



USDA Implementation Framework

for

A Plan to Enable the Bioeconomy in America: Building a Resilient Biomass Supply

A Message From Secretary Vilsack

President Biden acknowledged the importance of the U.S. bioeconomy with the issuance of Executive Order (EO) 14081 entitled “Executive Order on Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe, and Secure American Bioeconomy” on September 12, 2022. That EO established a whole-of-government approach to advance biotechnology and biomanufacturing towards innovative solutions in many areas including agriculture, food security, energy, and supply chain resilience. It also acknowledged that these technologies can be used to achieve our climate goals, improve sustainability, and grow the economy across all of America, including in rural communities.

The EO tasked USDA to submit a plan to the President “to support the resilience of the U.S. biomass supply chain for domestic biomanufacturing and biobased product manufacturing, while also advancing food security, environmental sustainability, and the needs of underserved communities.” The Plan USDA drafted identifies many opportunities that can support using domestic biomass for biobased products, including the abundance of woody biomass, the emergence of oilseed crops and biomass crops to increase feedstock quantities, and new and increased demand for biobased products. The Plan also provides recommendations for increasing the resilience of the domestic biomass supply chain, including supporting research and development, providing for infrastructure and workforce development, building markets, and incentivizing farmers to grow biomass crops while minimizing potential risks.

USDA wrote the Plan on behalf of the Federal Government because virtually all components of USDA have some role in the bioeconomy and the production of the biomass that supports biobased products. In many ways, USDA has been serving the bioeconomy since its establishment in 1862. Therefore, it is important that we not only issue the Plan but also provide an Implementation Framework that identifies what we will do to increase the resiliency of the biomass supply chain in the coming months. This Framework sets forth USDA programs that will support research on increasing biomass production and developing new biomass crops, programs that help fund the infrastructure to process different types of biomass, and activities that develop new biobased products and markets for those products. This work will deliver significant progress toward improving the resilience of the domestic biomass supply chain, and increasing the availability of biomass and marketing of biobased products. These actions will improve the livelihood of farmers, bolster the economies of rural communities, and lead to more sustainable agricultural production.

Tom Vilsack, Secretary of Agriculture

Introduction

On September 12, 2022, as part of [Executive Order 14081](#), President Biden directed USDA to produce a plan to ensure the resilience of domestic biomass supply for U.S. biomanufacturing and biobased product manufacturing. The result of that effort is a newly released report, *A Plan to Enable the Bioeconomy in America: Building a Resilient Biomass Supply* (“Plan”), which establishes a Government-wide roadmap for expanding sustainable biomass supply in response to the increased importance of domestic biomass and biobased production for the U.S. economy.

Biomass¹ is the foundation of the U.S. bioeconomy, and the supply of biomass is critical for meeting ever-increasing demand for biomanufactured and biobased products as a mainstay for climate-smart and sustainable solutions to address society’s needs. USDA has been serving America’s bioeconomy since 1862 (the year it was established); most of the Department’s diverse agencies and programs support the bioeconomy. The *Plan* reflects both the breadth and depth of USDA’s mission in biomass and the bioeconomy, and the convening role the Department can play for agencies across the Federal Government.

The *Plan* identifies opportunities for the United States to leverage its abundant supplies of biomass to foster a thriving bioeconomy that delivers prosperity to rural and underserved communities. Through recommendations for research and development to improve biomass supply chain systems, capacity building to scale them, and market development to match them with increasing demand for biobased products, the *Plan* orients the Government’s vast array of biomass-related programs and policies within the bioeconomy landscape and sets them on a course for continued growth in supply chains for biomass and biobased production.

