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Destination 2025 is an initiative of The BioBusiness Alliance of Minnesota in collaboration with Deloitte Consulting LLP to develop a roadmap for the bioscience markets in Minnesota.



The Destination 2025 project examines six markets of the bioscience industry: Animal Health, Food, Medical Device, Biologics and Biopharmaceutical, Renewable Materials, and Renewable Energy.

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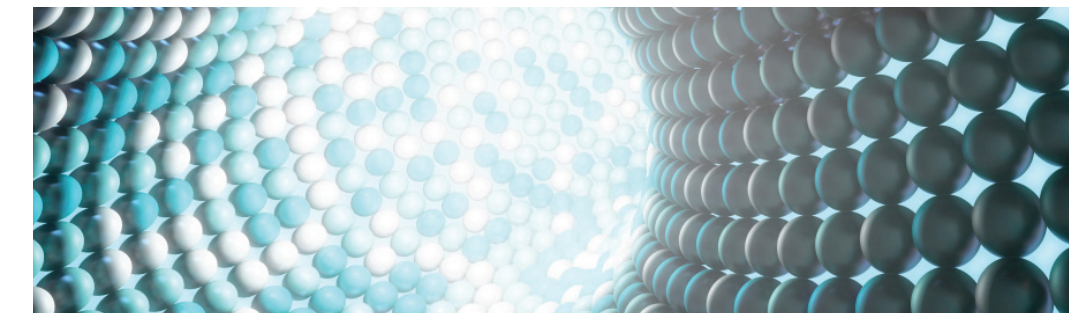
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Destination 2025 Focus on the Future of the Renewable Materials Industry



We have identified leading trends and technologies that are expected to significantly affect the renewable materials industry globally over the next two decades.

Executive Summary February 2009

Destination 2025 - a collaboration between The BioBusiness Alliance of Minnesota and Deloitte Consulting LLP

Executive summary

The trends and technologies identified, and opportunities in the industry, are likely to realign to different levels of importance over time.

Using the Strategic Flexibility Framework, we performed a scenario-based planning exercise to evaluate a range of different future scenarios. This allowed us to determine which of these trends and technologies are likely to have the greatest impact in the development of the industry.

The review of trends and technologies suggests that opportunities exist to develop new products and solutions. Moreover, existing markets and products may experience flux due to new trends and technologies. Strategies must evolve to benefit from opportunities and threats. Decision makers in academia, government, and industry can use the Strategic Flexibility Framework to develop strategies based on individual constraints and objectives.

Market definition

For our purposes, renewable materials are simply defined as materials that are made from biological sources, which include biochemicals, biofibers, biopolymers, and biodegradable plastics. Biofuels are also considered in our treatment of renewable materials because of the overlap between their supply chains and because biofuels can be used to make renewable materials.

The full white paper on the future of the biologic and biopharmaceutical industry is available for download at www.deloitte.com/us/d2025

Focus on the Future of the Renewable Materials Industry

Emerging and future trends

The following trends are expected to influence the industry in the next 20 years.

Technologies and policies affecting demand for liquid fuels are expected to drive the development of the biofuels industry.

Higher than historical average crude oil prices improve renewable materials' competitiveness, but can also leave the industry vulnerable to volatility in prices of traditional fossil fuels. Mandated or price-controlled limits on carbon emissions may also trigger a switch from fossil fuels toward alternative fuels. Rationing of petroleum reserves by the market can limit crude oil use to applications that have no substitute. Changing policy priorities and fiscal constraints may affect whether farm and biofuels subsidies can be sustained or extended. The push toward alternative energy is strong in the transportation sector because of increasing demand in the long run.

Renewable materials industry development is constrained by pressures on inputs to agriculture and biomass production.

