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Agencia Nacional de Investigación y Desarrollo

Gobierno de Chile

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IN-SET

BOLETÍN DE VIGILANCIA TECNOLÓGICA

SUSTAINABLE FUELS

Resumen de la actualidad tecnológica en transición energética, que recoge tendencias en energîas renovables, almacenamiento y materiales, combustibles sostenibles, procesos térmicos y de combustión, infraestructura eléctrica e inteligencia artificial, así como su aplicación en los distintos sectores de consumo.



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PREFACIO



Marco Mancilla
Director ejecutivo
Centro SET Chile



Mario Toledo
Director científico-tecnológico
Centro SET Chile

La conversión de biomasa es la ruta menos vistosa de la transición y, a la vez, la única que trabaja con un recurso que ya está en el territorio. La discusión técnica no es si los residuos forestales, agrícolas y urbanos pueden transformarse en combustible, porque las rutas termoquímicas y biológicas existen y operan, sino a qué escala opera cada ruta y con qué materia prima. Esta edición de In-SET concentra el eje de combustibles sostenibles en ese único ámbito, la conversión de biomasa.

Según Fortune Business Insights, la gasificación de biomasa movió 17.860 millones de dólares en 2025 y llegaría a 34.560 millones en 2034, con un crecimiento anual compuesto de 8%, mientras Asia-Pacífico concentra el 40,6% de ese mercado y América Latina apenas 1.090 millones. El biochar opera un orden de magnitud más abajo, y Precedence Research lo estima en 995 millones en 2025 y en 3.452 millones hacia 2035, aunque avanza a 13,2% anual, de modo que se trata de un mercado menor con un crecimiento más alto.

La investigación empuja hacia el combustible líquido, por ejemplo en el estudio del Laboratorio Nacional de Energías Renovables de Estados Unidos, donde se hidrotrató aceite de pirólisis catalítica rápida de pino sobre $NiMo/Al_2O_3$ sulfurado durante 410 horas para producir combustible de aviación, manteniendo alto el grado de desoxigenación. El Instituto de Carboquímica del CSIC, en Zaragoza, publicó a su vez en Chemical Engineering Journal una demostración a escala piloto que integró gasificación con sorción mejorada en un reactor de lecho fluidizado burbujeante de 30 kWth, tratando el flujo completo de gas de síntesis con adsorción secuencial de HCl y H_2S, reformado catalítico de alquitranes y reacción de desplazamiento agua-gas.

Por otra parte, el conglomerado industrial Alfanar completó la ingeniería básica extendida del proyecto Lighthouse Green Fuels en Teesside, Reino Unido, junto a la firma de ingeniería Worley, con lo que se convierte en el primer proyecto europeo de combustible de aviación sostenible de segunda generación en alcanzar esa madurez. Además, el Capital Regional District de Columbia Británica aseguró 7 millones de dólares de financiamiento federal y escogió a la empresa australiana Pyrocal para la primera planta canadiense que convertirá biosólidos de aguas servidas en biochar.

El foco se está moviendo aguas arriba, hacia la materia prima, ya que el residuo agrícola desplazará este año al residuo sólido urbano como principal insumo de la gasificación, con 32% del mercado, y el Gobierno de Australia publicó el 26 de agosto de 2026 su Estrategia Nacional de Materia Prima para Bioenergía, que reconoce la disponibilidad de residuos agrícolas y forestales como condición previa para producir combustibles líquidos de bajo carbono. Es un desplazamiento pertinente para Chile, cuya base de residuos forestales y agroindustriales define de antemano qué rutas de conversión resultan viables y a qué escala.

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Veolia opens integrated composting and biomass facility in Zaragoza

Etiqueta: Waste valorization | Publicada el 15/09/2026



Veolia has inaugurated a new composting and biomass plant in Fuentes de Ebro, Zaragoza in Spain, combining organic waste processing with the production of solid fuels from forestry and agricultural residues in a single integrated facility. The opening represents one of the most significant investments in bioenergy infrastructure in the Aragón region in recent years, and a concrete expression of the French environmental services giant's GreenUp strategy, which targets 8 GW of installed bioenergy capacity globally by 2030.

ver más...

