A Project of the Lowell Center for Sustainable Production at the University of Massachusetts Lowell

# CLEAN TECH
## An Agenda for a Healthy Economy

AT A GLANCE • JANUARY 2010

Protecting the environment has become a vibrant, new business opportunity. From innovative, green products for renewable and clean energy to smart and efficient materials for reusing and recycling, to new transportation and housing options, the time is now for Massachusetts to capture the Clean Tech market.

**Massachusetts, known throughout the world as a center of innovation in high tech, life sciences, and information technology, has an opportunity to add Clean Technologies to this list and lead a worldwide transition toward a cleaner, healthier economy.**

Under the leadership of the Governor and Legislature, Massachusetts has already made tremendous advances in the area of clean energy, passing a host of policies that encourage the development and use of renewable energy and energy efficiency, and reaching out to attract and retain businesses in the clean energy sector. *This same enthusiasm and leadership should be tapped and directed towards nurturing the broader range of Clean Technologies that will help solve the world's most pressing problems—resource depletion, climate change, and increasing rates of cancer and other diseases.*

No state yet has developed a comprehensive economic development strategy to reorient its economy around the broad definition of Clean Technologies. Internationally, only Germany has done so. Embracing the strategies proposed here could enable Massachusetts to become *the* international hub of Clean Technology innovation and adoption.

### Huge Market Opportunity

Local and international markets are increasingly demanding these cleaner technologies. The organization LOHAS (Lifestyles of Health and Sustainability) describes an estimated $209 billion U.S. marketplace for goods and services focused on health, the environment, social justice, personal development, and sustainable living. Programs such as the LEED™ green building rating system, European policies such as

### WHAT ARE CLEAN TECHNOLOGIES OR "CLEAN TECH"?

Products, services, and production processes that greatly reduce or eliminate environmental and health impacts throughout a product's lifecycle—from mining to manufacturing to product use and disposal—while maintaining the same or better levels of quality.


REACH, and individual state policies in the US on recycling, green chemistry, and bio-materials, are creating demand for less toxic, recyclable, and energy-efficient products and services.

The University of Massachusetts formed the *Clean Tech Initiative* in 2007 to learn where Massachusetts has the potential to take advantage of this emerging market, and to identify policies and actions to create a vibrant Clean Tech economy and identity. The project gathered input from a broad-based Advisory Committee, individual interviews, and through a series of stakeholder roundtables. Many of the resulting recommendations are low or no cost. Others may cost more, but given market trends and increasing awareness about environmental and health issues, the economic benefits should well outweigh the costs.

## Five Areas of Clean Tech Leadership

Massachusetts has a leading innovation and adoption edge in five Clean Technology areas:

1. **Safer Alternatives/Green Chemistry:** the design and use of safer alternatives to toxic chemicals in products and manufacturing processes.
2. **Green Buildings:** products and services that reduce the health and environmental impacts of constructing, renovating, and operating buildings.
3. **Materials Reuse:** returning products and materials back into the economic mainstream through reuse, remanufacturing, composting, and recycling.
4. **Emerging Materials:** such as safe and green biobased and nanomaterials which, when designed responsibly, have the ability to yield significant efficiencies in energy and materials use.
5. **Clean Energy:** the use of cleaner or more efficient energy sources and production methods that create less pollution—from fuel extraction to energy generation to reduced demand.

Strengths that give us this leading edge include a well-trained workforce, strong export ties, research leadership, entrepreneurial activity, and ability to attract public and private funding. However, to realize this leadership will take additional action from state leaders.

## Ten Ways to Support a Clean Tech Economy

1. **Create a "Clean Tech Blueprint" for Massachusetts That Establishes a Clear Vision, Goals, Metrics, and Leadership Roles.** By articulating a clear vision, goals, performance standards (such as energy efficiency, recycled content, or toxicity), and desired environmental and public health outcomes, government can set the parameters under which companies in the marketplace develop new technologies, and create conditions for those to thrive.
2. **Create a Massachusetts Brand or Identity for ALL Clean Tech Activity.** Developing this identity through public relations and marketing tools—such as a central web portal of Clean Tech activities and resources—and the use of the bully pulpit by state leaders to promote Clean Tech assets and products, will help the state emerge as a Clean Tech powerhouse that attracts investment, research, and business activity.
3. **Track Massachusetts Competitiveness by Creating an "Index of the Massachusetts Green Innovation Economy."** Similar to the John Adams Institute's Index of the Massachusetts Innovation Economy, the Green Innovation Index would determine indicators that are important in creating the Clean Tech economy, measure these indicators, and compare our progress in meeting them against other states that are Clean Tech leaders.
4. **Create a State Office of Clean Technology** (or Clean Tech Coordinating Council). To institutionalize its Clean Tech Blueprint, a governance and support structure is needed. This can be a new State Office of Clean Technology, or a Clean Tech Coordinating Council comprising the directors of all key state agencies who would have a role in implementing and updating the Blueprint.
5. **Create Regional Clean Tech Centers of Excellence.** A network of Regional Centers of Excellence would bring together leading businesses, researchers, labor leaders, environmental and health advocates, and researchers to identify and implement cutting-edge research, create partnerships, apply for funding, and act as a clearinghouse for Clean Tech information.
6. **Stimulate Collaboration and Cross-Fertilization of Technologies.** The state can foster a culture of collaboration within and among sectors and technologies, including industries that may not yet be "clean." This would not only help create partnerships among business, government, environmental and health advocates, and researchers, but help share knowledge and define needs and priorities that lead to environmental innovations and are more likely to attract funding.
7. **Support Manufacturing as a Viable Sector.** State officials must market and strengthen the Commonwealth's unique capacity for high-