The Implementation Framework presented here provides a roadmap of near-term actions that USDA will undertake to implement the *Plan*. These near-term activities are organized around six major actions recommended in the *Plan*:

- I. Develop the Next Generation of Biomass Feedstocks and Increase Use of Cover Crops;**
- II. Improve Access and Utilization of Woody Biomass for Biobased Products;**
- III. Invest in Resilient Infrastructure and Capacity to Utilize Biomass Feedstocks for More Jobs and Stronger Rural Economies;**
- IV. Support New and Better Markets for Biobased Products that Drive Demand for Biomass Feedstocks;**
- V. Promote Climate-Smart Practices to Enhance Productivity and Sustainability of Biomass Feedstocks; and**
- VI. Provide Stakeholder Outreach and Technical Assistance to Ensure the Resilience of Biomass and Biobased Supply Chains.**

¹ Biomass is any material of biological origin that is available on a renewable or recurring basis, for example, plants, trees, algae, and waste material such as crop residue, wood waste, animal waste and byproducts, food waste, and yard waste. [NIST Bioeconomy Lexicon](#) | National Institute of Standards

Many of these activities leverage ongoing programs and initiatives in addition to complementing the many bioeconomy-related goals and objectives within the Department’s strategic plan. Taken together, these activities will secure a sustainable supply of biomass feedstocks, build markets and infrastructure for biobased products, develop the next generation of biomass feedstocks, and help to create new jobs and economic opportunities in rural America.

Activities to Implement the Recommendations from the Plan

I. Develop The Next Generation of Biomass Feedstocks and Remove Barriers to Adoption and Production

Newer biomass crops, such as pennycress, camelina, and carinata, are not yet widely adopted but offer great potential as feedstocks for biofuels. Others, like guayule, switchgrass, and hemp, are recognized for their potential but remain underutilized due to challenges in harvesting, processing, conversion, and commercialization. All offer additional benefits such as reduced soil erosion, increased wildlife habitat, and improved water quality, but they are hindered by a lack of infrastructure, scale of implementation, weak markets, and risk. Agricultural and food wastes are a largely untapped resource that could contribute to biomass feedstock supply. Finally, existing cover crops can be an available source of biomass if farmers have incentives to grow them and their risks are managed. To support the development and production of new sources of biomass feedstocks, USDA will:

- a. **Develop agronomic best practices for new oilseed crops for biofuels.** Pennycress, carinata, and camelina are winter oilseed crops cultivated as feedstocks for biofuel that also improve soil quality. Pennycress, carinata, and camelina are cultivated as off-season cash crops (oils and biofuel applications) where their protein products provide a food source, an additional revenue stream, and increase profitability. USDA will continue to support the adoption of agronomic best practices and technologies for these crops beyond experimental field scale through the USDA, Agricultural Research Service’s (ARS) Regional Biomass Research Centers and the USDA, National Institute of Food and Agriculture (NIFA) Agriculture and Food Research Initiative (AFRI). In addition, USDA will continue to expand and characterize germplasm collection and public breeding programs for oilseed crops. For example, USDA researchers are working to domesticate oilseed crops such as *Silphium integrifolium* (rosinweed), a perennial native to the Great Plains, to diversify grain agriculture and produce biofuels.
- b. **Increase supply of new latex crops for domestic natural rubber.** Natural rubber is a critical agricultural material necessary for the broadest range of industries that underpin the U.S. economy, including many that are essential for public welfare and national security. Domestically produced crops such as guayule and rubber dandelion can play a fundamental role in ensuring resilient and self-reliant supply chains for these feedstocks. USDA will continue to increase research support for guayule and rubber dandelion production by expanding the germplasm collection, accelerating gene editing for crop improvement, and developing environmentally sustainable, commercially viable processes for fractionation and modification of co-

products. Additionally, USDA will continue work to develop biobased antioxidants for stabilization of natural rubber to replace 6PPD. USDA will also review statutory authority of the Supplemental and Alternative Crops (SAC) and Specialty Crop Research Initiative competitive grants programs, and possibly others, to include guayule. USDA currently leads the Domestic Natural Rubber Interagency Working Group with Department of Defense (DOD) and Defense Advanced Research Projects Agency (DARPA), with interest from the Departments of Homeland Security and Commerce. USDA will work with these agencies to develop a National Natural Rubber Strategic Plan that will focus on increasing supply and infrastructure for domestic natural rubber.