European regions launch wood energy network

Etiqueta: Lignocellulosic biomass conversion | Publicada el 14/09/2026



A new regional cooperation platform has been launched to strengthen wood energy's role across Europe, bringing together regions that view sustainable biomass as central to the continent's energy security, climate and resilience. The Wood Energy Regions Network (WERN), launched in Brussels on 9 September, was established by Bavaria, Styria, Castilla-La Mancha and Castilla y León.

ver más...

CRD secures $7M, selects Pyrocal for Canada's first biosolids-to-biochar facility

Etiqueta: Biomass carbonization | Publicada el 10/08/2026

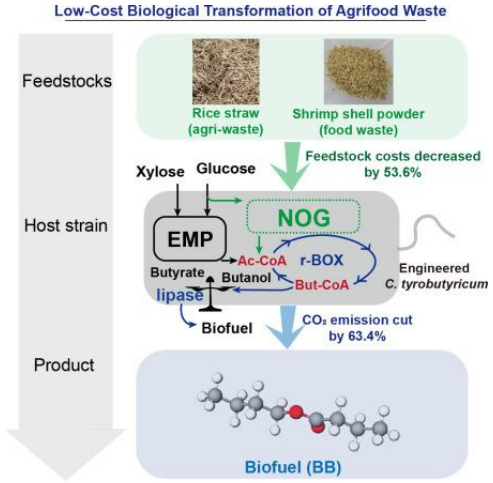


British Columbia's Capital Regional District (CRD) has secured $7 million in federal infrastructure funding and selected Australian engineering firm Pyrocal Pty Ltd. as the preferred proponent for a first-of-its-kind Canadian project that will convert wastewater biosolids into biochar at the Hartland Landfill Residuals Treatment Facility in Saanich, B.C.

ver más...

Carbon-efficient upcycling of agrifood waste into fatty acid ester by engineered Clostridium tyrobutyricum

Etiqueta: Waste valorization | Publicada el 24/06/2026



This study presents a carbon- and cost-efficient biosynthesis strategy for the biofuel butyl butyrate by engineering C. tyrobutyricum to utilize agrifood waste as the sole feedstock. Through iterative, multimodule strain engineering—including promoter engineering, multienzyme colocalization, nonoxidative glycolysis-driven carbon conservation, and cofactor engineering—high-titer butyl butyrate production with excellent selectivity was achieved in 5-l batch fermentations using only rice.

ver más...

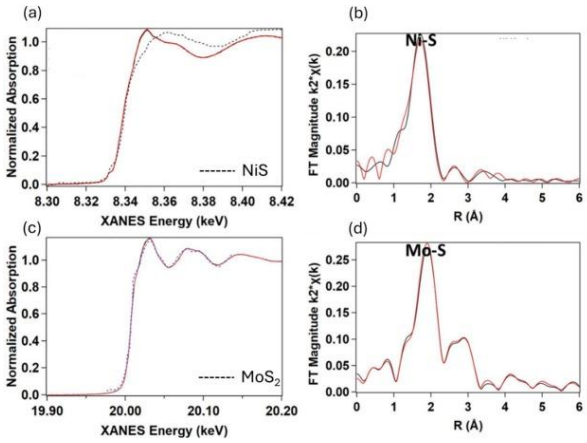
PUBLICACIONES CIENTÍFICAS

Edición n°3 | septiembre de 2026 | set.usm.cl

Hydrotreating pine-derived catalytic fast pyrolysis oil to jet fuel: Process durability and impact of operating conditions

Etiqueta: Biomass pyrolysis | Publicada el 15/09/2026

Hydrotreating woody biomass-derived catalytic fast pyrolysis (CFP) oil to jet fuel has the potential to enhance energy security due to the large abundance of forest and woody resources. CFP oil produced from pine over ZSM-5 was hydrotreated over sulfided NiMo/Al2O3 for 410 h to study the impact of hydrotreating conditions (pressure, temperature, and weight hourly space velocity (WHSV)). The degree of deoxygenation remained high across the tested hydrotreating conditions.

