# Second-Generation Biofuels Market - Global Industry Size, Share, Trends, Opportunity, and Forecast, Segmented By Feedstock (Simple Lignocellulose, Complex Lignocellulose, Syngas, Algae, and Others), By Application (Transportation, Power Generation and Others), By Type (Cellulosic Ethanol, Biodiesel, Bio Butanol, Bio Dme, and Others), By Process (Biochemical Process and Thermochemical Process), By Region, By Competition, 2018-2028

Market Report | 2023-10-03 | 174 pages | TechSci Research

**AVAILABLE LICENSES:**

- Single User License $4900.00
- Multi-User License $5900.00
- Custom Research License $8900.00

**Report description:**

Global Second-Generation Biofuels Market has valued at USD 7.08 billion in 2022 and is anticipated to project robust growth in the forecast period with a CAGR of 20.19% through 2028.

The Second-Generation Biofuels market refers to the sector within the renewable energy industry that focuses on the production and commercialization of advanced biofuels derived from non-food, lignocellulosic feedstocks. Unlike first-generation biofuels, such as corn ethanol or sugarcane biodiesel, which primarily use edible crops, second-generation biofuels utilize materials like agricultural residues (e.g., corn stover, wheat straw), woody biomass, algae, and dedicated energy crops (e.g., switchgrass).

The defining characteristic of second-generation biofuels is their ability to tap into a wider range of feedstock sources, thereby reducing competition with food production and minimizing the environmental impact associated with land-use change. These biofuels are produced through complex processes involving pretreatment, enzymatic hydrolysis, fermentation, and distillation to convert lignocellulosic materials into advanced fuels like cellulosic ethanol and renewable diesel.

The Second-Generation Biofuels market has gained prominence due to its potential to reduce greenhouse gas emissions, enhance energy security, and address the limitations of first-generation biofuels. Governments, industries, and researchers worldwide are actively engaged in developing technologies and policies to promote the growth of this market as part of broader efforts to

transition towards more sustainable and environmentally friendly energy sources.

Key Market Drivers

Growing Environmental Concerns and Stringent Regulations

The global Second-Generation Biofuels market is being significantly driven by growing environmental concerns and increasingly stringent regulations aimed at reducing greenhouse gas emissions. As the world grapples with the adverse effects of climate change, there is a pressing need to transition from fossil fuels to more sustainable energy sources. Second-generation biofuels, such as cellulosic ethanol and renewable diesel, are seen as promising alternatives. These biofuels are produced from non-food feedstocks like agricultural residues, algae, and municipal waste, which reduces competition with food production and minimizes land-use change, a key driver of deforestation. Consequently, governments and international bodies are implementing policies and regulations to incentivize the adoption of these advanced biofuels, driving the market's growth.

Energy Security and Diversification

Energy security is another pivotal driver of the global Second-Generation Biofuels market. Many countries are dependent on imported fossil fuels, which can be geopolitically unstable and subject to price volatility. To reduce this vulnerability, governments and energy companies are looking to diversify their energy sources by investing in domestically produced biofuels.

Second-generation biofuels, with their potential to be produced from locally sourced feedstocks, offer a means to enhance energy security and reduce reliance on imported oil. This driver is particularly relevant for countries seeking to enhance their energy independence and reduce exposure to global energy market fluctuations.

Technological Advancements and Research Investments

Advancements in biotechnology, process engineering, and agronomy are driving innovation in the Second-Generation Biofuels market. Researchers are continually working to improve the efficiency and cost-effectiveness of biofuel production processes. Breakthroughs in genetic engineering, enzyme technology, and fermentation techniques have significantly enhanced the yield and quality of biofuels. Furthermore, substantial investments in research and development are being made by governments, private companies, and academic institutions to accelerate the commercialization of second-generation biofuels. These technological advancements are making second-generation biofuels more competitive and attractive to investors and consumers alike.

Volatile Oil Prices and Energy Price Concerns

The volatility of oil prices and concerns about the long-term availability of conventional fossil fuels are motivating the shift towards Second-Generation Biofuels. The fluctuating nature of oil prices can have profound economic implications for both countries and businesses. By investing in biofuels, which have the potential for more stable pricing, stakeholders can mitigate the risks associated with oil price volatility. Additionally, the finite nature of fossil fuel resources is a genuine concern, prompting the exploration of sustainable alternatives like second-generation biofuels that can provide a more reliable source of energy in the future.

