Biobased Chemicals and Products

A NEW DRIVER OF U.S. ECONOMIC DEVELOPMENT AND GREEN JOBS


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BIOBASED CHEMICALS AND PRODUCTS:

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I. OVERVIEW

Historically, the U.S. chemicals and plastics industry was the envy of the world. At its peak in the 1950s, the industry was responsible for over 5 million U.S. jobs and a $20 billion positive trade balance for the United States. Jobs associated with the industry were typically among the highest paid in U.S. manufacturing.

Over the last two decades, competitive advantage for chemicals and plastics manufacturing has shifted towards the Middle East and Asia, as has the industry. U.S. employment in the sector has dropped over the last decade and is projected to shrink further as capital investment for the petroleum-based industry has essentially shifted away from the United States.

Biobased chemicals and plastics represent a historic opportunity to reverse these trends through the creation of a new generation of renewable, sustainable products developed and produced in the United States. Biobased chemicals and plastics — often referred to as biobased products — are virtually the same as their petroleum-based counterparts, but are manufactured from renewable resources. Recent advances in biotechnology are now making it possible to manufacture many traditional chemicals — and many promising new alternatives — from renewable biomass instead of petroleum.

Biobased products can supplement or replace a wide variety of petroleum-based products, and the United States has a substantial potential competitive advantage in their manufacture:

- We are home to much of the world's leading industrial biotechnology, which enables the creation of a wide range of biobased products;
- We have a very strong agricultural sector with the largest amount of arable land in the world;
- We are the largest chemicals and plastics market in the world; and
- Much of the downstream industry for biobased products (e.g., converting, logistics, warehousing) is already in place.

A growing number of early stage successes across a wide range of biobased products indicates this sector has tremendous potential. Even in its nascent state, the biobased products industry accounts for over 5,700 direct jobs, and is likely responsible for over 40,000 jobs economy wide. Achieving the industry's full potential could create tens of thousands of high-paying green jobs in the United States within the next five years.

The biobased products sector should be nurtured so that its benefits can be realized in the United States. Economic development impacts will include the creation of high-valued green jobs, an improved trade balance, the reduction of greenhouse gas (GHG) emissions and enhanced energy security through reduction of dependence on imported foreign oil.

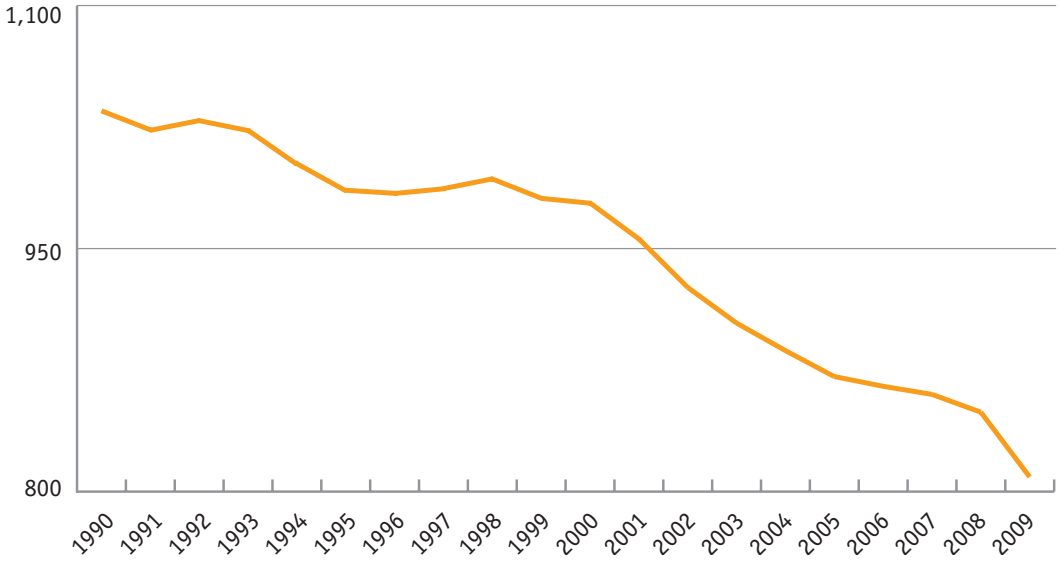
To foster growth of the biobased products sector in the United States, federal policy should provide strong support for research, development and commercialization of innovative biobased products, including grants and loans for construction of biorefineries, a strong biobased markets program, and tax incentives for pioneering commercial production,

