March 4, 2020

The Honorable Paul Tonko
Chairman
Subcommittee on Environment
and Climate Change
Energy and Commerce Committee
U.S. House of Representatives
Washington, DC 20515

The Honorable John Shimkus
Ranking Member
Subcommittee on Environment
and Climate Change
Energy and Commerce Committee
U.S. House of Representatives
Washington, DC 20515

The Honorable Frank Pallone
Chairman
Energy and Commerce Committee
U.S. House of Representatives
Washington, DC 20515

The Honorable Greg Walden
Ranking Member
Energy and Commerce Committee
U.S. House of Representatives
Washington, DC 20515

Dear Chairman Tonko, Chairman Pallone, Ranking Member Shimkus, Ranking Member Walden, and Members of the Subcommittee:

The Biotechnology Innovation Organization (BIO) is pleased to submit a statement for the record to the to the United States House of Representatives Committee on Energy and Commerce Subcommittee on Environment and Climate Change hearing entitled, "Reduce, Reuse, Recycle, Reform: Addressing America's Plastic Waste Crisis."

Introduction

BIO represents 1,000 members from this biotech ecosystem around a central mission – to advance public policy that supports a wide range of companies and academic research centers that are working to apply biology and technology in the energy, agriculture, manufacturing, and health sectors to improve the lives of people and the health of the planet.

Our members use technology to enhance cultivation and food production and produce sustainable biofuels, renewable chemicals, and biobased products, which provide a cost-competitive alternative to petroleum's value chain that also generates added value through economic development, job creation, and environmental and public health. Companies are utilizing biological processes to convert biomass and waste feedstocks into everyday products while creating new markets for agricultural crops, crop residues, and waste streams – in addition to contributing to a circular economy.

Executive Summary

BIO applauds the Subcommittee for examining the climate and environmental impacts related to recycling and waste management. The development of a biobased economy can revolutionize industry and reduce emissions and waste, by creating a value chain of sustainable manufacturing that uses biological processes to convert renewable, low cost, or waste feedstocks into everyday products. It creates new markets for agricultural crops, crop residues and waste streams, as well as opportunities for innovation in producing consumer goods.

Novel, innovative approaches to address domestic and global climate challenges are desperately needed. Fortunately, the application of biotechnology is advancing solutions to this problem. Through biobased manufacturing we can create sustainable chemicals. Made from renewable resources or waste feedstocks, instead of petroleum. These chemicals can be made into sustainable plastics that are recyclable or biodegradable. While these materials are molecularly like their petrochemical equivalent, they reduce greenhouse gas emissions since they are produced from renewable or waste resources instead of oil and gas.

Supportive policy will help reduce environmental impact from manufacturing by driving investment and consumption of renewable chemicals and biobased products.

Biobased Technologies Reducing Emissions in Plastics and Materials

According to the U.S. Energy Information Administration, U.S. chemical production uses 28 percent of the total energy used by all industrial sectors.[1] Without action, these emissions are expected to grow. In January, Louisiana regulators approved an air quality permit that will allow Sunshine Project, to pump 13.6 million tons of carbon dioxide into the atmosphere every year. That's equivalent to adding 2.6 million cars to the road annually. In 2018, only 13 coal plants emitted more.[2] A report in *Environmental Research Letters* identified 88 petrochemical projects along the Gulf Coast that are either in the planning stage or under construction. If all are completed, their combined emissions output could reach 150.8 million metric tons, the equivalent of 38 coal plants.[3,4]

However, biobased products can provide a solution to the increasing rise in emissions in petrochemical plastic production. The U.S. Department of Agriculture (USDA) found that the development of renewable chemicals and biobased products removed 12.7 million metric tonnes (mmt) of CO_2 from the manufacturing sector in 2016 alone in its report, "An Economic Impact Analysis of the U.S. Biobased

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[1] U.S. Energy Information Administration "Use of Energy Explained, Energy Use in Industry" (2018) Available at: https://www.eia.gov/energyexplained/use-of-energy/industry.php
[2] Storrow, B. "Meet America's new superpolluters: Plastic plants." Climatewire (Jan. 21, 2020) Available at: https://www.eenews.net/climatewire/stories/1062133995
[3] Ibid.
[4] Waxman, A. Khomaini, A., Leibowicz, B., and Olmstead, S. "Emissions in the stream: estimating the greenhouse gas impacts of an oil and gas boom." (Jan. 14, 2020) Available at https://iopscience.iop.org/article/10.1088/1748-9326/ab5e6f/pdf

Products Industry".[5] This is due to the displacement of petroleum and reduction of fossil fuels in the manufacturing and use of biobased products. The report goes on to note:

> The use of biobased products reduces the consumption of petroleum equivalents by two primary mechanisms. First, chemical feedstocks from biorefineries have replaced a significant portion of the chemical feedstocks that traditionally originate from crude oil refineries. Biorefineries currently produce an estimated 150 million gallons of raw materials per year that are used to manufacture biobased products. Second, biobased materials are increasingly being used as substitutes for petroleum-based materials, which have been used extensively for many years. An example of this petroleum displacement by a biobased material is the use of natural fibers in packing and insulating materials as an alternative to synthetic foams, such as Styrofoam. In this report we updated the oil displacement values from the 2016 report to reflect economic growth. In 2016 the estimated oil displacement is estimated to be as much as 9.4 million barrels of oil equivalents.

