From next-generation biodiesel waste resources to high-value-added fuels

High calorific value

10,900 kcal/kg

Low temperature fluidity

Available down to -40℃

Eco-friendly raw materials

Utilization of waste wood and agricultural by-products

Next-generation bioenergy solutions

Challenges in the Global Energy Market

Need to reduce dependence on fossil fuels

- Globally, reliance on fossil fuels is decreasing, and the transition to renewable energy is accelerating.
- Factors such as the IMO's tightening of marine fuel regulations and Europe's Carbon Border Adjustment Scheme (CBAM) are surging the demand for eco-friendly fuels.
- International standardization of green and low-carbon emission requirements is underway.

Limitations of Conventional Biodiesel

- High Raw Material Costs: The use of vegetable oils (such as palm oil) or frozen fats as the main raw materials makes them less competitively priced.
- Technical/performance disadvantages: Large amounts of waste glycerin are generated in wells using methanol and have a lower calorific value compared to diesel.
- Lack of Affordability: Traditional techniques for converting bio-oil to biodiesel are difficult to achieve due to excessive costs.

Challenges in the green energy transition

- In winter, the high condensation point limits its use.
- Vulnerable to fluctuations in international commodity prices.
- There is a lack of technology to effectively utilize non-edible resources.
- The infrastructure and investment structure of green fuel has not yet been completed.

Problems with conventional biodiesel

First-generation biodiesel has the following clear limitations

High raw material costs

- Use vegetable oil (palm oil, etc.) or animal fat as the main raw material
- Low price competitiveness, vulnerable to rapid fluctuations in international commodity price
- Price instability due to competition for edible resources

Technical and performance disadvantages

- The process using methanol produces large amounts of waste glycerin.
- Lower calorific value compared to diesel oil (Approx. 8,900 kcal/kg)
- In winter, the condensation point is high and its use is limited (below -12°C is not allowed)

Competitive products with disadvantageous performance

Lack of economic feasibility

- Conventional techniques for converting bio-oil to biodiesel are prohibitively expensive.
- The production process is complex and the energy consumption is large.
- It is difficult to secure economic feasibility without price competitiveness

Challenges in industrial expansion

Innovative Solution: Waste-Powered High-Efficiency Catalytic Conversion Technology

Diversification of waste resource-based raw materials

- Utilise low-cost waste materials such as waste wood, rice straw, palm kernel sugar (PKS), corn cobs, etc.
- Use raw materials in simple shredded form rather than expensive sawdust
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  (conventional biodiesel: minimum KRW 1,200/kg)

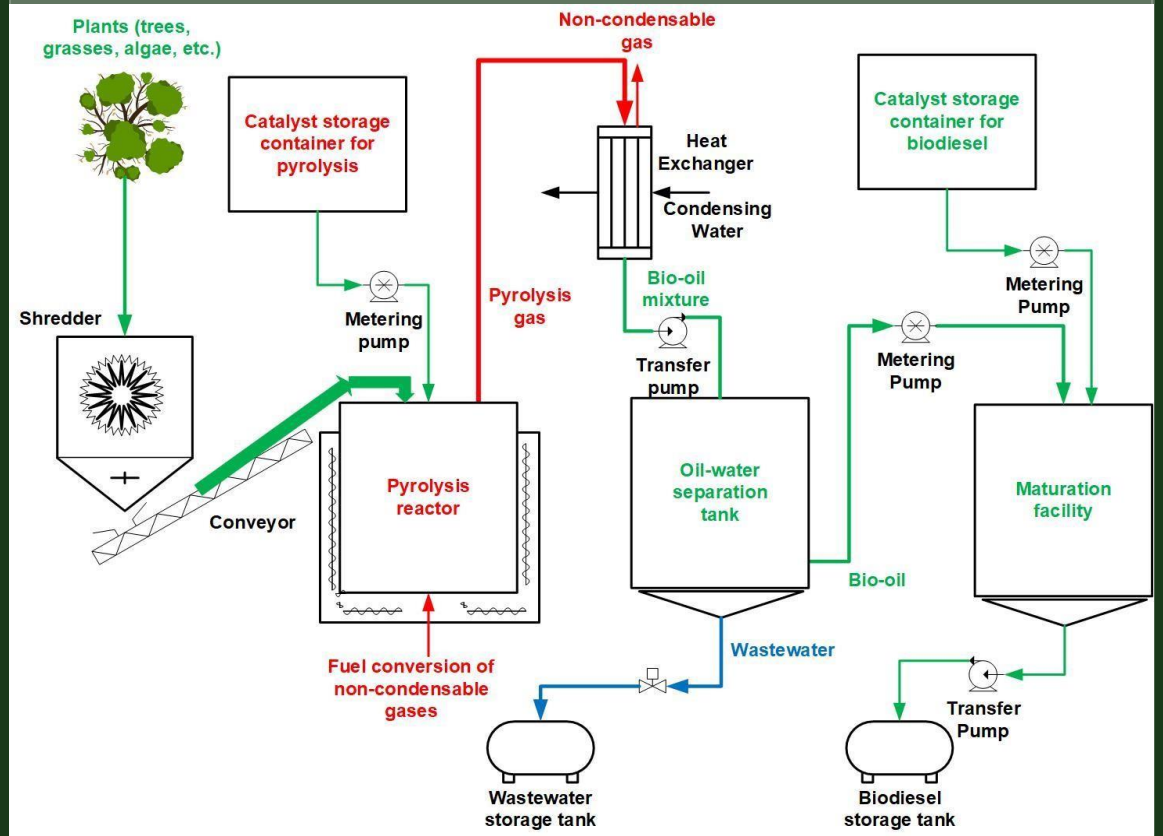
Slow Pyrolysis Process

- Reduced energy consumption through slow pyrolysis (~350°C) for more than 30 minutes
- More efficient than competitors' rapid pyrolysis (within 10 seconds, ~450°C, sawdust form) method
- Reduction of Waste Glycerin Generation in Methanol Use