Growing Demand for Sustainable Transportation

The transportation sector is a major contributor to greenhouse gas emissions, making it a prime target for sustainability efforts. Second-Generation Biofuels are increasingly being adopted in this sector as a means to reduce carbon footprints. Consumers are becoming more environmentally conscious, leading to a growing demand for vehicles that use biofuels or have flex-fuel capabilities. Furthermore, governments in various regions are incentivizing the use of biofuels by implementing mandates and tax breaks for biofuel users, further propelling the market's growth. As the world continues to prioritize sustainability, the demand for second-generation biofuels in the transportation sector is expected to rise.

Increasing Investment and Market Competitiveness

The influx of investment from both public and private sectors is a significant driver of the Second-Generation Biofuels market. Investors are recognizing the long-term potential of biofuels and are pouring capital into the development of production facilities, infrastructure, and research. This increased investment is leading to economies of scale, which in turn is reducing the cost of second-generation biofuel production. As production costs decrease and biofuels become more competitively priced compared to fossil fuels, their adoption in various industries is expected to accelerate, further driving the global market for second-generation biofuels.

In conclusion, the global Second-Generation Biofuels market is being propelled by a convergence of environmental, economic, and

technological factors. Growing environmental concerns, energy security, technological advancements, energy price volatility, sustainable transportation demands, and increased investment are all key drivers contributing to the market's growth. As the world seeks cleaner and more sustainable energy sources, second-generation biofuels are poised to play a pivotal role in the transition away from fossil fuels.

Government Policies are Likely to Propel the Market

Renewable Fuel Standards (RFS) and Biofuel Mandates

One of the primary government policies shaping the global Second-Generation Biofuels market is the establishment of Renewable Fuel Standards (RFS) and biofuel mandates. Many countries, including the United States and the European Union, have implemented RFS programs that require a certain percentage of transportation fuels to be derived from renewable sources. These mandates create a stable and predictable market for second-generation biofuels, encouraging investment and production in this sector. By setting specific blending targets, governments aim to reduce greenhouse gas emissions, enhance energy security, and stimulate the growth of the biofuels industry.

Research and Development Funding

Governments around the world recognize the importance of research and development in advancing second-generation biofuels. To encourage innovation and the commercialization of new technologies, they allocate significant funding to research institutions, universities, and private companies. These funds support projects aimed at improving feedstock production, refining conversion processes, and developing more efficient biofuel crops. Government-sponsored research initiatives foster collaboration between academia and industry, accelerating the development and deployment of second-generation biofuels.

Investment Incentives and Tax Credits

To stimulate private sector investment in the Second-Generation Biofuels market, governments offer various incentives and tax credits. These incentives may include subsidies, grants, loan guarantees, and tax breaks for companies engaged in biofuel production, infrastructure development, or research. By reducing the financial risks associated with biofuel investments, governments encourage greater participation from businesses, helping to create a robust biofuels industry. These policies also align with broader economic goals, such as job creation and rural development, making them politically attractive.

Feedstock Support Programs

The availability and cost of feedstock play a critical role in the competitiveness of second-generation biofuels. Governments implement policies to support the production of biofuel feedstocks, such as cellulosic biomass or algae. These policies can include subsidies to farmers, research into feedstock cultivation techniques, and land use regulations that promote sustainable feedstock production. By ensuring a consistent supply of feedstock at competitive prices, governments help stabilize the biofuels market and encourage its growth.

Import Tariffs and Trade Agreements

Government policies regarding import tariffs and trade agreements impact the global Second-Generation Biofuels market. Some countries impose tariffs on imported biofuels to protect domestic producers. Conversely, trade agreements may facilitate the export of biofuels to international markets. These policies influence the flow of biofuels across borders, affecting market dynamics and competition. Governments also use these policies to maintain energy security and reduce reliance on foreign sources of energy.

Environmental Regulations and Sustainability Certification

Environmental regulations and sustainability certification programs are crucial drivers of the Second-Generation Biofuels market. Governments set emission reduction targets and implement regulations that promote the use of low-carbon biofuels. Additionally, sustainability certification programs, such as the Roundtable on Sustainable Biomaterials (RSB) and the International Sustainability and Carbon Certification (ISCC), ensure that biofuel production adheres to stringent environmental and social criteria. These policies encourage the adoption of second-generation biofuels by demonstrating their environmental benefits and aligning with global sustainability goals.