- c. **Address barriers limiting utilization of lignocellulosic crops.** USDA will continue to support research and development of agronomic systems that include lignocellulosic crops which can provide biomass feedstocks while also enhancing food production and delivering environmental benefits. USDA will also support research and development to convert underutilized lignocellulosic biomass streams into biobased products. Examples include breeding of novel switchgrass germplasm for U.S. bioenergy supplies, and implementation of an industrial hemp research roadmap in genetics, agronomy, processing, and standardized quality testing to increase yields and market values of industrial hemp fiber for U.S. farmers and manufacturers of biobased plastics, building materials, composites, and textiles. Additionally, USDA NIFA is collaborating with the Department of Energy (DOE) Bioenergy Technologies Office (BETO) to pair research on purpose-grown feedstocks with world-class scale-up facilities at national labs, such as Idaho National Lab, through DOE’s [Regional Biomass Resource Hubs Initiative](#).
- d. **Increase utilization of food waste, manure, and farm residuals for biofuels and biobased products.** USDA, through its research agencies, will continue to support research and development for: (1) cost-effective collection and processing of wastes and residuals into renewable natural gas and value-added products for emerging markets; (2) converting food waste and byproducts into marketable plastics, specialty chemicals, proteins, cosmetics, pharmaceuticals, additives, and active agents; (3) converting agricultural wastes and low-value byproducts into biobased pesticides (fungicidal and herbicidal) to enhance quality and increase commercial agricultural/horticultural yields; and (4) increasing the processing efficiencies and value of existing products from feedstocks and coproducts to increase long-term profitability of these biorefineries. This includes research to improve production and characterization of oils produced via pyrolysis into alternative diesel fuel from inexpensive biomass waste materials, herbaceous crop residues, biomass/plastic mixtures, and energy crops.
- e. **Review conservation and crop insurance provisions to encourage greater use of harvestable cover crops:** Technical requirements in USDA’s conservation practice standards and insurance provisions preclude producers who wish to plant commercial cover crops from harvesting the cover crop for grain or seed, as well as collecting the biomass from cover crops for anything besides animal feed. This can be a particular challenge for encouraging adoption of cover crops that can be

harvested for use as feedstocks. USDA will review how these barriers can be removed in order to encourage expansion of such cover crops and second crops, which can return revenue to farmers while also replenishing soil nutrients and sequestering carbon. For consistency, currently USDA maintains the same cover crop definitions between the USDA, Risk Management Agency (RMA), Farm Service Agency (FSA), and Natural Resources Conservation Service (NRCS). Changes will need to occur in order for RMA’s crop insurance program, as well as FSA’s Noninsured Disaster Program (NAP), to be able to allow producers to harvest biomass for anything other than animal feed.

- f. **Leverage current authorities to enhance the sustainability and expand the production and collection of commodity-based feedstocks.** To enhance the sustainability and expand production of biomass feedstocks, USDA will leverage existing authorities. For example, a program like the Biomass Crop Assistance Program (BCAP) could be broadened to support annual crops in addition to perennial ones, thus incentivizing the production, collection, and transportation of commodity-crop feedstocks for conversion to biofuel. Currently, however, BCAP has no funding available for enrolling new participants into the program. Additionally, insurance coverage under the double cropping and relay cropping initiative can be expanded even further to offer coverage for second crops. Also, increased flexibility in adding new conservation practices to the Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP), and Field Office Technical Guides can support more pilots for new crops in Conservation Reserve Program (CRP) plantings. Additional support can be provided by adding feedstock crops to the eligibility list for Multi-Peril Crop Insurance coverage and FSA’s Noninsured Crop Disaster Assistance Program.