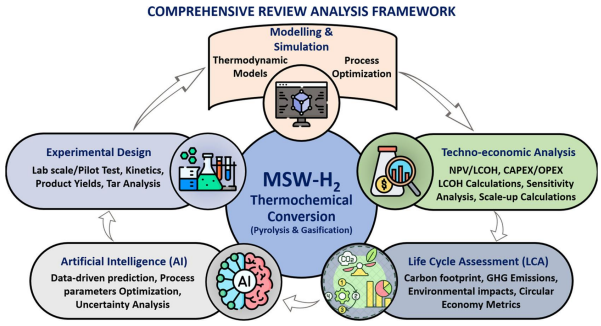


ver más...

Municipal solid waste to hydrogen: thermochemical pathways, carbon-negative potential, and AI-driven optimization toward circular energy systems

Etiqueta: Waste-to-energy | Publicada el 15/09/2026

This review provides a comprehensive and critical assessment of MSW-to-hydrogen production through gasification and pyrolysis by integrating recent advances in experimental studies, process modelling and simulation, techno-economic analysis (TEA), life cycle assessment (LCA), artificial intelligence (AI)-driven optimization, and technology readiness. Unlike previous reviews that primarily examine these topics independently, this work systematically connects feedstock characteristics, thermochemical performance, process simulation, economic feasibility, environmental sustainability, and digital optimization within a unified framework.

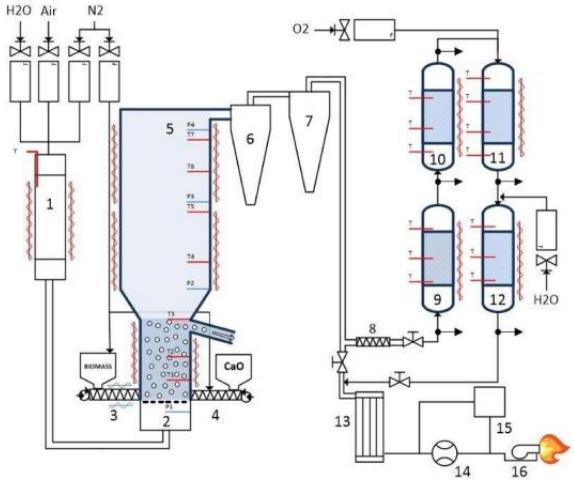


ver más...

Pilot-scale demonstration of integrated sorption-enhanced gasification (SEG) with commercial fixed-bed cleanup for hydrogen production

Etiqueta: Biomass gasification | Publicada el 15/09/2026

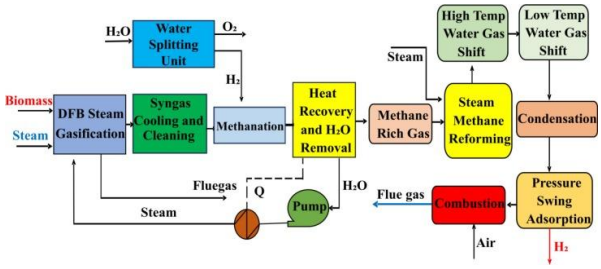
This work presents a pilot-scale demonstration of sorption-enhanced gasification (SEG) fully integrated with a fixed-bed gas cleaning and conditioning train, processing the entire syngas stream in a 30 kWth bubbling fluidized bed reactor. Unlike previous studies limited to syngas aliquots, the complete gas flow was treated through sequential HCl and H_2S adsorption units, a catalytic tar reformer, and a water–gas shift (WGS) reactor under realistic operating conditions.



ver más...

