost, low-carbon fuels could result in an overall savings for California as high as \$11 billion over 10 years. While the California experience is instructive, our states' own study must explore these issues independently, based on our region's own economic conditions.

We are confident that the LCFS can help improve state economies. Currently, the billions of dollars we spend each year on imported fossil fuels leaves the local economy. By developing a program that allows cheaper and in-region fuels to participate, we can stem the outflow of money and promote a market for locally produced lowcarbon fuels. The growing market for clean alternative fuels can also provide a welcome economic boost for our region—starting and attracting companies, creating and retaining jobs, and growing the states' clean energy sectors rather than sending our dollars away to foreignproduced fossil fuels. Moving forward to adopt a lowcarbon system now will give the Northeast an edge and allow us to start seeing the benefits of a reduced dependence on petroleum.

As a market-based policy, it will make low-carbon fuels like electricity, hydrogen, natural gas, and cellulosic ethanol more attractive to consumers, bringing real climate benefits. Equally important, the low-carbon fuel standard will also discourage the expansion of polluting high-carbon fuels, like corn ethanol or gasoline made from tar sands, which currently get a free ride in the marketplace.

The success of this program (or any other transportation fuel policy) as a climate change solution depends on having an accurate and complete understanding of the global warming impact of each fuel. Massachusetts and the other states have pledged to adopt "full lifecycle" accounting standards for fuel emissions. This means that when scoring the carbon impact of a fuel, they will count not only the tailpipe emissions, but also the emissions associated with a fuel's extraction, production, and transport to market. This is crucial to getting the fuel standard right. Giving credit for an electric car that runs on dirtycoal electricity but emits nothing from its tailpipe would

Transitioning to low-carbon fuels will require upfront investments, but states must compare these costs to the costs of inaction

> undermine the climate goals of the program. Fortunately, the body of research around lifecycle accounting of fuels is continually growing and getting more sophisticated, so states and stakeholders will have access to the tools and information needed to accurately assess the carbon intensity of our fuel choices.

> California adopted its low-carbon fuel program in 2009 and other states and regions are beginning to follow suit. Our region would do well to get ahead of the pack to help position the northeast and mid-Atlantic states to out-compete other regions in a clean energy economy while kick-starting a new transportation future that is cleaner and offers more choices to the consumer.

> Now it is time for state policymakers to pick up the pace of designing and implementing a program. The states can signal to the marketplace that they mean business by (a) developing a detailed framework for a model rule in 2010 (b) setting a target to reduce carbon-intensity in transportation fuels by at least 10 percent and (c) using the best science and economic analysis to account for the full lifecycle of emissions from each fuel. It's time to build a path to an optimistic, cleaner, and more energy-independent transportation future.

Jeremy McDiarmid is a staff attorney at Environment Northeast's Boston office. Abigail Anthony is a policy analyst at the group's Providence office.

Competition works

Long-term renewable energy contracts should be put out to bid

BY EDWARD N. KRAPELS

MASSACHUSETTS IS COMMITTED to the principle that approximately 20 percent of its existing electric generation capacity should be replaced by a combination of efficiency measures and renewable energy. On the demand side, this commitment has already spawned a boomlet of energy efficiency initiatives that are having a substantial impact on electricity demand.

On the supply side, progress is coming more slowly. Massachusetts, working through its largest utility, is on the cusp of making a long-term commitment to Cape Wind. National Grid negotiated a 15-year contract with Cape Wind and, as I write this, is awaiting regulatory approval to recover the cost of that contract from its customers.

Cape Wind, for all of its issues, is an important step in the right direction. Renewable energy developers need long-term contracts for their power if they're going to bring projects of sufficient scale online. But the contracting process in Massachusetts and across New England needs to move faster if we are to keep up with our obligations. It took Cape Wind years to land a contract. We need to step up the pace and approve a similar-size contract every year if Massachusetts and the other New England states are going to individually and collectively reach their renewable energy goals.

There are two questions for policymakers. First, what criteria should be used in selecting the next renewable projects and, second, how should the renewable projects be selected? I believe we should select the cheapest qualifying renewable projects that also create the greatest economic benefit for New England. And we should make the selections using a competitive procurement process.

In pursuing a cleaner electric system, Massachusetts has defined renewable energy as wind, solar, small hydroelectric, and biomass. Generation from oil, coal, natural gas, nuclear, and large hydroelectric facilities was excluded. One can argue about the definition, but these were not random choices.