II. Improve Access and Utilization of Woody Biomass for Biobased Products

Through the Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA), the USDA Forest Service is making major investments in improving forest health, which can lead to available woody biomass for biobased products. Overstocking of forest biomass leads to wildfire. These risks are amplified by stressors such as insects and disease, drought, and extreme weather. Federal and other public lands that provide multiple uses such as recreation are the most affected and have the highest risk for catastrophic wildfires, as mapped by the National Wildfire Coordinating Group. Forest management to reduce overstocking supports new markets for biomass material. USDA will leverage programs within the Forest Service and NIFA that are addressing forest health to incentivize the use of woody biomass in products that can build markets and benefit the bioeconomy.

- a. **Leverage non-Federal funds for increased access to woody biomass through the Innovative Finance for National Forest grant program.** Through the Innovative Finance for National Forest grant program, USDA provides financial and technical assistance to non-Federal organizations to develop and implement partnership models that leverage external capital to enhance resilience on National Forest System lands. The program has supported the incubation of a range of financial innovations tied to wood product markets, as well as recreation access and

infrastructure. USDA will continue to leverage this program to support the incubation of new innovative finance ideas that resolve upfront costs of hazardous fuels and restoration treatments that produce woody biomass for downstream utilization.

- b. **Support increased utilization of woody biomass for biobased production through the Wood Innovations Grant (WIG) Program.** USDA will continue to leverage its Wood Innovations Grant Program to enhance utilization of woody biomass for biobased production, such as for mass timber affordable housing projects that will showcase innovative uses of cross-laminated timber as a substitute for concrete and steel, leading to wider adoption of these techniques and thus market demand for these products. Grants provide financial and technical assistance to State or Tribal governments, industry, and other partners to increase manufacturing capacity for wood products, strengthen markets that support ecological restoration, and enable development of commercial facilities for woody biomass and other wood products.
- c. **Invest in facilities and innovative equipment through the Community Wood Grant Program.** The Community Wood Grant Program supports local economies by funding ready-to-implement projects that expand the number of thermally led wood energy systems in the United States or build and expand innovative wood products manufacturing facilities. These grants support local and domestic renewable energy and wood products while creating local markets for low quality wood biomass that supports forest management and industrial residue use.
- d. **Incentivize woody biomass utilization from high-priority landscapes through the Wood Products Infrastructure Assistance Program.** The Wood Products Infrastructure Assistance Program uses authorities and appropriations from the Infrastructure Investment and Jobs Act (IIJA) to provide financial assistance for facilities that purchase and process byproducts from Federal and Tribal forests that are designated as high priority areas for restoration. USDA will continue leveraging this program to incentivize woody biomass utilization in high-priority areas for ecological restoration due to unnaturally severe fire impacts, or insect or disease infestation.
- e. **Invest in research and demonstration projects for value-added uses of small-diameter biomass and other low-value woody residues.** USDA will continue to invest in applied research and demonstration partnerships to inform improvements in biomass supply chain logistics and identify viable opportunities for value-added uses of small-diameter biomass and other low-value woody residues. Actions supporting this work include continued investigation of biochar production techniques and logistics, and the use of biochar for water and soil remediation. Actions also include pursuing the development of a partnership and research plan on the potential benefits of combining agricultural and forest biomass residues together in a common supply chain and the effectiveness of this combined-stream biochar application to improve soil health in depleted croplands.

