BASF

The Chemical Company

Business Opportunities and Climate Policy

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Madam Chairman, Senator Inhofe, and Members of the Committee:

BASF appreciates the opportunity to present its views to the Committee on Environment and Public Works on business opportunities and climate policy.

My name is Jack Armstrong. I am the construction initiative leader in North America for BASF Corporation. In this capacity, I am responsible for educating BASF customers and governments about the enormous potential for energy efficient solutions for the building and construction industry.

For BASF, there are many business opportunities in climate protection policy. These opportunities include, but are not limited to, chemistry for --

- Agriculture, which, for example, significantly reduces emission of nitrous oxide.
- Special plastics and coatings for smooth, low-friction rotor blades on wind turbines.
- Auto emission reduction technologies.
- Plastics and additives for more sustainable transportation and infrastructure.
- Efficient and environmentally friendly materials for insulation, sealants, and coatings.

BASF: The Chemical Company

BASF Corporation is the North American affiliate of BASF SE, Ludwigshafen, Germany. BASF is the world's leading chemical company: *The Chemical Company*. Our portfolio includes chemicals, plastics, performance products, agricultural products and fine chemicals. As a reliable partner to virtually all industries, BASF's high-value products and intelligent system solutions help its customers to be more successful. BASF develops new technologies and uses them to meet the challenges of the future and open up additional market opportunities. We combine economic success with environmental protection and social responsibility, thus contributing to a better future. BASF presently operates facilities, including manufacturing sites, research facilities, and distribution centers, in more than 30 states, employing 15,000 people.

BASF Corporation has won a number of awards for its work in sustainability and climate protection, including the Presidential Green Chemistry Award, which was given by the U.S. Environmental Protection Agency for our Eco-Efficiency Analysis; and the New Jersey 2006 Governor's Environmental Excellence Award. BASF is also a member of the Clinton Climate Initiative.

Globally, BASF has been a Gold Class Member of the Dow Jones Sustainability Index – the world's foremost sustainability index – since its inception in 2001. We were also the winner of the first German Sustainability Award and the Federation of Germany Industry Award for the Environment.

BASF Views on Climate Protection

BASF is committed to sustainable climate protection, and we support the work of the United States Congress to develop and enact legislation that will lower greenhouse gas

emissions (GHGs). Climate change is one of our era's most significant global challenges. Industry, science, governments and citizens across the globe must work in tandem to halt rising GHG emissions.

BASF views climate protection as a challenge that calls for global strategies, and accordingly supports a global agreement to address climate change. Greenhouse gas emissions have a global effect, therefore there is a need to take a global view, and not only in our climate models but perhaps most importantly in our analysis of the economic and social implications. The solutions to climate change require unified, coordinated global action and targets that include all major emitters, including the U.S., Europe, and major emerging markets such as China and India.

We also believe that efficient industrial growth is required for social development. In particular, a sound chemical industry is mandatory to achieve ambitious and sustainable climate targets as it delivers innovative products and solutions to all consumer segments for efficient growth and development of our society.

BASF's 3:1 Carbon Balance

In the words of Dr. Jürgen Hambrecht, chairman of the BASF Board of Executive Directors, "A business cannot be successful in the long term if it does not act responsibly toward the environment and society. That is why sustainability is an integral part of our strategy." BASF spends globally about one-third of our total research and development budget in the areas of energy efficiency, climate protection, resource conservation and renewable raw materials.

Perhaps there is no better indication of BASF's ongoing commitment to climate protection and our desire to combine it with economic success than the fact that, globally our products save three times more CO_2 than is produced by the manufacture and disposal of all of these same products. This means that BASF has virtually a negative carbon footprint. The total impact of BASF products was determined through the use of eco-efficiency analysis – a widely accepted methodology certified by the U.S. National Science Foundation. As a rule, the eco-efficiency analysis covers the entire product lifecycle and measures a variety of ecological factors and impacts. The results demonstrating the emission reduction reality of our products were confirmed by the Öko-Institut, a leading European research and consultancy institution working for a sustainable future, at http://www.oeko.de/home/dok/546.php.

The innovative approach of the Carbon Balance has been recognized by the European Chemical Industry Council: BASF has won the European Responsible Care® Special Award for 2008. The judges considered it "to be a highly innovative global measurement approach that makes *BASF the world's first company to present a comprehensive, independently verified carbon balance for its operations by assessing the company's carbon footprint throughout the supply chain.*" (Emphasis added)

Why is Chemistry So Important in Climate Protection?

"Energy efficiency." "Wind." "Solar." "Water." "Emission reduction technology." These are words and phrases common to just about every climate protection bill that we have seen so far. All of them rely on chemistry to make them a reality.