In addition to the environmental benefits, USDA found that the value added to the U.S. economy by biobased products was $459 billion in 2016. With employment in the industry increasing from 4.22 million jobs in 2014 to 4.65 million jobs in 2016.

Even greater reductions of greenhouse gas emissions are possible through the expansion of biotechnology in manufacturing. World Wildlife Fund found "if existing biotech solutions were used extensively in other traditional industries, such as detergent, textile, and pulp and paper manufacturing, another 52 mmt of greenhouse gas emissions reductions would be achieved annually."[6]

Biotechnology is enabling the production of biobased plastics providing a sustainable alternative to petroleum-based plastics. More than half of all plastic ever created was produced in the last 15 years, and right now, about 335 million tonnes of new, virgin plastic is created each year. Virtually all that new plastic will be made from oil and gas. Plastics now account for 3.8 percent of global greenhouse gas emissions and at the current rate will account for 15 percent of global emissions by 2050.[7]

Because some bioplastics are derived at least in part from corn, sugarcane, or other plants, they have a smaller carbon footprint, with lower cradle-to-plant-gate greenhouse gas emissions than their fossil fuel-based counterparts.[8] Substituting

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[5] Daystar, J., Handfield, R., Golden, J., McConnell, E., & Morrison, B., "An Economic Impact Analysis of the U.S. Biobased Products Industry" (Jul. 2018). Available at: https://www.biopreferred.gov/BPResources/files/BiobasedProductsEconomicAnalysis2018.pdf

[6] Kornerup Bang, J., Follér, A. and Buttazzoni, M. "Industrial Biotechnology More Than Green Fuel in a Dirty Economy" WWF Available at: http://assets.panda.org/downloads/wwf_biotech.pdf

[7] Zheng, J. and Suh, S. "Strategies to reduce the global carbon footprint of plastics.' Nature Climate Change (Apr. 15, 2019) Available at: https://www.nature.com/articles/s41558-019-0459-z?utm_source=commission_junction&utm_medium=affiliate

[8] Hackett, M. "Bioplastics offer a smaller carbon footprint" HIS Markit (Nov. 20, 2018) Available at: https://ihsmarkit.com/research-analysis/bioplastics-offer-a-smaller-carbon-footprint.html

the annual global demand for fossil-based polyethylene (PE) with biobased PE would save more than 42 mmt of CO_2. This equals the CO_2 emissions of 10 million flights aground the world per year.[9] Replacing conventional 1,4-Butanediol (BDO) with biobased BDO would save over seven million tons of greenhouse gas emission per year, or the equivalent of taking 1.5 million cars off the road.[10] In addition to reducing greenhouse gas emissions, biobased BDO can produce compostable plastic packaging, reducing plastic waste.

All biomanufacturing processes – whether enzymatic or microbial – share the unique characteristic of avoiding use of toxic feedstocks and process reagents, which in turn minimizes toxic waste and byproducts. Manufacturers must manage byproducts of bioprocesses to prevent pollution.[11] Just as enzymes improve biofuel production, manufacturers are using enzymes commercially to produce pharmaceuticals and other chemical compounds, food ingredients, detergents, personal care products, textiles, and paper products, avoiding use of toxic feedstocks and process reagents, which in turn minimize toxic waste and byproducts.[12] By utilizing enzymes, textile mills used less energy and reduced their CO_2 emissions by 12 mmt. This technology also has the added benefit of reducing the use of water in textile production by 8.1 billion cubic meters, equal to the annual consumption of 140 million households.[13]

Sugar from crops like corn and wheat can be fermented using yeast to create renewable bio-succinic acid, which is commonly used as an emollient or fragrance carrier in various skin creams and lotions. Succinic acid is effective in combating acne and reducing skin flakiness and wrinkles. By using biotechnology, many personal care products can be made using a range of renewable, sustainable resources, including agricultural feedstocks. Carbon captured from industrial processes can be recycled, and fermented using microbes to create renewable non-toxic Isopropanol, a common alcohol used to extract and purify oils found in skin care products, such as acne treatments. Using synthetic biology, carbon-rich gases can be used to develop esters, a class of chemical compounds used to create certain aromas and fragrances in perfumes and cosmetics. By capturing and recycling these gases to be converted to esters instead of going into the atmosphere, environmental impact is reduced. Replacing petroleum-based butylene glycol with butylene glycol produced from a sustainable and renewable sugar

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[9] "Environmental benefits of bioplastics" European Bioplastics Available at: https://www.european-bioplastics.org/bioplastics/environment/

[10] Schilling, C. "Sustainability and Social Responsibility Report" Genomatica (Jun. 2019) Available at: https://www.genomatica.com/wp-content/uploads/Genomatica-Sustainability-and-Social-Responsibility-2019.pdf

[11] Junker, B. (2010). "Minimizing the environmental footprint of bioprocesses." BioProcess International, Oct. 1, 2010. http://www.bioprocessintl.com/manufacturing/facility-design-engineering/minimizing-the-environmental-footprint-of-bioprocesses-303905/.