In conclusion, government policies play a pivotal role in shaping the global Second-Generation Biofuels market. Through renewable fuel standards, research funding, investment incentives, feedstock support, import tariffs, and sustainability regulations, governments aim to promote the development and adoption of sustainable biofuels. These policies are instrumental in reducing greenhouse gas emissions, enhancing energy security, and fostering economic growth in the biofuels sector.

Key Market Challenges

Technological Complexity and Scaling-Up

One of the most significant challenges facing the global Second-Generation Biofuels market is the inherent technological complexity of producing these advanced biofuels at scale. Unlike first-generation biofuels, which are primarily made from food crops like corn and sugarcane, second-generation biofuels rely on non-food feedstocks such as agricultural residues, algae, and dedicated energy crops like switchgrass. Converting these materials into biofuels involves multiple complex steps, including pretreatment, enzymatic hydrolysis, fermentation, and distillation.

The technological challenges begin with feedstock collection and pretreatment. Agricultural residues, for example, need to be collected efficiently, transported, and pretreated to break down lignocellulosic structures into fermentable sugars. Pretreatment methods must strike a balance between maximizing sugar yields and minimizing energy and chemical inputs.

Enzymatic hydrolysis is another critical step that involves breaking down cellulose and hemicellulose into sugars using enzymes. Achieving high conversion rates while controlling enzyme costs and optimizing reaction conditions is a persistent challenge. Furthermore, the fermentation of these sugars into biofuels can be sensitive to contamination, and selecting the right microorganisms or yeasts for the job is crucial. Lastly, the scale-up of second-generation biofuel production from lab or pilot-scale facilities to large commercial plants poses significant engineering and logistical challenges.

Overcoming these technological complexities requires substantial research and development efforts, capital investment, and collaboration between industry and academia. It also demands innovation in process engineering, biotechnology, and agronomy to make second-generation biofuel production economically viable.

Economic Viability and Market Competition

Another significant challenge confronting the global Second-Generation Biofuels market is achieving economic viability and competing with well-established fossil fuels and first-generation biofuels. Second-generation biofuels often face higher production costs due to the complexities of processing non-food feedstocks and the need for advanced technologies.

The economic viability of second-generation biofuels is closely tied to the price of crude oil. When oil prices are low, biofuels often struggle to compete on a cost basis. This price sensitivity can deter investors and hinder the growth of the biofuels industry.

Market competition is another hurdle. First-generation biofuels, such as corn ethanol and sugarcane ethanol, have established markets and infrastructure. These fuels have benefited from years of government support, subsidies, and incentives. Additionally, fossil fuels continue to dominate the energy landscape due to their low cost and established distribution networks.

To compete effectively, second-generation biofuels must not only achieve price parity with fossil fuels but also differentiate themselves through environmental benefits, such as lower carbon emissions and reduced land-use change impacts. Achieving this competitive edge while navigating the complexities of market dynamics and government policies is a formidable challenge. Moreover, supply chain logistics, including feedstock availability, transportation, and storage, can pose challenges to maintaining consistent production and pricing competitiveness.

In conclusion, the global Second-Generation Biofuels market faces significant challenges related to technological complexity and scaling-up, as well as the economic viability of biofuel production and competition with well-established fossil fuels and first-generation biofuels. Addressing these challenges will require ongoing innovation, investment, and collaboration among industry stakeholders, researchers, and policymakers to unlock the full potential of second-generation biofuels in reducing greenhouse gas emissions and advancing sustainable energy solutions.