- f. **Provide technical assistance to support woody biomass utilization as feedstocks for Sustainable Aviation Fuel.** USDA is providing technical assistance in support of the Sustainable Aviation Fuel Grand Challenge Roadmap Feedstock Innovation Action Area Implementation, outlining opportunities for low value, small diameter, or hazardous wood as a feedstock for emerging sustainable fuels. This work also promotes wood as a sustainable, preferred, renewable raw material in replacement of fossil fuel-based products in biotechnology, biomanufacturing, and energy applications in the emerging bioeconomy.
- g. **Support expanded use of wood feedstocks for biorefinery demonstrations.** Second-generation biorefineries that use wood feedstocks have struggled commercially despite promising pilot projects. USDA will coordinate with and leverage other Federal investments in demonstration projects to develop effective biorefining processes for the types of woody biomass that result from hazardous fuels and restoration treatments in the western United States, thereby developing new markets to incentivize forest operations that reduce wildfire risk to communities, natural resources, and critical infrastructure.
- h. **Support woody biomass product exports.** USDA’s Foreign Agricultural Service (FAS) will build upon its efforts to expand, maintain, and establish new markets for U.S. woody biomass products to ensure that they are recognized for their sustainability, and that their use globally benefits efforts to ensure forest lands remain forested. FAS also supports its industry partners through its Market Access Program (MAP), Foreign Market Development (FMD), and Agriculture Trade Promotion (ATP) programs, which together provided over \$18 million to support forest product exports in 2023. U.S. wood pellet exports were valued at \$1.6 billion in 2023, the second largest forest product export by value, and USDA will support continued growth in these and other export markets by ensuring that accurate, science-based information on woody biomass supply and sustainability is conveyed to foreign counterparts.

III. Invest in Resilient Infrastructure and Capacity To Utilize Biomass Feedstocks for More Jobs and Stronger Rural Economies

Infrastructure to move and process biomass from fields and forests to manufacturers is an essential element of biomass supply chain systems, delivering jobs and economic opportunities to communities, especially in rural areas where most biomass originates. Investments in infrastructure must ensure that the appropriate kinds of facilities develop in the right sizes and places to ensure resilience in these supply chains, such as by incentivizing construction of facilities in proximity to biomass sources, and in greater numbers at smaller scales across more locations having such proximity. USDA’s Rural Development (RD) agency has numerous grant and loan programs that support rural businesses and communities to build infrastructure and capacity to capitalize on opportunities within the bioeconomy as well as utilize biomass to produce biobased products and fuels. USDA will leverage the following RD programs to invest in biomass feedstock infrastructure, capacity, and production and marketing of biobased products:

- a. **Rural Energy for America Program (REAP).** The REAP program provides guaranteed loan financing and grant funding to agricultural producers and rural

small businesses for renewable energy systems or to make energy efficiency improvements. Agricultural producers may also apply for new energy-efficient equipment and new system loans for agricultural production and processing. REAP provided 8 loans for \$120 million and over \$48 million across 56 grants in Fiscal Year 2023 for REAP biogas and biomass projects. In FY24 these projects will create new capacity for producing biofuel, electricity, and heat from biomass, including waste. Projects also include awards up to \$1 million for anaerobic digesters that utilize manure and other farm biomass waste to create renewable biomethane as well as renewable electricity, as well as ethanol plant retrofits and improvements. Awards can also be made up to \$1 million for anaerobic digester projects that produce renewable natural gas, fertilizer, or livestock bedding from manure combined with food waste, and/or herbaceous biomass. For FY24, REAP has \$1 billion in guaranteed loans and nearly \$800 million in grant funding available to applicants, many of which can be expected to build capacity to utilize domestic biomass resources.

- b. **Biorefinery, Renewable Chemical, and Biobased Product Manufacturing Assistance Program (Section 9003).** This program provides loan guarantees up to \$250 million to assist in the development, construction, and retrofitting of new and emerging technologies, including [advanced biofuels](#), [renewable chemicals](#), and [biobased products](#). In previous years, the program has funded projects such as a community-scale anaerobic digester that processes dairy manure and food waste into renewable natural gas (RNG). The Section 9003 program continues to accept applications in FY24, currently with \$233 million in applications in process covering a diverse array of projects: converting farm animal waste into carbon-based products such as densified biomass fuel, activated carbon, and biochar; processing miscanthus-based poultry litter into low-carbon RNG, natural-based fertilizers, and industrial carbon dioxide; converting fats, oils, and greases into drop-in liquid fuels such as renewable diesel and naphtha; and processing post-consumer vegetable oils and fats into biopolymers.
- c. **Advanced Biofuel Payment Program (ABPP).** ABPP provides grants to producers for increased production of biofuel that is derived from renewable biomass other than corn kernel starch (7 CFR Part 4288.102). The \$6.79 million program enrolled approximately 90 biofuel producers as of FY 2023: 20 percent in biogas, 60 percent in biodiesel and renewable diesel, 10 percent in cellulosic ethanol, and 10 percent in solid fuels. The program is authorized through FY24.
- d. **Higher Blends Infrastructure Incentive Program (HBIIP).** HBIIP grants support transportation fueling, fuel distribution, and home heating oil distribution facilities, lowering out-of-pocket costs for businesses to install or upgrade fuel dispensers, storage tanks and systems, and other related equipment. Since HBIIP's 2020 debut, USDA has invested more than \$77.8 million in projects expected to increase biofuels sales by 1.2 billion gallons annually. In FY24, USDA is making available approximately \$360 million to fueling stations, convenience stores, hypermarket fueling stations, fleet facilities, terminal operations, depots, midstream partners, and home heating oil distributors for implementation activities related to higher blends