A unified thermochemical conversion framework for hydrogen production from multiple biomass feedstocks

Etiqueta: Thermochemical biomass conversion | Publicada el 21/06/2026

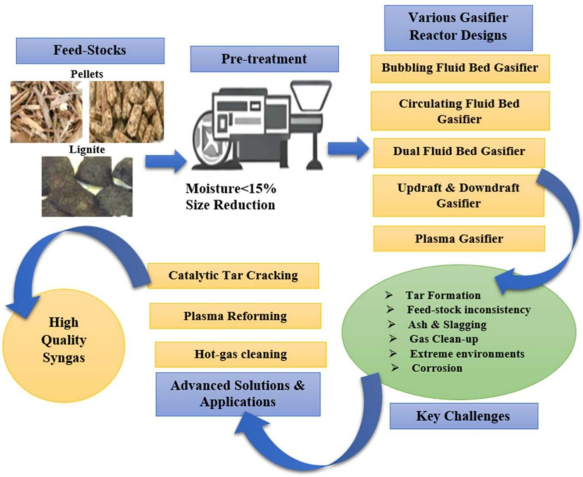


This study presents a validated, simulation-based thermochemical framework for hydrogen production from nine representative biomass feedstocks in Bangladesh. Using Aspen Plus, the integrated model encompasses DFB steam gasification, methanation and SMR as well as WGS reactions alongside hydrogen purification via pressure swing adsorption. Feedstocks-including food waste (FW), municipal solid waste (MSW), rice straw (RS), and wood residues (WR)-were evaluated across gasification temperatures from 500 °C to 1100 °C and steam-to-biomass ratios (SBRs) between 0.2 and 2.0.

ver más...

Advances, challenges, and future directions in biomass gasification

Etiqueta: Biomass gasification | Publicada el 21/06/2026



Biomass has recently gained recognition as a promising renewable energy resource with the potential to meet the growing global demand for continuous, clean power generation. Among thermochemical conversion technologies, gasification is considered one of the most viable approaches, offering cold gas efficiencies typically between 65% and 80%, depending on the feedstock and reactor design. Nevertheless, integrating producer gas into residential or commercial energy systems remains difficult due to technological and operational challenges. Critical issues include biomass supply chain management, pre-treatment and drying to achieve moisture content ideally below 15%, and effective gas cleaning and conditioning.

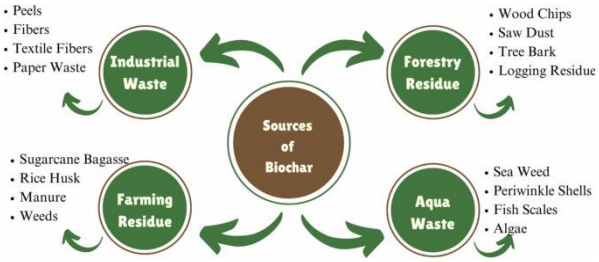
ver más...

Waste-to-value conversion: A comprehensive review on biochar production, modification, and remediation potential

Etiqueta: Biomass carbonization | Publicada el 21/06/2026

This review focuses on various organic waste feedstocks suitable for biochar production. It provides a comprehensive overview of different biochar production methods and discusses how these processes influence the structural and functional properties of the resulting biochar. While plant-based biomass is the most commonly used feedstock, forest residues and other organic wastes also offer significant potential for biochar production and utilization. Furthermore, various physical and chemical activation techniques employed to enhance the surface properties, porosity, and adsorption performance of biochar are critically reviewed.

ver más...



PATENTES

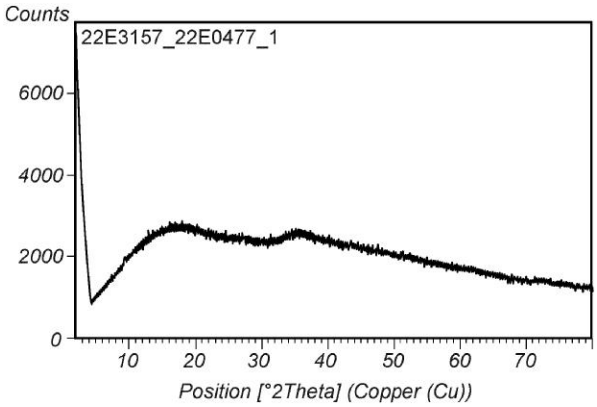
Edición n°3 | septiembre de 2026 | set.usm.cl

