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Re: Request for Information: Building a 21st Century Bioeconomy

DuPont is pleased to submit these comments in response to the Office of Science and Technology Policy (OSTP) Request for Information (RFI) regarding the National Bioeconomy Blueprint. The OSTP is seeking input and recommendations for "harnessing biological research innovations to meet national challenges in health, food, energy and the environment while creating high-wage, high-skill jobs. As a science company focused on each of these areas, DuPont is uniquely situated to respond to this solicitation. We commend the Administration for its focus on these important issues, and set forth below our response and recommendations on ways to encourage and foster innovation.

About DuPont

DuPont is a science company with a 200-year legacy of innovation in a broad range of market spaces. Its vision is to create sustainable solutions essential to a better, safer, healthier life for people everywhere. Operating in approximately 90 countries, DuPont makes a difference by bringing science-powered innovations to the world aimed at tackling big challenges, including how the world will be fed, reducing dependence on fossil fuels, and keeping people and the environment safe. In 2010, DuPont had net sales of \$31.5 billion and employed 67,000 people globally.

DuPont businesses are helping to lead the bioeconomy in a number of sectors through various business units that address health, food, energy and the environment.

Food Security, Agriculture and Health

A key focus for DuPont is ensuring that enough healthy, nutritious food is available for people everywhere. To that end, DuPont commits 60 percent of its research and development dollars to ensuring the world's population has enough food. From working with farmers and growers around the world to help them increase crop yields, to developing a wide range of packaging materials that enable food to be transported without spoilage, to developing more nutritious food options and ensuring food safety, DuPont works every day to contribute to food security. Examples of our products include animal science and solutions to improve the sustainability and efficiency of meat, fish and egg production; biocatalyst solutions, such as enzymes, that reduce food production costs and extend freshness.

Our agricultural businesses focus on crop protection, land management, and seed technology. Pioneer Hi-Bred is the world's leading developer and supplier of advanced plant genetics, agronomic support, and services to farmers. Pioneer seeks to increase farmer productivity and profitability, and to develop sustainable agricultural systems for people everywhere. Increasing populations, changing economies, and limited cultivatable land are significant factors driving Pioneer to use the broad application of plant science to

improve the value generated from each field.

Energy and the Environment

We are committed to reducing dependence on fossil fuels by creating cost-effective conversion of non-fossil carbon sources to high value products, products and technology for first generation ethanol and advanced biofuel production and materials and chemicals made from renewable resources.

DuPont Industrial Biosciences works with partners and customers to create world-changing solutions for a bio-based society. Industrial biotechnology holds great promise to solve global challenges, offering new potentials for meeting the world's demand for food, feed, fuel, materials and more while reducing our impact on the environment. We produce bioactives, such as enzymes, peptides and performance proteins, for markets such as food, animal nutrition, detergents, and textiles; biomaterials, such as advanced materials and intermediates manufactured with renewable feedstocks; and, biorefineries, such as products and technology for converting agricultural feedstocks into carbohydrates and fuels. We maintain a commitment to continuous evolution, ever improving our products and processes, making what used to be known as "alternative" materials into mainstream ones.

I. Grand Challenges: Global demand for more and healthier food and energy will put increasing demands on the agricultural sector.

Both food and energy security have substantial effects on our country's economy and national security. Global food demand will increase substantially in the coming decades, with a growing population expected to hit nine billion by 2050, increasingly urbanized populations, and a middle class with changing food preferences. Food shortages across the globe create political instability and disruption that can drastically impact our security at home, and the ability of our companies to do business and operate effectively abroad. Similarly, increased demands on energy supplies are driving the need for innovative solutions to reduce costs, improve efficiency and diversify energy sources.

Scientific advances in the agricultural sector have resulted in substantial gains in productivity over the years. Today, seed companies use a sophisticated toolkit, combining advances in genetics to continuously breed better germplasm for diverse conditions, and technological advances in biotechnology to incorporate new input and output traits. This results in greater yield for farmers, increased nutritional benefits to consumers, environmental sustainability by reducing nitrogen use and developing drought resistance, and better defense against threats.

Despite the scientific advances that have taken place to date in the agricultural sector, the challenge of the food, feed, fiber and fuel needs of a booming population will require much more. It will require producing more food with increased nutritional value, it will require making food more accessible and affordable for everyone, and will require doing all of this in a sustainable way given a scarcity of resources. Innovation in science will be paramount, but innovative collaborations to meet our needs will be equally as important.