of fuel ethanol (greater than 10 percent ethanol) and biodiesel (greater than 5 percent biodiesel).

- e. **Business and Industry Guaranteed Loan Program (B&I).** The B&I program offers loan guarantees to lenders for their loans to rural businesses. In the past, this program has provided loans used to expand capacity of biobased product manufacturers. For example, the program provided loans to purchase equipment to produce wood chips for the smoked meats industry, as well as loans to purchase state-of-the-art manufacturing equipment to expand production capacity for a wood-based specialty shelving company.
- f. **Rural Economic Development Loan Program (REDL).** The Rural Economic Development Loan and Grant programs provide funding for rural projects through local utilities. USDA provides zero-interest loans to local utilities, which they pass through to local businesses (ultimate recipients) for projects that will create and retain employment in rural areas. REDL has been used to build capacity for manufacture of biobased products. For example, the program provided a \$2 million loan for equipment to create new biobased product lines and a \$2 million loan to purchase new equipment to facilitate better conversion of free fatty acids into biodiesel.

IV. **Support New and Better Markets for Biobased Products That Drive Demand for Biomass Feedstocks**

Biomass demand is driven by markets for biofuels and biobased products, which requires reliable feedstock supply at scale as well as adequate processing infrastructure in addition to promoting the demand itself. These dynamics are detailed in USDA’s forthcoming publication, *An Economic Impact Analysis of the U.S. Biobased Products Industry*, which examines and quantifies the effect of the U.S. biobased products industry from economic, jobs, and environmental perspectives. USDA will utilize several programs to build these markets, which drive increased investment in all parts of the biomass supply chain. The following are implementation steps to address these needs:

- a. **Continue expanding the BioPreferred Program®.** The BioPreferred Program is a USDA-led initiative created by the 2002 Farm Bill that aims to spur economic development, create new jobs, and provide new markets for farm commodities by promoting the development and expansion of markets for biobased products. USDA’s BioPreferred® Program Catalog assists users in identifying products that qualify for mandatory Federal purchasing, are certified through the voluntary labeling initiative, or both. In FY23, 1,456 new products were added to the BioPreferred® catalog (a 17 percent increase), which now totals 9,948 products total in the catalog, and 521 new suppliers (a 27-percent increase) for a current total of 2,452 companies. USDA will continue efforts to increase Government procurement of BioPreferred® products and the range of products in the BioPreferred® catalog, such as by pursuing inclusion of USDA Certified Biobased Products in Amazon Business. USDA also issues annual reports on biobased products procurement.