end, first-run, niche manufacturing in all parts of the Clean Tech supply chain, so that it can thrive in the long term. The state's manufacturers should also be assisted in adopting environmental practices that help them stay competitive by saving energy, recycling wastes, and using less toxic substances.

8. **Develop a Trained Workforce.** Business and labor leaders, community colleges, vocational technology schools, workforce investment boards, regional employment boards, one-stop career centers, and other training agencies should be brought together to identify current and future workforce needs and how to fill them. Green jobs legislation should expand beyond the energy sector, and job and training forecasts be performed for future employment and training needs.

9. **Regulate, Procure, and Invest.** The state needs to show that it will provide long-term support for Clean Technologies and is committed to creating competitive conditions for their development and implementation. These market signals can help give entrepreneurs the confidence to innovate and spur change. However, any policies or specifications should encourage continuous improvement, not a static solution.

10. **Take Risks to Spur Innovations.** Agencies and programs that fund Clean Tech activities should be a little less risk averse when determining projects to fund. Even if a project fails, there is still something to learn and benefits that can be gained. Being less cautious may yield exciting breakthroughs.

# Policy Actions for Five Clean Tech Areas

## SAFER ALTERNATIVES TO TOXIC CHEMICALS

***Pass key policies on safer chemicals and products.*** Green chemistry legislation or an executive order focused on the right tools, regulations, and incentives would promote the transition to less toxic materials and products. It would encourage the research and use of safer, less-toxic, or non-toxic chemical alternatives to hazardous substances; advance long-term green chemistry

directions by building on Massachusetts' existing capacity; disseminate best practices; and develop education and training programs. A Green Chemistry Center that coordinates and evaluates these activities should be housed in the state Office of Technical Assistance or at a university. In addition, the state should pass the Safer Alternatives Bill, which establishes a policy framework that builds on the state's successful Toxics Use Reduction Act.

## GREEN BUILDING

***Create an implementation plan for the recommendations of the Governor's Zero Net Energy Building Task Force, prioritizing data collection and dissemination, and energy rating and certification.*** Governor Patrick's Zero Net Energy Building Task Force recommendations

are far-reaching ones that would put the state in the forefront of creating buildings that will eventually generate at least as much energy as they use, and incubate a market for technologies and services that can meet similar needs around the world. A plan should be developed to move forward on their implementation, with a priority on 1) developing a system for collecting and tracking information on energy use in buildings and 2) creating an annual energy rating standard and building certification that would be available to tenants and property buyers.

## MATERIALS REUSE AND RECYCLING

***Reestablish a stable funding mechanism adequate to double the state's recycling and waste reduction rates.*** The state's recycling rate leveled off when dedicated recycling funds from unredeemed bottle deposits were instead returned to the General Fund.

In order to significantly increase the state's recycling rate, and realize the considerable associated economic and environmental benefits, investments are needed in education, enforcement of bans on disposal of certain waste materials, next-generation collection and processing infrastructure, programs that encourage waste reduction and design for recyclability, research to develop and test new ways to use secondary materials, and assistance and incentives to increase the transformation of recyclable materials into new products by Massachusetts manufacturers. This requires a stable funding mechanism through the current or expanded bottle bill, waste disposal surcharge, and/or other mechanism.

## ADVANCED MATERIALS

**Biomaterials**—***Adopt the Sustainable Biomaterials Collaborative guidelines as criteria for state purchasing and investment in research and development.***
While biomaterials have the potential to reap environmental benefits, they can also be developed in ways that do the opposite by competing for food crops, using unsustainable agricultural practices, and creating products that contaminate recycling streams. The Sustainable Biomaterials Collaborative worked with a range of stakeholders to develop guidelines that help guide the development of biomaterials that are better for the environment. These guidelines cover feedstocks, life-cycle issues, genetically modified organisms, chemicals, and production systems. They should be adopted by the state and used as requirements for funding research and development of biomaterials, as well as for procuring biobased products with state funds.

**Nanomaterials**—***Advocate that more federal funding be dedicated to assessing health and safety aspects of nanomaterials and strive to double the Massachusetts share of these funds to create a Signature Research Center Initiative.***
Nanoparticles have tremendous potential to reap environmental benefits, but real concerns also exist about their environmental, health and safety risks. Congress passed the National Nanotechnology Initiative Amendments Act of 2009 (H.R. 554) that highlights the need to learn more about these possible dangers. Massachusetts should encourage its senators to support the bill in the Senate, and work with the state's nanotechnology research centers to double the amount of federal funding coming into the state. These funds would establish a Sustainable Nanomaterials Signature Research Program and Signature Research Centers for Sustainable Nanomaterials, housed at universities, to accelerate the commercialization of cutting-edge research and facilitate public-private partnerships that link research to key industries such as solar energy, life sciences, and pharmaceuticals.