II. THE DECLINE OF THE U.S. CHEMICALS AND PLASTICS INDUSTRY

The U.S. chemicals and plastics industry came to the forefront after World War II and spent the next four decades as a world leader[1]. Once a primary source of U.S. export earnings, the industry began to erode during the 1980s as oil rich countries began to aggressively invest in their own petroleum derivative industries[1]. As production moved to other countries, so did jobs. Total U.S. employment in the chemicals industry declined by over 20 percent in the last two decades, from more than 1 million in 1990 to just over 800,000 in 2009, and is projected to decrease further[2].

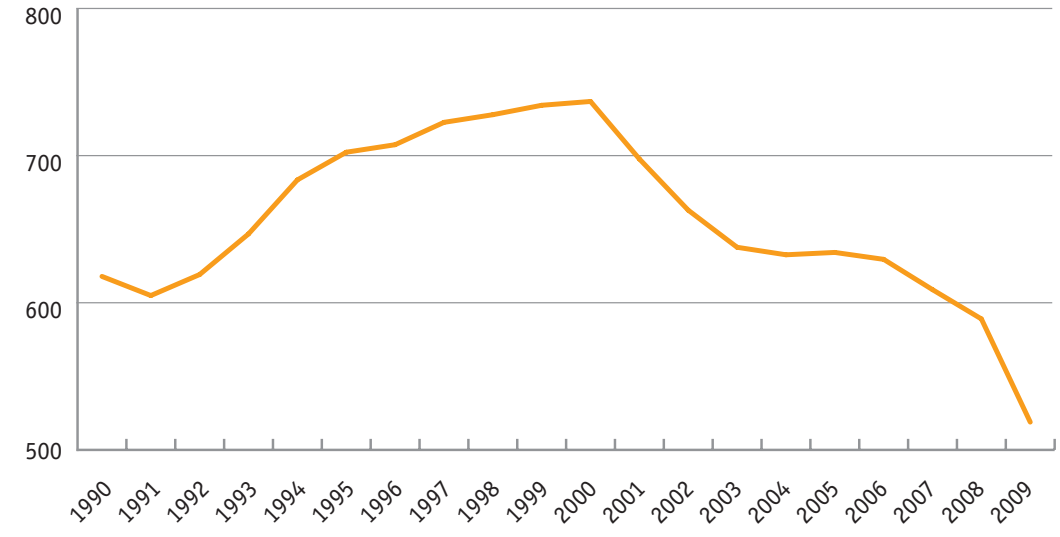
Employment in the plastics industry has followed a similar trend. There are 116,000 fewer employees in the industry since 2002 — a 12 percent decrease (Figure 1). Having increased from more than 600,000 in 1990 to nearly 750,000 in 2000, plastics jobs in the United States have decreased to just above 500,000 (Figure 2). The number of plastics establishments — primarily plastics converting operations, often small and family-owned — has declined by 13 percent[3]. Many have declared bankruptcy.

FIGURE 1.
CHEMICAL JOBS IN THE U.S. (in thousands)



Source: Bureau of Labor Statistics-Employment

FIGURE 2.
PLASTIC JOBS IN THE U.S. (in thousands)



Source: Bureau of Labor Statistics-Employment

The chemicals and plastics industry historically has also been a driver of export earnings for the United States. Between 1997 and 2003, the U.S. balance of trade in chemicals dropped from a $20 billion surplus to a $10 billion deficit (Figure 3). The United States has regained some ground but maintains an overall deficit.