[12] Phillips, T. (2016) "Enzyme Biotechnology in Everyday Life." The Balance, Oct. 13, 2016. https://www.thebalance.com/enzyme-biotechnology-in-everyday-life-375750.

[13] Novozymes "Biological solutions on the catwalk to find answers for sustainable fashion" Trade new (May 14, 2019) Available at: https://www.novozymes.com/en/news/news-archive/2019/05/biological-solutions-on-the-catwalk-to-find-answers-for-sustainable-fashion

fermentation process reduces greenhouse gas emissions by 51 percent and allows consumers to avoid petroleum-based ingredients in their personal care products.[14]

Biotechnology can also improve the environmental footprint of textiles. Replacing petroleum based paraxylene with a bio-paraxylene produced from a mix of sugar cane and corn-based ethanol results in a 70 percent reduction in carbon emissions. Bio-paraxylene can be used to produce a 100 percent bio-polyester. This can lead to a 25 percent to 50 percent reduction in carbon emissions when compared to petroleum based polyester products. Further bio-polyester produced using bio-paraxylene can be recycled in the same recycling infrastructure as petroleum-based polyester.[15] Gas fermentation, which uses biology to convert waste industrial emissions to ethanol production, can produce textiles through conversion of this sustainable ethanol into fibers.[16]

Traditional carpets take up the second-largest amount of U.S. landfill space. Approximately 3.5 billion pounds of carpet are put in U.S. landfills every year. Carpets are made up of a complex array of chemicals, either made of nylon, polyester, or polypropylene. Biotechnology can manipulate the polyester to form every element of the carpet, from base to tufts, the flooring, when discarded, can be returned to the manufacturer, ground up, and repurposed as another carpet, reducing the need for petroleum to manufacture new carpet.[17] Biological gas fermentation combined with gasification, can convert mixed flooring wastes into the same chemicals used in carpet production.

Supportive Policies

As the Committee develops legislation to reduce greenhouse gas emissions and waste, BIO would encourage members to advance policies that support research and development and investment in biobased manufacturing processes, products and bioplastics derived from renewable or waste-based chemicals.

Climate legislation, such as the draft Climate Leadership and Environmental Action for our Nation's (CLEAN) Future Act,[18] should seek to address the ever increasing rise in emissions from petrochemicals and plastics and encourage the use of biobased products instead.

Regulatory and legislative proposals to promote and incentivize recyclability and reduce plastic waste are also critical, but they should also seek to promote the use

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[14] Pacheco, R. and Huston, K. "Life Cycle Assessment (LCA) of Naturally-Sourced and Petroleum-Based Glycols Commonly Used in Personal Care Products" sofw journal (Nov. 15, 2018) Available at: https://www.genomatica.com/wp-content/uploads/SOFW-LCA-Article.pdf

[15] Virent, Sustainability Webpage, Available at: https://www.virent.com/technology/sustainability/

[16] https://www.lanzatech.com/2019/10/07/world-first-products-made-from-recycled-pollution-reduce-emissions-and-keep-carbon-in-the-ground/

[17] Anzilotti, E. "The First 100% Recyclable Carpets Are Here" Fast Company (Feb. 21, 2017) Available at: https://www.fastcompany.com/3067849/the-first-100-recyclable-carpets-are-here

[18] House Committee on Energy & Commerce. "E&C Leaders Release Draft Clean Future Act Legislative Text to Achieve a 100 Percent Clean Economy." *Press Release,* 28 Jan. 2020. Available at: https://energycommerce.house.gov/newsroom/press-releases/ec-leaders-release-draft-clean-future-act-legislative-text-to-achieve-a-100

of bioplastics. Biotechnology allows us to make renewable chemicals that are identical to their petroleum equivalent. Given this equivalency, these products are 100 percent recyclable without the emissions impact. Other technologies enable us to create bioplastics that are biodegradable and just as functional as conventional plastics. Most plastics generated are not recycled, for a myriad of reasons; therefore, the gap between U.S. plastics generated and recovered continues to grow.[19] For these plastics, technologies such as gasification and microbial gas fermentation can enable complete carbon recycling that goes well beyond the limits of conventional recycling.

Conclusion

Decarbonizing our economy will require numerous innovations. Supporting the development and deployment of biotechnologies producing biobased products will enable the United States to reduce greenhouse gas emissions in petrochemicals and plastics.

BIO and its member companies stand at the forefront of the U.S. bioeconomy and we are proud that we have helped to make the United States the global leader in biotechnology innovation. The furthering of biotechnology solutions can help achieve our shared goals of reducing greenhouse gas emissions and developing cleaner and more sustainable energy sources.

BIO looks forward to working with the Committee and Congress in developing pro-innovation policies and technologies to address climate change.

[19] Kerston-Johnston, S.et al "The Bridge to Circularity: Putting the New Plastics Economy into Practice in the U.S." The Recycling Partnership (Oct. 2019) Available at: https://recyclingpartnership.org/circularity/