As a matter of state economic and environmental policy, the governor and the Massachusetts Legislature wanted as much of the renewable energy as possible to be generated within the state. They even set up special initiatives targeting Massachu setts-based renewables. Cape Wind's proposed contract with National Grid was the outgrowth of one of those initiatives.

The preference for in-state renewables is understandable. At both the federal and the state level, environmental policy is increasingly conflated with economic policy. Simply stated, we need jobs.

A big push for renewable energy could create thousands of new and sustainable jobs. For that reason, we need to reframe environmental policy to take into account the number of jobs environmental initiatives may create. To the extent we

make long-term commitments (and we will have to do so), the number of jobs created should be among the selection criteria determining which alternatives we pursue.

But we also have to keep in mind that a project's selection shouldn't be dictated by its location. We should select the projects that are cheapest first, wherever they happen to be located in the region, while taking employment effects into account. The key to successful development of renewable energy is competitive procurement of the long-term contracts that will have to be issued to get largescale projects built.

There are three sources for the next wave of large renewable projects, each with its own employment consequences.

First, we could develop more offshore wind projects like Cape Wind. If done on a large scale (as is currently contemplated by other East Coast states), this could evolve into a huge industry, with thousands of high-skill, high-paying jobs. While early offshore projects will have understandably higher capital costs, these should come down over time. The development of offshore wind could have an enduring and even profound effect on the economies of the East Coast states, which have largely failed to develop a large, indigenous energy sector.

Second, we could import wind power from Maine, New Hampshire, and upstate New York, which each have excellent onshore wind prospects that (unlike Massachusetts) can be developed on a large scale. This would also generate thousands of jobs for New England states.

Third, we could import hydroelectric energy from Canada. The choices are Quebec and Newfoundland. Unfortunately, these neighbors are locked in a bitter dispute over the rights of way needed to get their abundant hydroelectricity to the northeastern United States. While it would be ill-advised for Massachusetts to get involved in this dispute, both provinces would like the state and the region to make long-term commitments to the purchase of their hydroelectricity and for that power to count towards the states' renewable energy targets. According to Massachusetts custom, however, large-scale hydro is not renewable. Perhaps more significantly, reliance on Canada for New England's renewable energy means fewer renewable energy jobs in New England.

These projects all require some investment in transmission lines to deliver power from where it is generated to the population centers in southern New England where it is needed. Some have advocated for an elaborate regional or even national transmission system to carry this power, but it would be more cost-effective to build transmission lines on a case-by-case basis and bundle the lines and the power in one package.

Only a competitive process will unleash the creative energies of our most innovative businesses—the Googles of electricity, in essence—by encouraging them to compete to provide New England with affordable, clean energy. We cannot, in other words, simply give this business to the first companies that walk in the door, or to utilities simply because these activities occur in their traditional service areas. The winners of this regulated competition will be specialists who will not be allowed to pass through cost overruns to electricity ratepayers, forcing them to bring their projects in on budget and on schedule. Noncompetitively awarded projects, in contrast, typically come in behind schedule, well above budget, and with consumers unknowingly picking up the extra tab.

Edward N. Krapels is the chief executive of Anbaric Holdings LLC of Wakefield, which has incubated several large, innovative transmission projects (see www.NeptuneRTS.com), and Smart Grid companies (see www.ViridityEnergy.com).

MassINC's CITIZENS' CIRCLE

COLLABORATION. INVESTMENT. IMPACT.

MassINC's Citizens' Circle brings together exceptional people who care about improving the quality of life in Massachusetts. These valued supporters are leaders in a wide range of fields, including business, philanthropy, labor and government.

For more information on joining the Citizens' Circle —please call Lauren Louison at 617.224.1613.

1500 Members. 175 Million Square Feet. Endless Opportunities.

NAIOP members get effective legislative advocacy, access to limitless contacts, and inside information you just can't get anywhere else.

Rely on the power of NAIOP.

 144 Gould Street, Needham, Massachusetts 02494

 Tel: (781) 453-6900 | Fax: (781) 292-1089 | Email: information@naiopma.org | www.naiopma.org

18 Tremont Street, Suite 1120 Boston, MA 02108

Address Service Requested

PRESORTED STANDARD U.S. POSTAGE PAID HOLLISTON, MA PERMIT NO. 72

Visit MassINC online at www.massinc.org

The Medium is the Message

Call us to make your printed materials reflect your principles.

Recycled Paper Printing, Inc.

Phone: 1-800-886-9901 • www.recycledpaper.com

What's In Your Paper?