Segmental Insights

Simple Lignocellulose Insights

The Simple Lignocellulose segment had the largest market share in 2022 & expected to maintain it in the forecast period. Simple lignocellulosic feedstocks, such as agricultural residues (e.g., corn stover, wheat straw) and forestry residues, are readily available in significant quantities. These feedstocks are generated as byproducts of existing industries like agriculture and forestry, making them abundant and accessible for biofuel production. Their widespread availability reduces transportation costs and supply chain complexities. Compared to complex lignocellulosic feedstocks and algae, simple lignocellulose feedstocks are generally less complex to process. The pretreatment and enzymatic hydrolysis required to break down the cellulose and hemicellulose into fermentable sugars are typically more straightforward, which can result in lower production costs and greater process efficiency. Simple lignocellulose feedstocks often benefit from well-established supply chains and infrastructure. This means that the logistics

for collecting, transporting, and storing these feedstocks have been developed over time, making it easier for biofuel producers to access the raw materials they need. The economic viability of biofuel production from simple lignocellulose feedstocks has been relatively well-demonstrated. These feedstocks can be processed into various biofuels, including cellulosic ethanol and renewable diesel, with reasonable conversion efficiencies. This has made them attractive to investors and biofuel producers looking for economically viable and scalable options. In many regions, government policies and incentives have supported the use of simple lignocellulose feedstocks for biofuel production. Renewable fuel standards, biofuel mandates, and financial incentives often favor the utilization of these feedstocks, providing a stable market and encouraging investment. Simple lignocellulose feedstocks have the advantage of not competing with food production, reducing concerns about land-use change. This aligns with sustainability goals and environmental considerations, making them an attractive choice for biofuel production..

Transportation Insights

The Transportation segment had the largest market share in 2022 and is projected to experience rapid growth during the forecast period. The transportation sector is a major contributor to greenhouse gas emissions, making it a primary target for environmental mitigation efforts. Second-generation biofuels are considered a sustainable and environmentally friendly alternative to traditional fossil fuels. They can significantly reduce carbon emissions, aligning with stringent environmental regulations and global climate goals, such as the Paris Agreement. As governments around the world tighten emissions standards and impose carbon reduction targets, the demand for cleaner transportation fuels like second-generation biofuels has grown. Second-generation biofuels, including cellulosic ethanol and renewable diesel, are designed to be drop-in replacements for conventional fossil fuels. They can be used in existing transportation infrastructure, including vehicles, pipelines, and fueling stations, with minimal modifications. This compatibility makes it easier for consumers, businesses, and governments to transition to biofuels without the need for costly infrastructure changes. Many countries view the transportation sector as a key component of their energy security strategies. By promoting domestically produced second-generation biofuels, nations can reduce their dependence on imported fossil fuels, thereby enhancing energy security and reducing vulnerability to global energy market fluctuations and geopolitical tensions. Government policies and incentives have played a significant role in promoting the use of biofuels in the transportation sector. These policies include biofuel blending mandates, tax incentives, grants, and subsidies. Governments worldwide have implemented measures to encourage the adoption of biofuels, creating a stable and supportive environment for biofuel production and consumption. There is a growing awareness among consumers about the environmental impact of transportation fuels. Many individuals and organizations are actively seeking more sustainable and eco-friendly options for their vehicles. Second-generation biofuels, which are often marketed as cleaner and greener alternatives, have seen increased demand from environmentally conscious consumers and fleet operators. The economics of second-generation biofuels have improved over time due to advancements in technology and economies of scale. While they were initially more expensive to produce than fossil fuels, ongoing research and development efforts have made biofuel production more cost-effective, making them competitive in the transportation sector. Second-generation biofuels are produced from non-food feedstocks, reducing concerns about land-use change and competition with food crops. This aligns with sustainability goals and mitigates some of the ethical and environmental concerns associated with first-generation biofuels.

.

Regional Insights

North America

The North American second-generation biofuels market had the largest in the world in 2022. The United States is the leading producer and consumer of second-generation biofuels in the region. The US government has a number of policies in place to support the development and deployment of second-generation biofuels, such as the Renewable Fuel Standard (RFS). The RFS mandates a minimum volume of biofuels to be blended into gasoline and diesel fuel each year.

The major feedstocks used for second-generation biofuels production in North America are corn stover, sugarcane bagasse, and wood chips. The major types of second-generation biofuels produced in the region are cellulosic ethanol and biodiesel.

The major players in the North American second-generation biofuels market include POET-DSM Advanced Biofuels, Abengoa, and Gevo.