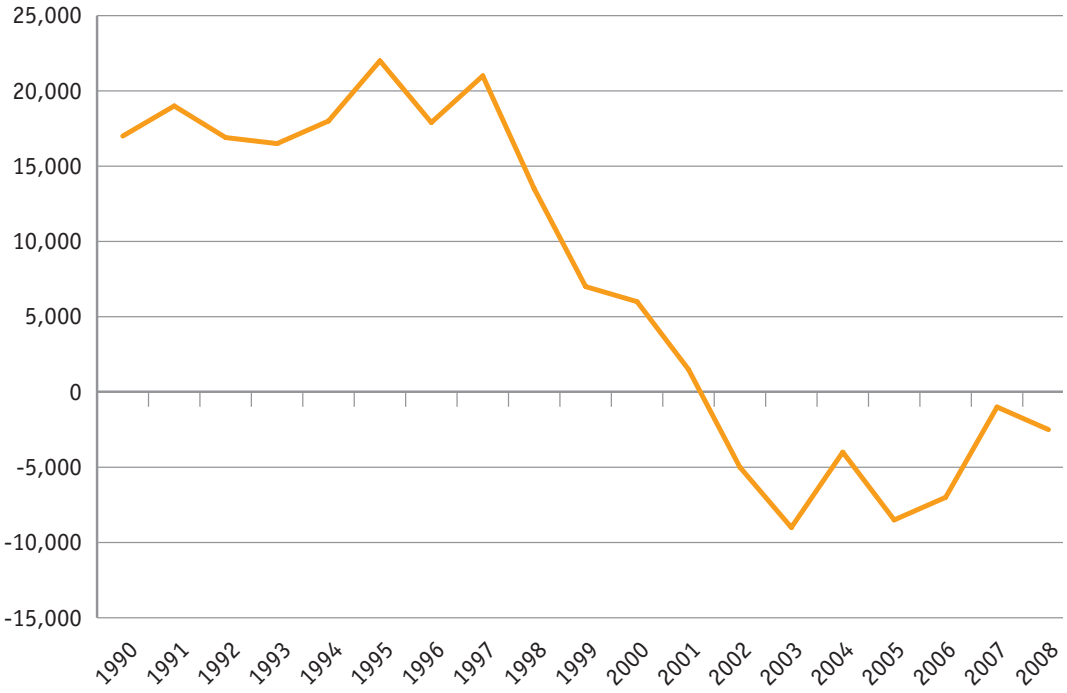


FIGURE 3.
CHEMICAL MARKET TRADE BALANCE (in millions of $US)

Source: TradeStats Express™, National Trade Data

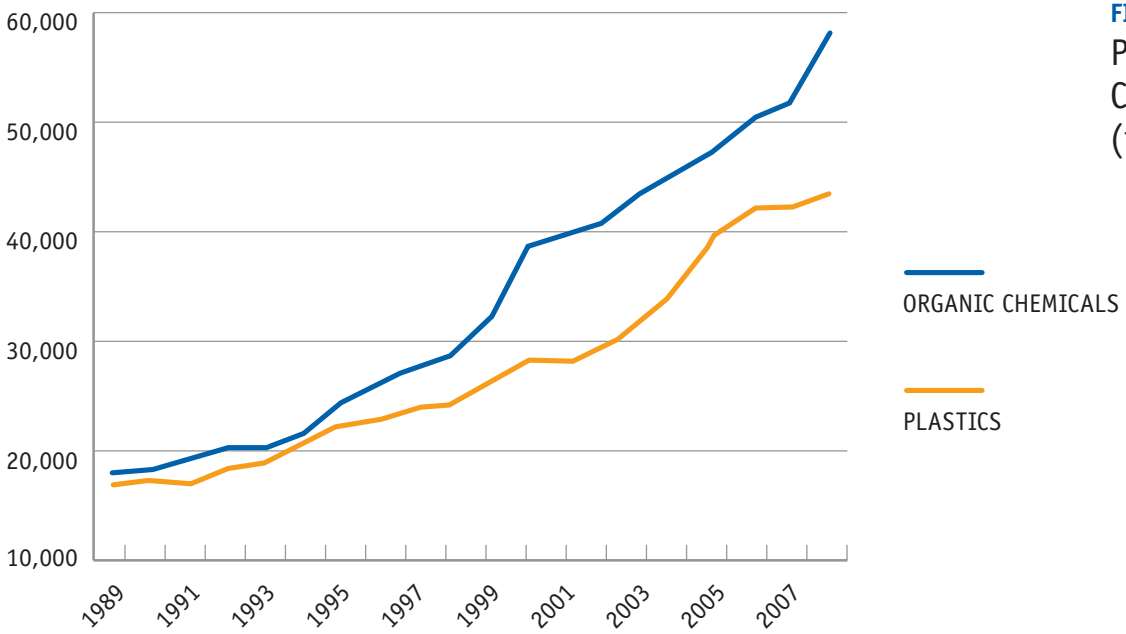


FIGURE 4.
PLASTIC AND CHEMICAL IMPORTS (in millions of $US)