Process for conversion of lignocellulosic material to an organic liquefaction product

Etiqueta: Lignocellulosic biomass conversion | Publicada el 03/09/2026

Lignocellulosic starting materials can be converted into one or more liquid phases and/or an aqueous phase and a hydrocarbon phase in a process by subjecting a mixture of a lignocellulosic starting material, an amorphous and unsupported sulfided molybdenum catalyst comprising one or more of the following elements; iron (Fe), tungsten (W), cobalt (Co), vanadium (V) and ruthenium (Ru), and a co-feed, to not less than a stoichiometric amount of hydrogen, elevated pressure and a temperature within the range of from 270 to 450° C. A catalyst for use in said process and a method for its production are also disclosed.

ver más...



Pyrolysis enhanced hydrogen augmentation

Etiqueta: Biomass pyrolysis | Publicada el 13/08/2026

By selectively augmenting feedstocks with one or more of hydrogen gas, carbon solids, carbon monoxide, or carbon dioxide a methods and systems control production of hydrogen gas, carbon black, carbon monoxide, heat, or electricity in a thermally regulated processes.

ver más...

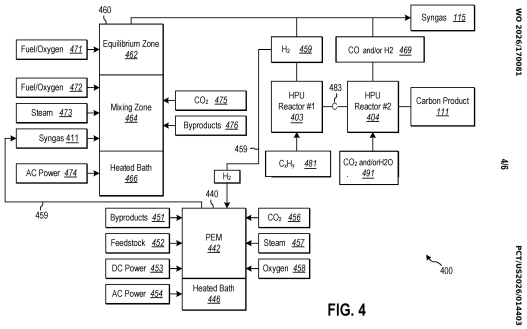


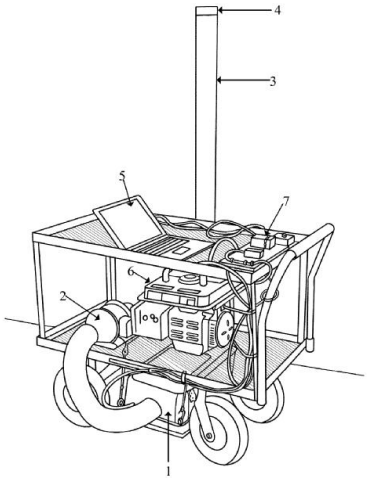
FIG. 4

Autonomous device for in-field conversion of biomass into biochar

Etiqueta: Biomass carbonization | Publicada el 09/07/2026

Systems, methods and apparatus for the thermal conversion of biomass into biochar. A mobile platform may be used to maneuver a mobile biochar generation system within a field of biomass. The biomass may be harvested, preprocessed and pyrolyzed. After pyrolyzation, the biochar may be cooled to a predetermined temperature by integrating water and liquid nutrients into the biochar. The system may then control the application of the infused biochar by adjusting a spreading attachment and a plowing attachment.

ver más...



Integrated bio-refinery for bio-p-xylene with internal bio-ethylene production

Etiqueta: Biorefinery | Publicada el 18/06/2026

Integrated processes for producing p-xylene from biomass are described. The biomass is converted to sugars which are converted to 5-hydroxymethylfurfural (HMF) which is converted to dimethylfuran (DMF). The biomass derived DMF is reacted with internally generated de-watered, unpurified ethylene to form the p-xylene. The de-watered, unpurified ethylene is also derived from sugars made from the biomass.

ver más...