Agriculture. If soil contains much more nitrate than the plants can absorb, soil bacteria can convert the nitrate into the greenhouse gas N_2O (nitrous oxide), which has a 300 times greater climatic impact than CO_2. Moreover, excess nitrate can also be leached out into the groundwater. Preventing the creation of too high a concentration of nitrate in the soil when using fertilizers is therefore crucial to sustainable agriculture. BASF has developed a nitrification inhibitor that can help. When added to fertilizer, BASF's nitrification inhibitor optimizes the nitrification process so that the concentration of nitrates in the soil does not exceed the plant's requirements. This allows the farmer to use fertilizer more efficiently, and reduces N2O emissions significantly. Use of the nitrification inhibitor reduces emissions of the climatically harmful nitrous oxide N_2O by an average 50 percent. In 2006 alone, the use of this innovative BASF product saved more than 400,000 metric tons of CO_2 equivalents.

Wind Power. Wind energy is undoubtedly among the cleanest sources of energy available, and one that will play a critical role in sustainably meeting the energy needs of the future. BASF products are helping to make the harvesting of wind energy more efficient. Larger and lighter rotor blades increase the performance and output of modern wind turbines. Epoxy resin-based composite materials have become the industry standard for producing wind turbine blades. A current innovation includes the replacement of balsa wood, a limited natural resource, in turbine blades with foam.

Auto Emission Reduction. BASF's catalyst group continues to lead the way in the development and commercialization of advanced emissions catalysts for both gasoline and diesel powered vehicles. Today, thousands of older diesel-powered buses and trucks, notorious for their harmful emissions, have been retrofitted with filters containing cutting edge BASF catalysts. As a general principle, a catalyst allows chemical conversions to desired products to occur more rapidly and at lower temperatures. For this reason, in addition to pollution control, industrial catalysts find use in a wide field, be it the processing of petroleum to produce transportation fuels or the production of chemicals including polymers and pharmaceuticals. Ideally, the catalyst itself is not chemically consumed during this process. Automotive emissions catalytic converters consist of special combinations of precious metals such as platinum, palladium and rhodium dispersed on high surface area carriers which in turn are coated onto the walls of ceramic or metallic monolithic structures. A typical catalytic converter is capable of destroying around 98 percent of hydrocarbons, carbon monoxide and nitrogen oxides produced by the car's engine.

Transportation. The transportation sector offers a particularly high potential for reducing carbon emissions. Automotive manufacturers are increasingly using lighter materials for applications throughout the vehicle. BASF plastics provide the solutions that make

automobiles lighter, improve fuel efficiency and reduce carbon emissions. Also, a test BASF performed jointly with a leading petroleum company on a fleet of vehicles over 64,000 kilometers showed that a premium fuel additive package reduced pollutant emissions by 20 percent and improved average fuel economy by 2 percent. An eco-efficiency analysis that compared fuel with and without additive clearly showed that our fuel additives contribute significantly to climate and environmental protection.

Focus on Building and Construction

The BASF Building and Construction (B&C) business view is that improved energy efficiency in commercial and residential construction results in lower operating costs, accelerated return on investment, and lower environmental impact. Our emphasis is on the "building envelope," a term that refers to the foundation, roof, walls, doors, and windows of a structure, which protect the indoor environment from the outside and allow for climate control. The United States Department of Energy estimates that up to 40 percent of the energy used for comfort conditioning in an average home or building is lost to uncontrolled air leakage through the building envelope, which also contributes to premature deterioration of building materials, moisture and condensation problems, ice damming, spalling and comfort issues such as cold drafts or extremes in temperature and humidity levels. This is why we have placed our focus on the building envelope.

Chemistry helps building materials not only deliver superior insulation performance, but also provide unparalleled air migration control. For example, we at BASF have developed chemistry that –

- allows for super insulated homes and buildings while controlling air leakage or in other words an insulating air barrier in one product;
- helps make exterior insulating finish systems (EIFS), hard-coat stucco and architectural finishes perform better and last longer with industry-leading weatherproofing performance;
- improves sealants around windows and air ducts that helps to eliminate air leakage, moisture build up, and mold growth;
- creates storm doors, siding, decking, and pipe with high-performance plastics; and
- is used in roofing membranes that in turn offer a strong barrier against moisture and great sealant features including high elasticity and longer life expectancy.

Energy efficiency up-front, during the construction of a home or office building, is the best use of consumer dollars. Heating and cooling systems can be downsized to save money. It is certainly cheaper and cleaner to do it beforehand, as opposed to having someone come in later in the life of the structure to make changes. And, importantly, these products are not expensive, and they are widely available today.