The production of renewable materials is constrained by prices of inputs, such as fertilizers, which in turn pressure agricultural production and feedstock prices. Increasing competition for land and water resources is also expected to constrain biomass production, unless technological innovations can improve productivity. Climate change scenarios, and their potential impacts for water use in agriculture, suggest higher uncertainty for planning. Concerns about soil productivity and water scarcity are likely to focus attention on soil management. Concerns about nitrogen release from fertilizer-dependent cropping systems may shift production to systems that require less fertilizer, such as prairie grass.

Supply chain constraints, if not resolved, are likely to affect the development of the renewable materials industry.

Improvements are needed in the production, location, and storage of biomass as well as in the transportation infrastructure and logistics for hauling biomaterial feedstock.

Solutions to supply-chain constraints are likely to evolve from strategies that manage the value and diversification of the product.

Ethanol and biodiesel production plants may add production of chemicals to their portfolios. Cellulosic fuel production, when feasible, is likely to be added to existing ethanol production infrastructure. Other developments along the biomass supply chain, such as trading lignocellulosic feedstock as an independent commodity, can encourage growth in the development of cellulosic ethanol.

Opportunities exist in the pulp and paper industry.

Conversion of some chemical pulp and paper mills capacity to biorefineries producing an array of new biofuels and biochemicals in addition to pulp and paper could markedly improve the profitability of these mills.

Demographic and cultural trends are also expected to support the development of the renewable materials industry.

The shift toward electronic media is limiting demand for paper products, especially newsprint, creating opportunities for pulp and paper mills to develop newer, value-added products. Meanwhile, increased concern for the environment is pushing consumers toward more environmentally benign products and environmentally friendly companies. Concurrently, consumers are increasingly concerned about the health issues associated with some chemicals.

Environmental trends are likely to support industry development.

An increased emphasis on Life Cycle Analysis may rank biofuels differently from the current, short-term policy preferences, with the potential for some biofuels to be preferred over others in the long term. Increased emphasis on carbon sequestration and carbon dioxide emission reduction may favor fuels with lower carbon footprints compared to fossil fuels.

Next steps

The review of trends and technologies suggests that opportunities exist to develop new products and solutions. Moreover, existing markets and products may experience flux due to new trends and technologies. Strategies must evolve to benefit from opportunities and threats. Decision makers in academia, government, and industry can use the Strategic Flexibility Framework to develop strategies based on individual constraints and objectives.

Emerging and future technologies

Market segment	Representative products based on relevant technologies
Biochemicals	<ul style="list-style-type: none"> Carbohydrate-based biorefineries Oil-based biorefineries New enzymes for enzymatic conversion Anaerobic digestion Catalytic processes Biomass gasification Commercial operating plants based on pyrolysis using agricultural and forest biomass Biomass liquefaction Omnivorous biorefineries that use multiple forms of biomass Fischer-Tropsch catalysis Syngas fermentation to make ethanol and organic acids Portable biorefineries Utilizing existing pulp and paper mills Extracting value from wood before pulping Black liquor gasification Advanced biofuels beyond simple alcohols Algae as a feedstock Fractionation of biomass Crops designed for biorefinery operations Densification of biomass Biochar for fertilizer and CO₂- sequestration
Biorefineries and biofuels	<ul style="list-style-type: none"> Producing platform chemicals from biomass feedstocks Genetic and metabolic engineering of microbes Wind-to-anhydrous ammonia Conversion of carbon dioxide to chemicals Use of biomass to make drugs Organic chemical production
Bioplastics	<ul style="list-style-type: none"> Biodegradable plastics Polysaccharide conversion to plastics Biotech processes to convert vegetable oil to plastics Polyurethane foams from renewable materials Lignin-based polymeric materials
Forest products	<ul style="list-style-type: none"> Improving surface and physical properties through nanotechnology Cell wall technology Intelligent wood and paper products with nanosensors
Other technologies	<ul style="list-style-type: none"> Nanostructures to develop new materials, processes, and applications Biomimicry in nanofactories Characterization and modeling Tools for nanomaterials Computational systems biology