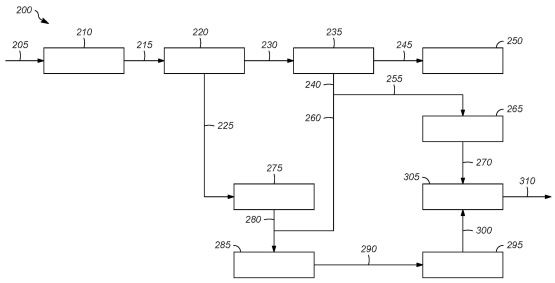


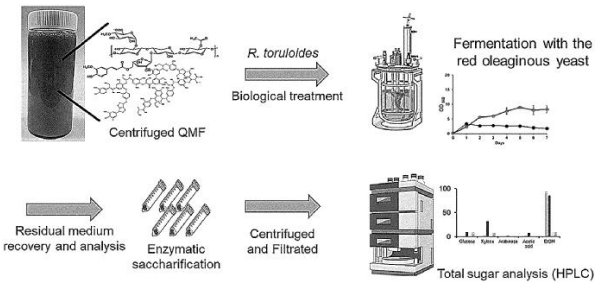
FIG. 2

Method for biological pretreatment of hemicellulose-lignin and method for enzymatic saccharification comprising the same

Etiqueta: Lignocellulosic biomass conversion | Publicada el 04/06/2026

The present disclosure provides a composition for biological pretreatment of hemicellulose and lignin, comprising a red oleaginous yeast strain. Further, the present disclosure discloses a method for biological pretreatment of hemicellulose and lignin using a red oleaginous yeast strain, and a method for enzymatic saccharification comprising the same. According to the present disclosure, the efficiency of producing sugars from lignocellulosic biomass can be increased by biologically pretreating hemicellulose and lignin without sugar loss.

ver más...



PROYECTOS

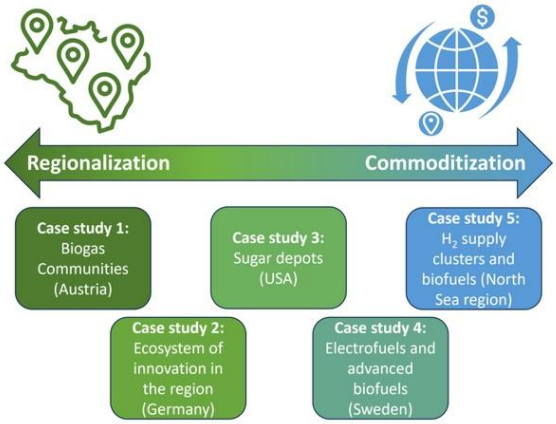
Edición n°3 | septiembre de 2026 | set.usm.cl

Regional Transitions 2.0

Etiqueta: Biorefinery | Publicada el 30/08/2026

The Regional Transitions 2.0 project has evaluated case studies on both regionalisation and commoditisation strategies in in five different countries: Austria, Germany, Sweden, USA, and the North Sea region. Both strategies present unique opportunities and risks, whereby in all cases, the regional context is crucial for the sustainability of biobased supply chains.

ver más...



BIOVAL — Integrated BIOrefinery to VALorize CO2 and biomass for the co-production of advanced biofuels and bioproducts

Etiqueta: Biorefinery | Publicada el 10/08/2026

Europe's clean energy ambitions require circular, low-waste systems that balance climate goals with affordability and safety. The EU-funded BIOVAL project is designing a next-generation biorefinery for near zero-waste and zero-carbon emissions, using microalgae and bacterial gas fermentation. The system converts biomass waste and captured CO2 into advanced biofuels such as algal HVO, hydrogen and methane, as well as high-value products such as pigments. Supported by digital modelling and sustainability assessments, BIOVAL will scale its technologies to demonstration level.

ver más...



Lighthouse Green Fuels (LGF) — Teesside SAF plant

Etiqueta: Biomass gasification | Publicada el 11/06/2026



Alfanar has completed Front-End Engineering Design (FEED) for its Lighthouse Green Fuels (LGF) project in Teesside, marking a major milestone for what will become one of the world's largest secondgeneration Sustainable Aviation Fuel (SAF) facilities. Delivered with engineering partner Worley, the achievement makes LGF the first project of its kind in Europe to reach this level of engineering maturity, according to the document: "With completion of FEED, it has become the first second-generation SAF project in Europe to reach this level of engineering maturity."

ver más...

