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# Hydrothermal Liquefaction Market Forecasts to 2034 – Global Analysis By Product (Bio-crude Oil, Bio-char, Aqueous Phase and Gas), Feedstock, Technology, End User and By Geography

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## Abstracts

According to Stratistics MRC, the Global Hydrothermal Liquefaction Market is accounted for $320.0 million in 2026 and is expected to reach $726.9 million by 2034 growing at a CAGR of 10.8% during the forecast period. Hydrothermal liquefaction converts high-moisture biomass into liquid biofuel by using elevated temperatures and pressures in a water-based environment. This method works well with materials such as algae, crop waste, and wastewater sludge, avoiding energy-intensive drying steps. During the process, large organic compounds are decomposed into a dense bio-crude, along with by-products like gases and char. The technology provides benefits including improved energy recovery, lower environmental impact, and flexibility in processing varied waste resources. As a result, hydrothermal liquefaction is emerging as an efficient pathway for renewable fuel generation and sustainable waste management solutions worldwide today in modern energy systems.

According to the U.S. Department of Energy’s Bioenergy Technologies Office, hydrothermal liquefaction (HTL) is recognized as a leading pathway for converting wet waste feedstocks into renewable bio-crude oil, with demonstration projects in North America validating its commercial potential. Data shows HTL can achieve energy yields of up to 85% from wet biomass, positioning it as a critical technology in the global biofuel transition.

Market Dynamics:

Driver:

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Rising demand for sustainable fuels

Growing interest in eco-friendly and low-emission energy sources is significantly boosting the hydrothermal liquefaction market. With stricter environmental regulations and a global push to minimize reliance on conventional fossil fuels, industries are exploring renewable fuel technologies. Hydrothermal liquefaction provides an effective way to convert wet biomass into high-energy bio-crude, making it an attractive alternative. Its compatibility with existing refining systems adds to its practicality. As nations aim to meet climate goals and enhance energy independence, the technology is gaining traction across various applications, supporting the broader transition toward cleaner and more sustainable energy solutions worldwide.

Restraint:

High capital and operational costs

One of the major challenges for the hydrothermal liquefaction market is the substantial cost involved in setting up and running facilities. The need for specialized equipment that operates under extreme conditions raises initial investment requirements. Continuous expenses related to energy consumption, system maintenance, and catalyst replacement further adds to the financial burden. These high costs make it difficult for smaller businesses to adopt the technology. Moreover, uncertain profitability and extended return periods create hesitation among investors. Although improvements in technology may lower expenses in the future, current cost-related constraints continue to restrict widespread adoption and market expansion globally.

Opportunity:

Expansion in waste-to-energy applications

The rising focus on utilizing waste as a source of energy offers significant growth potential for the hydrothermal liquefaction market. Large amounts of organic waste from cities, industries, and agriculture require effective disposal methods. This technology can efficiently convert such wet waste into useful bio-crude, minimizing the need for preprocessing. It helps reduce landfill dependency while generating energy, making it highly attractive. Increased investments in waste-to-energy systems by governments and private entities further support market expansion. As environmental concerns grow, hydrothermal liquefaction is emerging as a valuable solution for sustainable waste

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utilization and renewable fuel production worldwide.

Threat:

Competition from alternative biofuel technologies

A significant threat to the hydrothermal liquefaction market comes from other biofuel technologies like anaerobic digestion, pyrolysis, and gasification. These alternatives have already achieved higher levels of commercialization and industry trust. They often require lower investment and are easier to operate, making them more attractive to stakeholders. Existing infrastructure and operational familiarity also support their adoption. As these technologies continue to improve in performance and cost efficiency, they become even more competitive. This growing competition may limit the expansion of hydrothermal liquefaction, affecting its ability to gain a strong foothold in the global renewable energy market.

Covid-19 Impact:

The hydrothermal liquefaction market experienced both challenges and opportunities during the COVID-19 pandemic. Initially, restrictions caused supply chain interruptions, delayed projects, and reduced funding for new technologies, slowing market progress. Economic instability made investors cautious about committing to advanced biofuel solutions. Despite these setbacks, the crisis emphasized the need for sustainable energy and efficient waste management. Many governments introduced green recovery strategies that encouraged renewable energy development. As global conditions improved, the market began to recover, supported by stronger environmental policies and growing investments in sustainable solutions worldwide.

The bio-crude oil segment is expected to be the largest during the forecast period

The bio-crude oil segment is expected to account for the largest market share during the forecast period because of its high energy content and ability to replace traditional petroleum-based fuels. As the main product generated from the process, it can be refined into various transportation fuels, including diesel and aviation fuel. Its ease of integration with existing refinery systems makes it highly practical for large-scale use. Growing emphasis on reducing carbon emissions and adopting renewable energy sources strengthens its position. Compared to other outputs, bio-crude offers greater economic benefits and broader applications, making it the most dominant and valuable segment within the market worldwide.

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The chemicals & intermediates segment is expected to have the highest CAGR during the forecast period

Over the forecast period, the chemicals & intermediates segment is predicted to witness the highest growth rate, driven by increasing interest in sustainable chemical production. This process generates useful compounds that can be converted into industrial chemicals, solvents, and other intermediate products. Stricter environmental policies and a growing focus on green chemistry are pushing industries toward renewable raw materials. Furthermore, demand for environmentally friendly inputs across sectors such as manufacturing, healthcare, and consumer goods is accelerating expansion. Due to its high-value applications and broad industrial relevance, this segment is emerging as the most rapidly growing area within the hydrothermal liquefaction market worldwide.

