

Prepared Remarks to U.S. Senate Committee on Small Business and Entrepreneurship:
Hearing on Climate Change and the Implications for Small Business

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By

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Introduction

Public awareness of climate change in the United States and globally is higher than ever before. From the consumer purchasing energy efficient lightbulbs to the large corporations constructing LEED (Leadership in Energy and Environmental Design) green buildings and powering them with green energy, our nation is becoming proactive in the effort to combat climate change. Small businesses play an important role in the efforts to reduce climate change, both in technology development and in business practices. Industrial biotechnology, sometimes referred to as "green biotech" or the third-wave of biotechnology, is making important contributions to our alternatives to a fossil-carbon based economy. Industrial biotechnology uses the same genomic, proteomic, and recombinant DNA technologies used to discover new drugs and therapeutics, to produce polymers and plastics, chemicals, and biofuels. Industrial biotechnology companies that use sugar and agricultural crops as feedstock for product manufacture are helping the U.S. to move from a petroleum-based economy to a "bio-based economy."

Metabolix is a small business located in Cambridge, Massachusetts, and is a leader in the use of biotechnology to provide clean, sustainable solutions to satisfy our needs for plastics, fuels, and chemicals. We were formed in 1992, and we've had some help along the way from the Department of Energy, the Department of Agriculture, and the Department of Commerce. In 2005, we received the President's Green Chemistry Award.

Metabolix Technology

Metabolix is a world leader in metabolic engineering – the sophisticated reprogramming of cellular metabolism to provide for the efficient expression of desired traits – and in applying the advanced tools of metabolic engineering and molecular biology to create a broad link between sustainable, renewable agricultural production and polymers and chemicals.

Metabolix's first platform, which we are now commercializing in a strategic alliance with Archer Daniels Midland Company (ADM), converts sugars or vegetable oils to a versatile family of *Natural Plastics*. With ADM, we are now building a 110 million pound per year plant in Clinton, IA, which will start up in 2008, to produce *Natural Plastic* from corn sugar, an abundant agriculturally-produced renewable resource. *Natural Plastic* are useful in a wide range of everyday products, including disposable goods, packaging, agricultural products, consumer goods and electronics.

Beyond our first platform now being commercialized, we have other exciting developments in the pipeline. Five years ago, we started working on developing enhanced switchgrass that would co-produce *Natural Plastic* right within its leaves and stems, and we now have test plants of switchgrass producing measurable levels of *Natural Plastic* in our greenhouse. The *Natural Plastic* that is produced within the leaves and stems will be extracted for use in everyday products, and the remaining biomass will be used for producing cellulosic ethanol or other biofuels, and will result in significant cellulosic ethanol cost reduction. The production of a valuable co-product - *Natural Plastic* – along with switchgrass biomass that can be converted to liquid fuels, will significantly lower the hurdle to the economic production of cellulosic biofuels. And we have earlier stage concepts for biobased production of large volume chemical intermediates, now made from petroleum and natural gas.

The markets for petrochemical-based plastics, fuels and chemicals are among the largest in the global economy. While these markets encompass a diverse array of products, they are all derived from fossil fuels, particularly petroleum and natural gas. The prolonged, broad use of petrochemical-based fuels and products has created large economic, social and environmental issues, including green house gas emissions tied to global warming, plastic waste management and pollution, rising demand and resulting rising fossil fuel prices, and energy security. These problems have resulted in rising levels of interest in product alternatives that are renewable, sustainable and not dependent on fossil fuels.

Natural Plastic is the best candidates for broad replacement of petrochemical plastics due to their broad range of properties, which make them useful in a wide range of everyday items, from molded goods and housewares to packaging for fast food to gift cards to plastic bags. By replacing current plastics with *Natural Plastic* products, the U.S. will realize an overall decrease in the use of petrochemical feedstocks and a corresponding increase in utilization of agricultural feedstocks. Metabolix's *Natural Plastic* will bring a range of environmental benefits, including:

- **Reduced reliance on fossil fuel and reduced greenhouse gas emissions.** *Natural Plastic* is now based on conversion of renewable raw materials, such as sugar and vegetable oils. In the future, they will also be produced directly in plants.
- **Reduced plastic waste burden.** Whereas one of the unfortunate characteristics of most plastics is that they will persist in the environment for hundreds or thousands of years, while they are typically used only once (as in single use food service), or over a few year period, *Natural Plastic* will biodegrade harmlessly, reducing burdens on the solid waste system, the municipal waste treatment system, and marine and wetlands ecosystems.