MERCADO

Edición n°3 | septiembre de 2026 | set.usm.cl

Biomass Gasification Market Size, Share and Regional Forecast, 2026-2034

Etiqueta: Biomass gasification | Publicada el 07/09/2026

The global biomass gasification market was valued at USD 17.86 billion in 2025 and is expected to reach USD 18.63 billion in 2026, growing to USD 34.56 billion by 2034 at a CAGR of 8.03% over 2026-2034. Asia Pacific dominated with a 40.65% share in 2025, generating USD 7.26 billion, followed by Europe at USD 5.33 billion and North America at USD 3.18 billion; Latin America accounted for USD 1.09 billion. By feedstock, municipal solid waste held the largest revenue share at 31.66% in 2024, while agricultural waste is expected to account for 32.05% of the market in 2026.

ver más...

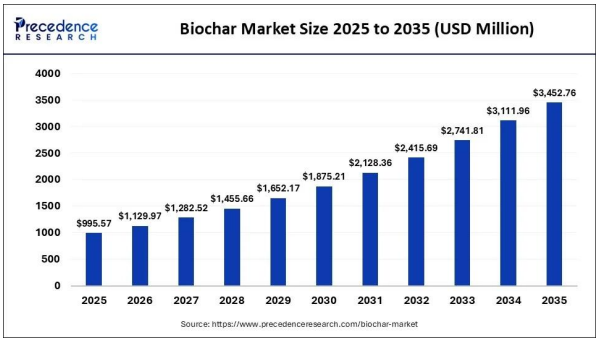


Biochar Market Size, Regional Outlook, and Forecast 2026 to 2035

Etiqueta: Biomass carbonization | Publicada el 08/07/2026

The global biochar market size was calculated at USD 995.57 million in 2025 and is predicted to increase from USD 1,129.97 million in 2026 to approximately USD 3,452.76 million by 2035, expanding at a CAGR of 13.24% from 2026 to 2035. The rising importance of biochar to increase soil porosity and reduce soil water loss is considered to boost the demand for biochar in the global market.

ver más...



Biochar Market 2026: Carbon Credits, Pyrolysis & Global Growth Forecast

Etiqueta: Biomass carbonization | Publicada el 11/06/2026

The global biochar market size stands at US$838.22 million in 2026 and is projected to reach US$2,285.78 million by 2034, advancing at a CAGR of 13.36% during the forecast period 2026–2034. Biochar, a carbon-rich material derived from biomass pyrolysis, fulfils dual roles as a renewable fuel and a soil amendment. Government support through the USDA is catalysing growth: NRCS Conservation Practice Standard Code 336 (Soil Carbon Amendment) recognises biochar, produced by heating biomass above 350 °C under controlled, oxygen-limited conditions (pyrolysis or gasification), as an eligible carbon-based amendment.

ver más...



EVENTOS

Edición n°3 | septiembre de 2026 | set.usm.cl

Bioenergy Expo Asia 2027

Etiqueta: Waste-to-energy | Publicada el 14/09/2026

Bioenergy Expo Asia 2027 has officially opened global exhibitor bookings, establishing a dedicated commercial and technical nexus for the biomass, biogas and agricultural waste-to-energy sectors across Southeast Asia. Scheduled for 29–30 September 2027 at Marina Bay Sands Expo & Convention Centre in Singapore, the event targets the region's most urgent market challenge: securing stable, traceable feedstock supply chains.

ver más...



11th International Symposium on Energy from Biomass and Waste - Venice

Etiqueta: Waste-to-energy | Publicada el 15/08/2026

The Symposium is organised by IWWG–International Waste Working Group with the scientific involvement of the Universities of Kyoto (JP), Padova (IT), Queensland (AU), Rostock (DE), Tongji (CN), and Sultan Qaboos University (OM). The programme features more than 150 scientific presentations organised in 3 parallel tracks of oral sessions, workshops and posters, lively social events and outstanding networking opportunities.

ver más...



European Biomass PowerON Conference 2026

Etiqueta: Thermochemical biomass conversion | Publicada el 10/08/2026

Biomass is playing an increasingly important role in the low-carbon transition-supporting renewable heat and power, enabling negative emissions through BECCS, and adding flexibility to energy systems. As the market evolves, the focus is shifting toward real projects, regulatory impact, and sustainable feedstock strategies.

ver más...