Region with largest share:

During the forecast period, the North America region is expected to hold the largest market share, driven by advanced technology development, favorable policies, and high investment in clean energy solutions. The region benefits from strong research capabilities and active involvement of major companies working on biofuel technologies. A steady supply of biomass resources, such as agricultural residues and urban waste, supports industry expansion. Strict environmental standards and efforts to reduce carbon emissions are further boosting adoption. The presence of several demonstration and large-scale projects strengthens its position. These factors collectively make North America the leading region in the global hydrothermal liquefaction market.

Region with highest CAGR:

Over the forecast period, the Asia-Pacific region is anticipated to exhibit the highest CAGR, driven by expanding industrial activities and rising energy needs. Governments across the region are prioritizing renewable energy adoption to lower carbon emissions and reduce reliance on traditional fuels. The wide availability of biomass sources such as crop waste and urban organic waste supports the development of this technology. Policies encouraging sustainable practices and waste-to-energy solutions are also boosting demand. Additionally, ongoing urban development and infrastructure expansion are increasing adoption rates, positioning Asia-Pacific as the most rapidly growing market for hydrothermal liquefaction worldwide.

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Key players in the market

Some of the key players in Hydrothermal Liquefaction Market include Licella, Steeper Energy, Genifuel, AquaGreen, Worley, Technip Energies, KBR, Jacobs, Veolia Water Technologies, Scion, Muradel Pty Ltd., Circlia Nordic, Kvasir Technologies, RTI International, Arbios Biotech and Haldor Tops?e.

Key Developments:

In February 2025, Licella has formed a global upgrading collaboration with Shell Catalysts & Technologies targeting the development of an integrated biomass-to-advanced biofuels commercial solution. This collaboration between Licella and Shell Catalysts & Technologies aims to transform the production cost of advanced biofuels globally, with a focus on sustainable aviation fuel (SAF).

In January 2025, Veolia Water Technologies & Solutions and Transition Industries LLC have signed an agreement to explore the provision of advanced industrial water technology for the Pacifico Mexinol project in Sinaloa, Mexico. Expected to initiate operations in 2028, Pacifico Mexinol is poised to be the world's largest standalone ultra-low carbon chemical production facility in the world, with an output of 6,145 metric tons (MT) per day.

In January 2023, Steeper and Topsoe have signed a global licensing agreement for a complete waste-to-fuel solution. The agreement combines Topsoe's unique technologies in renewable fuels and hydrogen production as well as decades of experience in engineering to the table, with Steeper's proprietary Hydrofaction™ technology and industry know-how.

Products Covered:

Bio-crude Oil

Bio-char

Aqueous Phase

Gas

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Feedstocks Covered:

- Algae
- Agricultural Residues
- Forestry Residues
- Municipal Solid Waste (MSW)
- Sewage Sludge
- Industrial Organic Waste

Technologies Covered:

- Direct HTL
- Catalytic HTL
- Co-liquefaction
- Continuous-flow HTL Systems
- Batch HTL Systems

End Users Covered:

- Transportation Fuels
- Power Generation
- Chemicals & Intermediates
- Fertilizers & Soil Conditioners

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Regions Covered:

- North America
  - United States
  - Canada
  - Mexico
- Europe
  - United Kingdom
  - Germany
  - France
  - Italy
  - Spain
  - Netherlands
  - Belgium
  - Sweden
  - Switzerland
  - Poland
  - Rest of Europe
- Asia Pacific
  - China
  - Japan

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- India
- South Korea
- Australia
- Indonesia
- Thailand
- Malaysia
- Singapore
- Vietnam
- Rest of Asia Pacific

South America

- Brazil
- Argentina
- Colombia
- Chile
- Peru
- Rest of South America

Rest of the World (RoW)

- Middle East
  - Saudi Arabia

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- United Arab Emirates
- Qatar
- Israel
- Rest of Middle East

Africa

- South Africa
- Egypt
- Morocco
- Rest of Africa

What our report offers:

- Market share assessments for the regional and country-level segments
- Strategic recommendations for the new entrants
- Covers Market data for the years 2023, 2024, 2025, 2026, 2027, 2028, 2030, 2032 and 2034
- Market Trends (Drivers, Constraints, Opportunities, Threats, Challenges, Investment Opportunities, and recommendations)
- Strategic recommendations in key business segments based on the market estimations
- Competitive landscaping mapping the key common trends
- Company profiling with detailed strategies, financials, and recent developments
- Supply chain trends mapping the latest technological advancements

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Free Customization Offerings:

All the customers of this report will be entitled to receive one of the following free customization options:

- Company Profiling
  - Comprehensive profiling of additional market players (up to 3)
  - SWOT Analysis of key players (up to 3)
- Regional Segmentation
  - Market estimations, Forecasts and CAGR of any prominent country as per the client's interest (Note: Depends on feasibility check)
- Competitive Benchmarking
  - Benchmarking of key players based on product portfolio, geographical presence, and strategic alliances

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