Source: TradeStats Express™, National Trade Data

Other regions of the world, especially the Middle East and Asia, have increased their chemicals and plastics exports at a substantially higher rate than the United States[4]. At the same time, U.S. chemical and plastic imports have had a steady rise[5]. From less than $10 billion each in 1989, U.S. imports of plastics have climbed to more than $35 billion and imports of chemical have topped $50 billion (Figure 4).

Some of the most concerning data relative to the outlook for the U.S. industry has been the pattern of new capital investment. For the period 1998-2009, there has been an increase of 32 percent in new petrochemical capital investment outside of the United States by U.S. companies[6]. There has only been a 2 percent increase in petrochemical capital investment by U.S. companies within the United States. This is indicative of competitive advantage shifting away from the United States. The shift in investment is a leading indicator of a future eroding trade balance and industry jobs outlook, which is bleak.

Recent capital investment in the chemicals and plastics industry globally has favored other areas of the world. Most large deals and investment are being made by Middle Eastern companies, whereas historically U.S. and European firms have led investment in this sector[7].

III. POTENTIAL FOR BIOBASED PRODUCTS

The nascent biobased products industry employed over 5,700 Americans at 159 facilities in 2007 — the most recent industry analysis[8]. Given that every new job in the chemical industry creates 5.5 additional jobs elsewhere in the economy[13], and considering recent biorefinery openings, the current industry is likely already responsible for more than 40,000 U.S. jobs.

Presently, less than 4 percent of U.S. chemicals sales are biobased[8]. But a recent USDA analysis puts the potential market share in excess of 20 percent by 2025 with adequate federal policy support (Table 1)[10]. If this rate of growth is achieved, the industry could create or save tens of thousands of additional jobs in the next five years.

TABLE 1.
WORLD BIOBASED MARKET PENETRATION 2010-2025

CHEMICAL SECTOR	2010	2025
Commodity Chemicals	1-2 percent	6-10 percent
Specialty Chemicals	20-25 percent	45-50 percent
Fine Chemicals	20-25 percent	45-50 percent
Polymers	5-10 percent	10-20 percent

Source: USDA, U.S. Biobased Products Market Potential and Projections Through 2025

The United States is as well positioned as any country in the world to capture a disproportionate share of the biobased product market:

- We are home to much of the world's leading industrial biotechnology, which enables the creation of a wide range of biobased products
- We have a very strong agricultural sector with the largest amount of arable land in the world (Figure 5);
- We are the largest chemicals and plastics market in the world; and,
- Much of the downstream industry for biobased products (e.g., converting, logistics, warehousing) is already in place. Production of U.S. biobased products can easily be integrated into the existing networks constructed when the United States was a global leader in the chemicals and plastics industry