Agricultural productivity and biotechnology advancements are also critical to supplying the feedstocks for materials and fuels.

To meet these challenges, we recommend the following:

- Regulatory schemes should be science-based, promote and foster innovative solutions in agricultural and industrial biotechnology. Public policy should facilitate competition in the marketplace to ensure that farmers and customers have the choice of tools and technology that are more effective at the best price.
- Investments should be made in public research and development funding in agriculture. The government should collaborate with other organizations to promote research in areas such as improvement of indigenous crops, as well as technology and best practices to improve agricultural sustainability and resource efficiency.
- Governments, companies, nonprofits and other organizations must collaborate differently and more effectively to find innovative, holistic solutions, across the entire supply chain to meet the demand for food, feed, fuel and materials, while protecting the environment and assuring everyone's access to safe, nutritious food and sustainable energy supplies.
- The federal government should work with companies and governments abroad to ensure strong intellectual property and trade secret protection.
- The government should continue to fund foreign aid and companies and organizations should support efforts to reduce uncertainty and risk in order to make long-term investments in emerging markets to enhance food security in those regions.
- Governments and the private sector should work together to ensure a skilled and globally competitive workforce and to educate society on the benefits of science and bioeconomy innovations.

The bio-based economy will use biotechnology to convert renewable raw materials derived from plants, starch, and cellulosic biomass sources into food, feed, energy and other products needed by advanced societies, while reducing our impact on the environment. Industrial bio-processes will complement and, in some cases replace, traditional chemical processes. DuPont and many others have been working on bio-based solutions for several years already, and have demonstrated that biotechnology solutions can significantly improve agriculture productivity and renewably sourced products can provide a solid foundation for continued economic growth and sustainable development.

II. Government R&D Investment and Development Support is Vital to Growth

Substantial investment by both the public and private sector are necessary to meet these challenges.

Establishing and commercializing a new technology foundation for our economy is a massive, but critical, undertaking. Government support can mitigate the risk inherent in new technologies, which require huge investments and long time horizons, and are therefore extremely difficult for any company to undertake in isolation.

In the industrial arena, the conversion to a real bio-economy focused on addressing the global food and energy challenges hinges on the control of raw material costs and conversion processes. Complementary action by government might include supporting the creation of the new raw materials supply chain - a comprehensive and coherent strategy to direct efforts in biomass development, engineering and sourcing, coupled with sponsorship of competitive processes for conversion to final products. In addition, continued support is needed for public-private research collaborations to achieve biomass density goals (development of energy crop technologies). By focusing the various academic and private resources to consolidate the raw material path and then allowing competition and diversity in the subsequent conversion steps, we will more rapidly hit the high-value and high-volume targets.

Public research and investment in basic and applied research is required to maintain U.S. competitiveness for crop production systems and industrial biotechnology applications. Encouraging U.S. students to obtain advanced science degrees (Masters and PhD) is also important to maintain a pipeline of future talent in the biosciences.

Encouraging public-private partnerships to accelerate new technology development and deployment is also important.

Limited government support through pilot and demonstration can be more valuable, given the technology risk and capital intensity required. Ranges of \$25-50 million would be sufficient scale to demonstrate feasibility for the next level of financing within the private sector. Ensuring the use of market-based performance metrics (cost, capital productivity, sustainability delivered) through independent private sector review could provide a mechanism to distribute funding to the more deserving opportunities. Heavier involvement in middle-to-late stages by large industrial entities is key to drive large-scale commercialization in this sector. Many large companies have taken significant steps here, including DuPont. We have proven our ability to bring new, advanced, bio-based technology to market, with commercial products available today in our Biomaterials and Bioactives segments. We will build on this foundation as we invest about \$200 million per year through 2015 to bring our advanced biofuels technology from the current demonstration plants to full commercial scale. Government support is important for the next stage to help modify the risk for bringing innovation to scale.

Later-stage government support would best facilitated by:

- Clear, stable, long-term policy signals that reduce the risk and justify investment today.
- Effective Interagency coordination to ensure consistent strategic direction and support.
- Streamlined regulatory review and approval processes better matched to private sector pace and timelines.
- Farming support programs to enable establishment of the commercial energy crop supply chain, which requires significant investment prior to completion of large-scale biorefinery projects.

- Refundable, product-based, tax credits, based upon success of operational economics and market requirements.