Metabolix Technology Impacts on Climate Change

There is now a scientific consensus that global climate change is occurring and that the rise in carbon dioxide emissions over the last 100 years has contributed to this situation. A significant source of CO₂ emissions comes from the use of fossil fuel. The broad acceptance of the Kyoto protocol is evidence of the widespread concern for global climate change in the industrialized world. In the United States, companies have started to account for carbon emissions, to prepare for carbon limits and credit trading schemes, and to seek solutions for reducing their carbon emission profile, and several states are enacting limits on carbon emissions.

Considerable attention has been focused on reducing carbon emissions using biofuels rather than petroleum-based fuels. What is not as widely recognized is that other products currently made from petroleum resources can also be made from the same agricultural feedstocks used for biofuels with similar carbon emission reductions. Plastics and chemicals consume nearly 10% of the oil we use and can be made from the same cellulosic feedstocks as biofuels, in some cases directly in crops like switchgrass.

While the production of bioproducts such as our *Natural Plastic* produces carbon dioxide, both the agricultural production of corn feedstock for microbial fermentation and the direct production of *Natural Plastic* in plants such as switchgrass have the added benefit of removing carbon dioxide from the environment through plant photosynthesis. While fermentation processes do require electricity which may be generated by carbon dioxide emitting sources, the increasing availability of clean power (such as biomass, wind or solar power) is an attractive alternative to employ as the business develops.

The life cycle analysis (LCA) of our fermentation and purification process for *Natural Plastics* production that shows a net beneficial energy balance versus traditional fossil carbon based products. This LCA is currently being verified by independent third-party scientists.

When the technology for *Natural Plastic* production in switchgrass is commercialized, CO₂ will actually be removed from the environment, as switchgrass stores large amounts of carbon in its root systems.

Metabolix Business Practice Impacts on Climate Change

Metabolix is creating a unique brand for our *Natural Plastic* which is predicated on reducing pollution, energy use and greenhouse gas emissions. Metabolix is endorsing this vision not only in the products we sell, but in our business practices. From a rigorous recycling program within Metabolix's headquarters in Cambridge to partnerships with state and local composting programs to the publication of our IPO prospective on recycled paper with soy inks, Metabolix is assuming a leadership role for responsible environmental corporate policy.

Recommendations for Government Efforts on Climate Change

There are at least three ways that the U.S. government can play an important role in encouraging small businesses such as Metabolix to develop and deploy *Natural Plastic* technology. First, the federal government could invest in a public-private partnership to accelerate the research and development work that is necessary to reach commercial quantities of organic plastic in switchgrass. Second, the government could provide a tax credit for *Natural Plastic* equivalent to the tax credit it provides for ethanol. And third, any climate change "cap and trade" legislation should include provisions to encourage the production of renewable *Natural Plastic*.

There is now heavy emphasis on stimulating adoption of biofuels and on developing technology for cellulosic biofuels. Proportionate emphasis should be put on stimulating the development and adoption of bioproducts, which will also help reduce our reliance on fossil fuels. For example, the policy incentives now in place to promote biofuels, should be extended to bioproducts. This would encourage investment in all alternatives that would reduce our use of petroleum, and reduce the associated greenhouse gas emissions.

The Metabolix-ADM Natural Plastic Solution



Metabolix ADM *PHA Natural Plastic* starts with a renewable resource from nature, corn sugar. Through our proprietary process the corn sugar is turned into *PHA Natural Plastic*, and then made into pellets to produce products with the same performance features as traditional plastic. Our *PHA Natural Plastic* will then harmlessly biodegrade back to nature at the end of its life.

Printed on recycled paper (10% post-consumer) with soy inks.