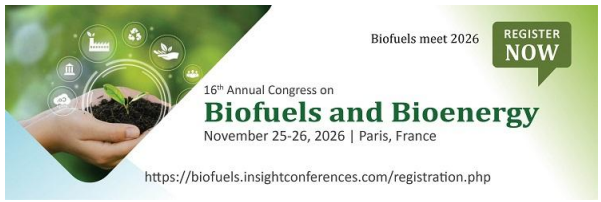


16th Annual Congress on Biofuels and Bioenergy

Etiqueta: Thermochemical biomass conversion | Publicada el 15/07/2026

The 16th Annual Congress on Biofuels and Bioenergy is a premier international event focused on the latest scientific, technological, and industrial advancements in biofuels, bioenergy, and renewable energy systems. The conference provides a multidisciplinary platform for experts from academia, industry, government, and research institutions to share cutting-edge discoveries, innovative technologies, and sustainable solutions that contribute to global energy security and environmental sustainability.

ver más...



REPORTES

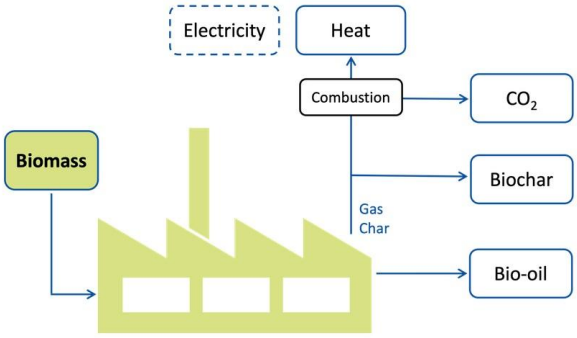
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Direct Thermochemical Liquefaction (DTL) Technology Options for Bioenergy Carbon Capture and Storage (BECCS)

Etiqueta: Thermochemical biomass conversion | Publicada el 30/08/2026

The traditional concept of bioenergy with carbon capture and storage (BECCS) is based on biomass combustion for the provision of heat and power, coupled with an integrated capturing of CO2 from the emitted flue gases. In the processing steps from biomass resource to usable bioenergy significant carbon containing waste streams/ byproducts also may emerge, not required for the specific envisaged bioenergy conversion facility. Typical examples are e.g. the direct emission of biogenic CO2, or biogenic solid waste fractions (e.g. distillers dried grains with solubles from ethanol production, seed expeller from oil extraction for the production of HVO, lignin from lignocellulosic fractionation etc.).

ver más...



Advanced and smart sorting and monitoring technologies for food waste – Swedish case study & emerging digital solutions

Etiqueta: Waste-to-energy | Publicada el 30/07/2026



Food waste remains a major environmental, economic, and social challenge in Europe, with over 58 million tonnes generated annually and households accounting for the largest share. Beyond direct economic losses, food waste significantly contributes to greenhouse gas emissions and represents inefficient use of natural resources. In response, the European Union has strengthened its policy framework, most notably through the amended Waste Framework Directive, which sets binding food waste reduction targets and highlights the need for innovative and circular approaches to the management of biological resources.

ver más...

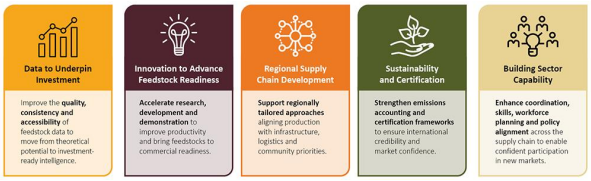
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Australian National Bioenergy Feedstock Strategy

Etiqueta: Lignocellulosic biomass conversion | Publicada el 26/08/2026

On 26 August 2026, the Australian Government released the National Bioenergy Feedstock Strategy (strategy). Development of the strategy reflects the importance of feedstocks to domestic low carbon liquid fuel (LCLF) production. It recognises Australia's strong agricultural and forestry sectors, the potential to grow feedstock production and the economic opportunities this creates for producers and regional communities.



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