While a traditional home, according to the American Chemistry Council, has approximately $17,000 worth of chemistry, BASF calculates a high-performance home with the above mentioned products includes $25-30,000 worth of chemistry. The overall construction impact for the homebuyer is neutral because of the integrated design and synergy.

The above mentioned products can also be used in energy efficient strategies for retrofitting the 130 million existing homes and five million commercial buildings. Between new construction and the retrofits, many new jobs will be created, *e.g.*, construction, energy auditors, and manufacturing.

Much like a fuel efficiency rating for automobiles, equipping consumers with energy and environmental data for buildings and homes will enable them to make better informed purchasing decisions. Programs similar to the energy disclosure requirements in California's AB 1103 and Washington, DC are a good idea and ought to be pursued elsewhere moving forward. Under these programs, energy usage is disclosed upon purchasing or renting a building.

A good example of BASF's work in the field of energy efficiency is our "Near-Zero Energy Home" in Paterson, New Jersey. This project demonstrates how good chemistry helps make healthy, energy efficient and affordable homes better. BASF chemistry helps the building materials in the zero-energy home not only deliver superior thermal insulation, but also address the missing performance ingredient – resistance to uncontrolled air leakage that can waste up to 40 percent of the energy used to heat and cool a home. The near-zero project has achieved a 34 Home Energy Rating System ENERGY STAR® score (which means 80% more efficient than the average home). It has received the U. S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design for Homes (LEED-H) green rating system's highest level platinum score. And, the products used in this house have a low environmental impact. They are formaldehyde-free and water-based. There are no volatile organic compounds and zero ozone depletion.

Another recent example of BASF's energy efficient B&C products in use is the work done to rebuild a home owned by a senior citizen in New Orleans that was condemned as a result of Hurricane Katrina. The completed home achieved a rating that was 26% more efficient than the International Energy Conservation Code for a structure built in 2003 thanks in large part to BASF's closed cell spray foam insulation. The homeowner now saves $178/month on her average utility bill.

Business Opportunities for the Future

There are several exciting areas, including the three identified below, where BASF is working to improve how energy is captured, stored and used.

- Organic Solar Cells. We are presently looking at organic solar cells, which instead of very costly high-purity silicon used in conventional solar cells, uses organic compounds to trap the sunlight and turn it into electrical energy. The organic materials are expected to be easier and thus cheaper to process. Additionally, the production of organic solar cells consumes much less energy and raw materials, such as silver, giving them a decisive ecological advantage over conventional silicon-based solar cells.

- Fuel Cells. A fuel cell is like a small chemical factory. Inside the cell, the "fuels" hydrogen and oxygen react to produce water vapor, thereby generating electricity and heat. The great advantage of fuel cell technology is that pure water is the only emission formed. The cells can also produce electricity and heat very efficiently at the same time. However, fuel cell technology can only contribute to climate protection if renewably produced electricity is available to provide the hydrogen as fuel. Fuel cells could then, for example, be used as very climate friendly components for refrigerated vehicles, for automotive propulsion systems or to generate electricity and heat in private homes. I am pleased to tell the committee that BASF just opened a new fuel cell facility in Somerset, NJ, which manufactures membrane electrode assemblies (MEAs). The MEA is the heart of the fuel cell.

- Lithium-ion Batteries. Lithium ion batteries can not only be recharged faster than other available batteries, they are also capable of storing electricity more efficiently, meaning they are also much lighter. The new lithium ion battery technology is intended mainly for transportation applications, such as hybrid automotive propulsion systems. The use of lithium ion batteries together with an internal combustion engine makes propulsion significantly more efficient in energy terms – a hybrid automobile can help save up to 20 percent fuel and the associated CO2 emissions. Lithium ion batteries are also used, for example, in wind turbines for stationary energy storage. In 2006, about 15 percent of the wind energy generated could not be supplied to the grid because of the lack of suitable storage capacity. This intermediate storage option, therefore, will improve the utilization of sustainable energy sources in the future. BASF intends to conduct R&D and produce lithium-ion battery technology in the state of Ohio.

We at BASF are especially keen on opportunities in non-emissive sources of power. Congress provided some incentives for these new technologies in the recently enacted economic recovery package, and we ask that in the climate protection legislation now under consideration continue this trend so that we may soon realize on a mass scale the products I have just described.

Conclusion

Climate protection and social responsibility combined with economic growth is an achievable goal. America, its manufacturers, and its citizens possess the desire to effectuate new policies and the resources to make it possible. BASF looks forward to working with Congress on legislation that not only protects our climate, but also ensures that our nation can press forward with its economic recovery. I would be pleased to answer the committee's questions.