- b. **Leverage the Fertilizer Production Expansion Program (FPEP).** FPEP supports the production of agricultural commodities by providing financial assistance to expand the manufacturing and processing of fertilizer and nutrient alternatives. Some grant recipients source biomass for fertilizer converted from animal waste, organic waste, or food waste, while others convert from biosolids and biochar.
- c. **Continue research and analysis supporting market development of biobased products and biofuels.** USDA will continue to leverage its NIFA Agriculture and Food Research Initiative (AFRI) Sustainable Agricultural Systems (SAS) grants to support commercial supply chain demonstration projects to enable conversion of selected agricultural feedstocks into biofuels such as sustainable aviation fuel. The value-added “U.S. Bioenergy Statistics” data product, published by USDA’s Economic Research Service (ERS) in January 2024, further supports this research with statistics highlighting biofuel-based demand for agricultural feedstocks. AFRI SAS grants also support demonstration projects for value-added biobased products such as engineered wood products, biochar, and bio-pesticides. To further expand market development, USDA will support research for innovative biomanufacturing of novel proteins from biomass sources.
- d. **Leverage the Value-Added Producer Grants (VAPG) program.** The Value-Added Producer Grant (VAPG) program helps agricultural producers enter value-added activities related to the processing and/or marketing of biobased, value-added agricultural products in order to generate new products, create and expand marketing opportunities, and increase producer income. Eligible value-added agricultural products can include commodities such as forestry products, hemp, and on-farm generated manures, among other biomass sources. Since FY21, 50 biomass-based VAPGs have been awarded for a total of \$6.8 million. The new funding cycle is planned for early 2024.
- e. **Develop and expand export markets for biofuels and biobased products.** Since 95 percent of the world’s population lives outside our border, and most of these countries are experiencing more rapid growth than the United States, ensuring U.S. products are welcome in foreign markets is critical for building demand for products of the bioeconomy. Moreover, developing global norms for sustainable and climate-smart products will help promote institutional recognition of these attributes in U.S. bioeconomy products and encourage more investment and commercialization in new technologies needed to bring them to market. Through the Foreign Agricultural Service (FAS), USDA will build upon its efforts to expand, maintain, and build new markets for biofuels and biobased products to maximize the ability for U.S. farmers to compete in the global marketplace. FAS generates 14 required market reports and additionally issued 17 voluntary reports in 2023; these 31 reports were downloaded by the public nearly a quarter-million times. FAS’s support to industry partners through its MAP and ATP programs has provided \$27 million since 2014 to invest in ethanol promotion worldwide, doubling the value of ethanol exports since 2014 to a record \$4 billion in 2023. Leveraging this public-private support, FAS continues to identify opportunities and resolve obstacles in markets to facilitate the trade or use of biofuels, including

capacity building and technical exchanges to increase global awareness of biobased products and USDA’s programs supporting their use and development. FAS continually seeks the fair treatment and use of both traditional as well as advanced biofuels, such as sustainable aviation and marine fuels, through various means bilaterally, globally, and through strategic partnership with stakeholders, including with other government agencies.

V. Promote Climate-Smart Practices to Enhance Productivity and Sustainability of Biomass Feedstocks

The bioeconomy relies heavily on commodity crops such as corn and soy to serve as feedstocks, particularly for biofuels. Climate-smart practices can enhance the productivity and sustainability of these commodities to help meet future demand while conserving natural resources and improving environmental quality. Oilseed crops grown as cover crops are also promising feedstocks for biofuels, and they have the potential to expand production on existing cropland, enhance soil health benefits, and increase farmer income. To meet these objectives, USDA will:

- a. **Leverage the Partnerships for Climate-Smart Commodities program.** USDA’s ground-breaking \$3.1 billion Partnerships for Climate-Smart Commodities program is expanding markets for America’s climate-smart commodities—including biomass feedstocks from commodity crops and other sources—while leveraging the greenhouse gas benefits of their production and providing direct, meaningful benefits to production agriculture, including for small and underserved producers. Eighteen of the Department’s Partnerships for Climate-Smart Commodities projects, totaling over \$309 million, focus on expanding the bioeconomy. USDA will work to facilitate these projects in navigating the relatively novel and complex dynamics relating to biomass and biobased production, and to assess the program’s effectiveness in de-risking and incentivizing production and preprocessing of feedstock crops and in enhancing demand through downstream biobased product manufacturing.
- b. **Continue research and policy analysis to support decreasing the carbon intensity of commodity crops.** Research on integrating cover crops into existing feedstock rotations through innovative cropping systems can increase photosynthetic carbon capture and potential carbon sequestration while increasing overall agricultural productivity. USDA will continue to support improving the use of cover crops in major crop portfolios in different regions. New biotechnology and machine learning/artificial intelligence-powered tools will be used to discover the function of genes that govern lipid and biomass production and accelerate crop environmental resilience, enhance nutrient use efficiency, strengthen disease and pest resistance, and reduce production costs.
- c. **Improve analysis of carbon intensities (CI) for biofuels and biobased products** Increasingly, incentives for biofuels and biobased products are connected to their greenhouse gas performance. To take advantage of these incentives, up-to-date carbon intensity (CI) scores are needed. This includes ensuring that data on climate-smart farming practices are reflected in models that estimate the carbon intensity of commodity-crop feedstocks and their products. USDA will continue to invest in