## CLEAN ENERGY

***Define what clean energy is.***
Despite all of its activity to promote the development and use of clean energy, the state has not developed principles or criteria that define what clean energy is, leaving the door open to technologies that might not actually meet the state's interest in developing clean energy sources. An ideal definition would at a minimum include the following elements:

- the energy should be from natural and renewable resources that replenish themselves in a certain period of time, and don't degrade the environment by their extraction or use;
- it should be locally produced, and not cause the buildup of global warming gases or toxins in the atmosphere or produce waste;
- it should only create a certain amount of greenhouse gases per BTU;
- or, it should avoid the generation of energy altogether, through conservation or efficiency measures.

Legislation, funding for research and development, and other incentives should reflect this definition.

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## Working Together

Achieving a broad and comprehensive transition to a Clean Tech economy will require effort on the part of many public and private entities.

- **Elected officials** must provide leadership for articulating a vision and passing key legislation that creates incentives and markets for development and adoption of Clean Technologies.
- **State agencies** can coordinate Clean Tech task forces and roundtables, bring together stakeholders to identify needs and opportunities, and track our progress in transitioning to the new economy, as well as promote procurement of Clean Technologies and products.
- **Public and private research institutions** should keep conducting cutting edge research, licensing new technologies, and creating business spin-offs in the state.
- **Businesses** must continue to develop and invest in new and existing Clean Tech activities in this state, encourage others to do the same, and help spread the word that Massachusetts is an inviting place for Clean Tech.
- **Environmental groups** should continue to advocate for cutting-edge policies that push the envelope for environmental protection, promote the most environmentally sound solutions and technologies, and educate the public on the benefits for health, jobs, and the economy of cleaner products and processes.

## A Vibrant, Healthy Economy

A Clean Tech initiative in Massachusetts can bring together the well-respected strengths of Massachusetts businesses and institutions to lead the transition to safer technologies that serve the local as well as global marketplace. Massachusetts has an opportunity right now to start taking steps to make it *the* place where:

- Companies compete actively to make the safest, most environmentally benign and most effective products and processes for local and global markets;
- Regular new breakthroughs in technologies that are less toxic, polluting, and/or wasteful are creating safer products and services to meet world demands;
- Significant federal dollars and private investments support our cutting-edge research into next-generation Clean Technologies;
- Our energy demands are greatly reduced through investment in conservation and efficiency techniques, and our remaining energy needs are met through renewable resources, such as wind, solar, and biomass;
- Our air, water, and land are cleaner because our wastes are turned back into new products rather than buried or burned;
- Our population is healthier because our homes, workplaces, and the products we use do not poison the air we breathe, the ground or waters where our food grows, or the water we drink;
- Our firms provide good, secure jobs, from entry level to executive, in safe and healthy workplaces;
- Entrepreneurs and individuals are clamoring to come to Massachusetts and take advantage of the healthy environment, good jobs, and wealth of intellectual and physical resources we have in Clean Technologies; and
- Our tax base is growing, allowing us to have a truly healthy economy in all senses of the phrase.

Whether and how we achieve this vision in the future will depend on the policies and programs that we put in place today. Massachusetts has an unprecedented opportunity to turn environmental protection into a vibrant and long-term sustainable economy. This means building a Clean Tech economy that is broader than the current focus on clean energy alone. Recognizing and supporting the full existing and emerging Clean Tech industry is critical to that vision.


## Clean Tech Initiative Advisory Committee

- **Steve Andrade**, Program Manager, Battelle Technology Partnership Practice
- **Barbra Batshalom**, Executive Director, Green Roundtable and NEXUS Green Resource Centers
- **Michael Best**, Co-Director, Center for Industrial Competitiveness, University of Massachusetts Lowell
- **Tom Burton**, Chair, Energy and Clean Technology Practice Group, Mintz, Levin, Cohn, Ferris, Glovsky and Popeo P.C.
- **Tom Chmura**, Vice President for Economic Development, University of Massachusetts Office of the President
- **Ed Collins**, International Representative of the International Brotherhood of Electrical Workers and Executive Vice President of the Massachusetts AFL/CIO
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- **Michael Goodman**, Associate Professor and Chair, Department of Public Policy, University of Massachusetts Dartmouth
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- **Robert Halpin**, President and CEO, Merrimack Valley Economic Development Council, Lawrence
- **Berl Hartman**, New England Co-Founder, Environmental Entrepreneurs (E2)
- **Jack Healy**, Director, Massachusetts Manufacturing Extension Partnership; CEO, Manufacturing Advancement Center
- **James Hoyte**, Assistant to the President and Associate Vice President, Harvard University
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- **Daniel K. Moon**, Executive Director, Environmental Business Council
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- **Andrea Silbert**, President, Eos Foundation
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To read the full Clean Tech final report, visit **www.sustainableproduction.org**.

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