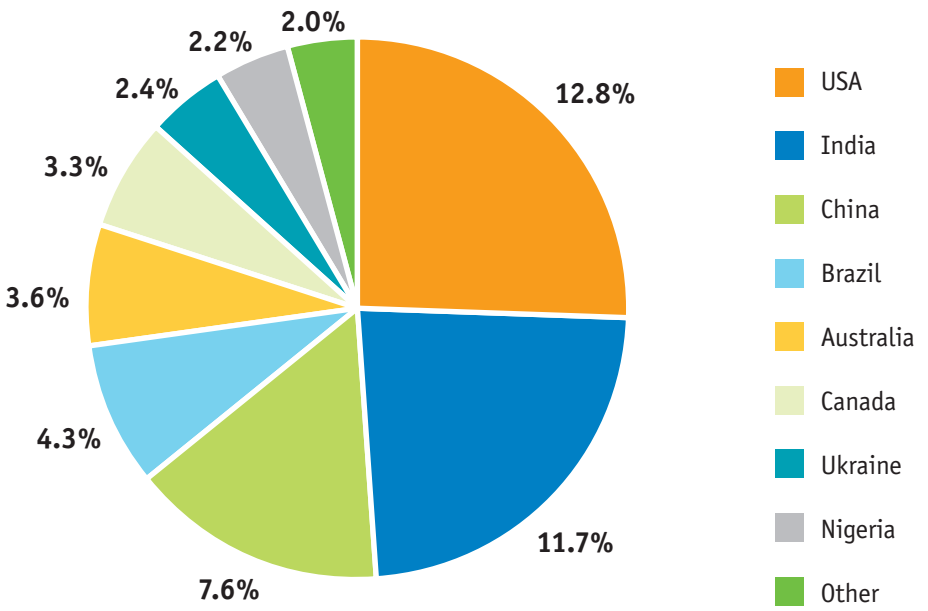


FIGURE 5.
% OF ARABLE LAND IN COUNTRIES AROUND THE WORLD

Source: NationMaster.com, Arable Land hectares by country

Consumers around the world are also demanding greener products — products that are made from renewable resources and offer societal benefits such as lower CO_2 emissions, reduction of waste to landfills, and reduced reliance on fossil resources.

Globally, studies have shown that biofuels can reduce CO_2 emissions by 123.5 million tonnes[11]. Similar studies have shown that biobased products can have a similar beneficial effect by using less fossil fuels and emitting fewer greenhouse gases than traditional petroleum-based alternatives[12]. A recent report from WWF determined that greenhouse gas emissions could be reduced by 1.0 billion to 2.5 billion tonnes of CO_2 equivalent by 2030 through the development and implementation of biobased products and other industrial biotechnologies[13].

Biobased products also promote energy independence. Approximately 10 percent of U.S. crude oil imports — which at the beginning of 2010 still amounted to 8.4 million barrels per day[14] — are used to produce chemicals and plastics. Replacing petroleum-based products with products derived from renewable sources will directly reduce our dependence on crude oil imports. Biobased products will also be an essential component to deliver competitive economics in integrated biorefineries. Although plastics and chemicals have lower volume than fuels, they add disproportionate value. In the petrochemical sector, chemicals and plastics contribute $255 billion to the economy, almost three quarters as much as the $350 billion in value added to the economy by commercial transportation and transportation-related manufacturing[15]. With improved market traction and resulting manufacturing economies-of-scale, biobased products are forecast to achieve cost parity with traditional petroleum-based products in the next 5 to 10 years.

Some critics have suggested that biobased products could cut into the food used for human consumption. Data from the American Corn Growers Foundation shows that, in fact, as a result of improved farming practices, domestic corn available for food has grown 21.5 percent over the last five years — even with substantial increases in ethanol production[16]. Biobased products represent only a tiny fraction of demand for corn starch, and are poised to tap into next-generation technologies driven by the biofuel industry that will allow for use of cellulosic and other non-food feedstocks in the near future.

IV. POLICY

Policy makers and industry leaders must work together to ensure that the United States captures its natural advantages for biobased products and not let the industry shift overseas as did the petroleum-based industry. Asian countries like Japan, China and South Korea are attempting to take the lead in green technology pursuits. A proactive approach to grow the biobased products segment is a key component to realizing U.S. leadership in green technologies. Congress can assist in developing the U.S. biobased products industry and create tens of thousands of green jobs through the following policy actions:

1. **Provide product parity and early stage support in biorenewables tax policy**
   Biobased products offer the same benefits to the United States as biofuels, including reduced petroleum dependence, green job creation, greenhouse gas reductions and other environmental attributes. Congress has recognized the many societal benefits of biofuels through the tax code, with a combination of incentives to spur both capital investment and pioneering commercial production. No such incentives exist for non-fuel biobased products, greatly hindering investment. Congress should:

   Enact a production tax credit (PTC) for biobased products
   A PTC for biobased products will promote investment, production, and adoption of biobased products much as the existing biodiesel and cellulosic biofuels production tax credits have done for investment in those industries. Federal policy supporting biofuels in the United States has resulted in an additional 240,000 jobs and contributed $65 billion to GDP in 2008. The increase in economic activity resulting from ongoing production, construction of new capacity, and biofuel R&D supported more than 494,000 jobs in 2008[17]. By establishing a production tax credit for biobased products, similar statistics for job creation and capital investment are possible.