transportation fuel models to ensure that they accurately estimate the lifecycle greenhouse gas impacts of domestic biofuels and biobased products, and to publish updated data as it becomes available.

- d. **Improve modeling and analysis of carbon-market value.** USDA is a key organizer and participant in the Forestry and Agriculture Modeling Forum, which supports development of carbon markets for biomass and biobased products by bringing together leading researchers from around the world for dialogue and collaboration on modeling and empirical analysis of greenhouse gas (GHG) mitigation, carbon sequestration, resilience, and bioenergy potential in the agriculture and forestry sectors.

VI. **Provide Stakeholder Outreach and Technical Assistance to Ensure the Resilience of Biomass and Biobased Supply Chains**

The preceding five sections outline USDA’s current research and development, capacity building, and market development initiatives to strengthen supply chains for biomass and biobased production. Ensuring the resilience of these supply chains going forward will require well-coordinated efforts to engage with bioeconomy stakeholders in leveraging public and private investments. USDA can also play a key role as a convener of public-private partnerships to build out and link biomass supply chains with economic value propositions, such as through development zone initiatives and interagency working groups with robust stakeholder participation, such as in sustainable aviation fuel and domestic natural rubber.

- a. **Increase awareness of USDA funding programs to support biomass and biobased production.** USDA will perform targeted outreach to farms, manufacturers, and other stakeholders, particularly in underserved communities, to increase their awareness of USDA funding programs available to support biomass and biobased production and facilitate the delivery of publicly available guidance on how to apply. Targeted outreach will include engagement on Biobased Products Day (annually on March 8), participation in various conferences, and program-specific webinars that highlight opportunities for biomass and biobased production support.
- b. **Develop resources to guide ongoing investments in resilient biomass/biobased supply chains.** USDA will explore public-private partnerships and cooperative agreements with research institutions to integrate information resources with market and supply-chain assessments to create a public resource for targeting public and private infrastructure investments to facilitate supply-chain resilience over the long term. Such efforts would combine basic principles of resilience analysis (diversity, redundancy, interconnectedness), review of best practices in bioeconomy supply-chain development, and integration of key bioeconomy and lifecycle analysis indicators to customize a supply-chain mapping and analysis resource to guide supply chain investments.
- c. **Support demonstration projects for biomass utilization in construction.** Pilot projects have shown that non-sawlog wood material and other biomass feedstocks can be used to reduce greenhouse gas emissions in the production of cement,



insulation, and structural insulation panels. Biomass-based products from these pilots need to be evaluated for mechanical features, durability, and fire resistance to support uptake and code compliance in the engineering and construction trades. USDA plans to synthesize findings in a report on the suitability of biomass construction materials for zero- or negative-carbon building applications and demonstration projects at scale.

- d. **Strengthen strategic partnerships with trade associations to assess workforce development needs.** A robust workforce is necessary for various biomass supply chains. For example, logging workforce development is important to meet demand for increased woody biomass supply from ecological restoration activities, while ‘reskilling’ programs assist tradespeople seeking to enhance their skills in adoption of biomass and biobased materials in building construction.

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