III. Investments in Education are Important to Make our Workforce Globally Competitive and Society Accepting of Bioeconomy Solutions

Addressing long term food and fuel challenges will require generational investment to encourage science-based education. Expanding and encouraging science and math education in primary education will be necessary to lead to a higher number of undergraduates entering secondary education science and math programs. Identifying and encouraging programs and curriculum that bring more students into bioscience majors is also important, beginning as early as kindergarten and throughout secondary school. Additionally, K-12 educational curriculum should enhance general understanding of science and how it can help address our most pressing global challenges.

Community colleges can play an important role in bringing urban-based students into educational programs that support agriculture and bioscience. Training university students at all levels to understand basic plant biotechnology principles is imperative. The private sector can play an important role in training through internships programs and programs that supplement graduate student education.

Fostering a system of science-based education will also help build a society that embraces the role of science in addressing global challenges like food and energy security and environmental protection, and accepts the innovations that come from a bioeconomy.

IV. Reducing Regulatory Barriers: A Science-Based Regulatory Environment that Encourages Competition and Innovation

To address the grand challenges of food and energy security, regulatory schemes both here and abroad should be science-based, and should promote and foster safe, innovative solutions in agricultural and industrial biotechnology. Public policy should facilitate competition in the marketplace to ensure that farmers and customers have the choice of tools and technology that are more effective at the best price.

Open and clear regulatory pathways are necessary to facilitate innovation and access in the area of agricultural traits. The first agricultural biotechnology trait patent is set to expire in 2014, with several others to follow. There is a pressing need to more clearly define the transition to generic biotechnology products and associated issues pertaining to registration, stewardship and the appropriate use of and access to data created to satisfy regulatory requirements. Currently, we have no regulatory pathway to allow for the use of biotechnology traits in the agriculture space once those traits lose their patent protection.

The U.S. patent policy provides for limited monopoly power to reward technology innovators. This limited exclusivity was never intended to permanently bar new market

entrants after a patent expires. But, that is what is happening in the newer area of agricultural biotechnology, where seed patent holders can exclude potential generic entrants by simply withholding information required to manufacture and market the seeds. In contrast, in the pharmaceutical industry, there are legal and regulatory structures in place to ensure that generic medications, which are equally valuable to treating illnesses and diseases – make it to the hands of patients in our country, giving them the choice to choose between brands and generics. Similarly, there exists a regulatory structure in the crop protection industry.

Additionally, industry and government scientists and policy makers should work on a common understanding of sound science and protective regulations. For example, regulations attempting to achieve “zero risk” can result in unnecessary testing and major delays in biotechnology product approvals.

Potential suggestions for improvement in industry/regulator dialogue could include:

- Visit production plants
- Interface with safety experts in the field (both academic and industrial).
- Convening panels to work on common definitions and standards.

V. Public/Private Partnerships are Essential to Achieve Scale

The challenges outlined above are complex and beyond the capacity of any one organization to solve. Not only will scientific advancements be required to solve these problems, DuPont believes innovation in the way organizations and governments partner and collaborate will be necessary to achieve the kind of scale and impact necessary to meet our global challenges.

A major innovation of the last century was to learn to use fossil fuel based sources for our transportation, energy, and material needs. At the turn of the 20th century, 25% of all energy used in the US came from burning wood, and in 1915, some 90 million acres of US cropland were used to grow feed for horses and mules – our transportation at that time. The objective for the next century is securing alternate and renewable sources of carbon, through the application of industrial biotechnology. DuPont believes this can be achieved in a very sustainable manner, without increasing the environmental footprint of the agricultural enterprise.

Similarly, the food security crisis will require more and different kinds of collaboration between governments, NGO, the private sector and other organizations than ever before, to achieve the research necessary to achieve better and more sustainable productivity, more funding and resources to make an impact on a larger scale, and to drive change across the entire value chain.

Government support and funding is a key driver of progress in many scientific sectors. Models that emphasize (i) focused and substantial programs aimed at a key high impact areas, (ii) clear metrics that drive company investment and participation to commercialize

by private sector, and (iii) that provide near term as well as long term visible results, would help provide confidence and ensure longer term funding and desired outcomes.

Conclusion

DuPont commends the Administration for its interest in the bioeconomy and innovation in key areas, including health, food, energy and the environment. DuPont is committed to advancing solutions in these areas through the latest science and technology, and by continuing to partner with other interested organizations. DuPont appreciates the opportunity to respond to this solicitation and stands ready to serve as a resource on these issues to federal regulators.