   Open the section 48C advanced energy manufacturing credit to renewable chemical and biobased product biorefineries
   The current 48C advanced energy manufacturing credit provides much needed assistance to developers of a wide range of renewable energy technologies, including biofuels projects, but fails to recognize biobased products manufacturing projects as explicitly eligible. Authorizing language should be clarified to ensure biobased product manufacturing projects are eligible.

   Provide robust early stage R&D tax credits to drive development of specialty biochemicals
   Initially, when a specialty biochemical is first commercialized, sales volumes are low, and due to the lack of economy of scale, costs are high. A tax credit for qualifying specialty biochemicals products during these intervening high cost years, will provide a needed incentive to accelerate the market growth and innovation of this sector.

2. **Increase funding through grants and other programs for non-fuel biobased products**
   Grants, loan guarantees, and other financial assistance programs are needed to stimulate innovation and demonstration of new biological conversion of agricultural feedstocks to biobased products. Much like the DOE and USDA programs directed toward next-generation biofuels development, programs focused on next-generation biobased products technology will stimulate new feedstocks and conversion technology.

   Open existing DOE and USDA loan guarantee programs to biobased product projects
   Current DOE (EISA Title XVII and ARRA) and USDA (Farm Bill Sec. 9003) renewable energy loan guarantees have not been awarded to biobased product manufacturing projects despite their vital role in achieving the green jobs, energy independence, and environmental policy goals of these programs. Congress should clarify that biobased product projects are eligible for assistance under these programs.

Ensure existing and future DOE and USDA grant programs support biobased products
Biobased product projects are under-represented or, in some cases, not even eligible for current DOE and USDA grant programs designed to support innovative renewable energy projects. Authorizing language for existing grant programs should be clarified to ensure adequate support for biobased products. Future grants programs should be authorized so as to provide full support as well

Establish grants and loans to help struggling biorefineries add high value chemical production
Specialty biochemicals production can provide vital stability and profitability to biorefineries by offering non-cyclical products at much higher margins, which can be depended upon across the commodity cycle. For many years, DOE and USDA have provided significant research support for both biofuels and commodity biochemicals, which has greatly accelerated the development of these products. Similar grants and programs are requested to support specialty biochemicals growth.

3. **Ensure biobased products are incentivized in climate change/carbon legislation**
Biobased products provide superior greenhouse gas performance compared to traditional products made from petroleum feedstocks. In fact, many biobased products are carbon negative on a lifecycle basis by sequestering atmospheric carbon within the product itself. However, because the carbon embodied in plastics and other chemicals rightly falls outside the cap envisioned by current climate legislation proposals in Congress, these bills do not adequately distinguish between biobased and fossil-based products, and thus provide little incentive for development or production of biobased products that displace fossil-fuel based alternatives. Congress should therefore:

Include "production of biobased products" in the list of eligible offset project types
Doing so would provide the necessary market signal to drive investment in critical low-carbon biobased products while providing obligated parties access to real, verifiable and additional CO_2 reduction opportunities.

4. **Ensure timely implementation and eligibility of renewable chemical intermediates in USDA BioPreferred voluntary labeling and procurement programs**
The USDA BioPreferred voluntary labeling and procurement programs have the potential to be major market drivers for biobased products. To drive innovation in this space, the programs must be extended to renewable chemical intermediates, as required by authorizing statute, and the programs must be implemented without further delay.

Biobased products can offer significant growth to the U.S. economy and offer America a competitive advantage in the chemicals and plastics industry. The industry can create tens of thousands of green jobs and provide a range of additional societal benefits to the United States, including a reduction in CO_2 emissions and reduced dependence on foreign oil. Policy makers and industry leaders working together can advance these high potential industries.

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