Europe

The European second-generation biofuels market had the second-largest in the world in 2022. The European Union has ambitious

targets for renewable energy deployment, and second-generation biofuels are seen as a key way to meet these targets. The EU has a number of policies in place to support the development and deployment of second-generation biofuels, such as the Renewable Energy Directive (RED). The RED sets binding targets for EU member states to produce a certain percentage of their energy from renewable sources.
The major feedstocks used for second-generation biofuels production in Europe are wheat straw, barley straw, and wood chips. The major types of second-generation biofuels produced in the region are cellulosic ethanol and biodiesel.
The major players in the European second-generation biofuels market include Neste, Clariant, and DuPont.
Asia-Pacific
The Asia-Pacific second-generation biofuels market is the fastest-growing market in the world, with a CAGR of over 25% expected over the forecast period. This growth is being driven by a number of factors, including rising energy demand, growing environmental concerns, and government support for renewable energy.
China is the largest producer and consumer of second-generation biofuels in the Asia-Pacific region. The Chinese government has a number of policies in place to support the development and deployment of second-generation biofuels, such as the National Policy on Biofuels. The National Policy on Biofuels sets targets for the production and consumption of biofuels in China.
The major feedstocks used for second-generation biofuels production in Asia-Pacific are rice straw, wheat straw, and sugarcane bagasse. The major types of second-generation biofuels produced in the region are cellulosic ethanol and biodiesel.
Key Market Players
Abengoa S.A.
Gevo Inc
Neste Oyj
Clariant AG
DuPont de Nemours, Inc
GranBio Investimentos S.A.
Reliance Industries Limited
Raizen
Cosan S.A.
Report Scope:
In this report, the Global Second-Generation Biofuels Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:
?□Second-Generation Biofuels Market, By Feedstock:
o□Simple Lignocellulose
o□Complex Lignocellulose
o□Syngas
o□Algae
o□Others
?□Second-Generation Biofuels Market, By Application:
o□Transportation
o□Power Generation
o□Others
?□Second-Generation Biofuels Market, By Type:
o□Cellulosic Ethanol
o□Biodiesel
o□Bio Butanol
o□Bio Dme
o□Others
?□Second-Generation Biofuels Market, By Process:
o□Biochemical Process

o Thermochemical Process
? Second-Generation Biofuels Market, By Region:
o North America
? United States
? Canada
? Mexico
o Europe
? France
? United Kingdom
? Italy
? Germany
? Spain
o Asia-Pacific
? China
? India
? Japan
? Australia
? South Korea
o South America
? Brazil
? Argentina
? Colombia
o Middle East & Africa
? South Africa
? Saudi Arabia
? UAE
? Kuwait
? Turkey
Competitive Landscape
Company Profiles: Detailed analysis of the major companies present in the Global Second-Generation Biofuels Market.
Available Customizations:
Global Second-Generation Biofuels market report with the given market data, Tech Sci Research offers customizations according to a company's specific needs. The following customization options are available for the report:
Company Information
? Detailed analysis and profiling of additional market players (up to five).

**Table of Contents:**

# Second-Generation Biofuels Market - Global Industry Size, Share, Trends, Opportunity, and Forecast, Segmented By Feedstock (Simple Lignocellulose, Complex Lignocellulose, Syngas, Algae, and Others), By Application (Transportation, Power Generation and Others), By Type (Cellulosic Ethanol, Biodiesel, Bio Butanol, Bio Dme, and Others), By Process (Biochemical Process and Thermochemical Process), By Region, By Competition, 2018-2028

Market Report | 2023-10-03 | 174 pages | TechSci Research

To place an Order with Scotts International:

- - Print this form
- - Complete the relevant blank fields and sign
- - Send as a scanned email to support@scotts-international.com

**ORDER FORM:**

| Select license | License | Price |
|---|---|---|
| | Single User License | $4900.00 |
| | Multi-User License | $5900.00 |
| | Custom Research License | $8900.00 |
| | VAT | |
| | Total | |

*Please circle the relevant license option. For any questions please contact support@scotts-international.com or 0048 603 394 346.

** VAT will be added at 23% for Polish based companies, individuals and EU based companies who are unable to provide a valid EU Vat Numbers.

| | | | |
|---|---|---|---|
| Email* | | Phone* | |
| First Name* | | Last Name* | |
| Job title* | | | |

| | | | |
|---|---|---|---|
| Company Name* | | EU Vat / Tax ID / NIP number* | |
| Address* | | City* | |
| Zip Code* | | Country* | |
| | | Date | 2026-02-17 |
| | | Signature | |