Proprietary catalytic conversion technology

- Convert oil produced by pyrolysis into biodiesel within 24 hours under room temperature and pressure conditions
- Proprietary catalyst manufacturing technology: key know-how that is difficult for others to replicate
- Excellent performance: high calorific value (10,900 kcal/kg), low temperature fluidity (available down to -40°C)

Biodiesel Production Process



Our core competitive advantage

Non-edible resource utilization + energy efficiency + unique catalytic technology = economic and performance advantages

The Technological Difference: The Slow Pyrolysis Process

Comparing our competitors' rapid pyrolysis methods with our slow pyrolysis process, our technology distinguishes itself in the following ways

Our Company: Slow Pyrolysis

Pyrolysis Time: **30 minutes+**

Temperature: **About 350℃**

Waste heat recovery and circulation possible

Reduced energy consumption

Maximize energy efficiency with slow pyrolysis

Diversification of raw materials

Various low-cost waste resources such as waste wood, rice straw, palm trees (PKS), and corn stalks can be used

Cost Competitiveness

Raw materials can be used in simple shredding form rather than expensive sawdust

VS

Competitor: Rapid Pyrolysis

Pyrolysis Time: **Within 10 seconds**

Temperature: **About 450℃**

Waste heat cannot be recovered

High energy consumption

Rapid pyrolysis results in low energy efficiency

Raw materials limited

Only expensive raw materials in the form of sawdust can be used

Cost Burden

High production costs due to expensive sawdust raw materials

Our slow pyrolysis process is superior in terms of energy efficiency compared to our competitors' rapid pyrolysis methods, The variety and affordability of raw materials make them economically competitive.

Quality Verification: Analysis of Certified Test Reports

Core data of certified test reports (TSC2025-0454)

High calorific value
46,060 J/g

Flash point
54.0℃

Kinematicviscosity
(40℃)
2.140 ㎟/s

Freezing point
-42℃

Ready-to-issue: Bio-Aviation Fuel (SAF) certified

When domestic production facilities are put into operation, bio-aviation fuel reports can be issued immediately.
This means that the product's performance is too good to fit into the existing category.

Korea Petroleum Management Service Test Report

Key Implications of the Analysis Results

- This product has a fundamentally different chemical composition from conventional biodiesel (FAME) based on waste cooking oil and does not meet current biodiesel quality standards.
- The performance of the product is too good to fit into the existing category
- Establishing new quality standards is essential for future market entry
- This is a regulatory hurdle and at the same time a crucial point that disproves the technological differentiation that can lead the market.

Market Opportunities: Global Regulations and Growth Prospects

IMO Marine Fuel Regulations

Tightening of Marine Fuel Regulations by the International Maritime Organization (IMO) Increases the Demand for Eco-Friendly Marine Fuel

EU, Fit for 55

Europe's Carbon Border Adjustment Scheme (CBAM) and others are surging the demand for eco-friendly fuels.

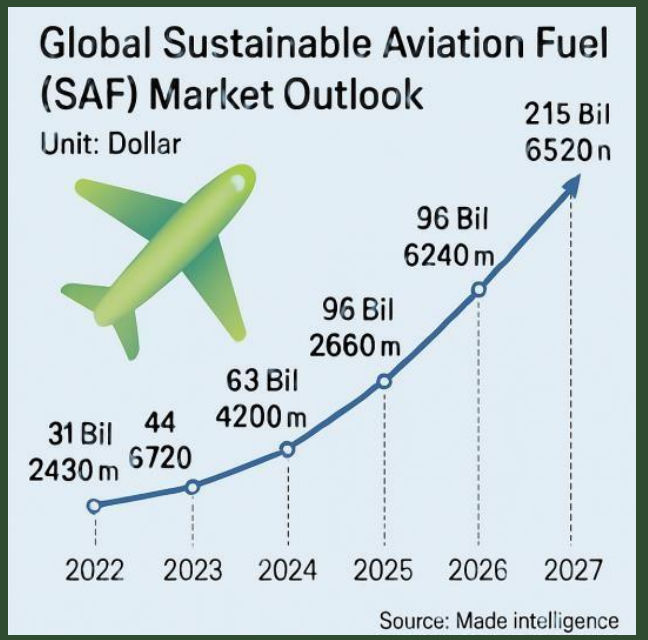
Mandatory Bio-Aviation Fuel (SAF)

Market growth due to mandatory introduction of biodiesel for aviation use and establishment of certification schemes

Marketing and go-to-market strategies

- Early Stage: Targeting the market for alternative fuels for industries such as transportation, power generation, and shipbuilding
- Medium-term: Biodiesel certification and training, special market entry
- Final: Promote bio-aviation fuel (SAF) certification and enter the high-value-added market

Global Bio-Aviation Fuel (SAF) Market Growth Forecast



Data sources: Modo Intelligence

Market entry timing and strategy

Step 1: Early 2025s, start producing and selling biodiesel

Step 2: In 2027, prepare for bio-aviation fuel (SAF) certification and enter some markets

Step 3: Large market share after the mandate of bio-aviation fuel (SAF) in the 2030s

Regulatory Trends: Comparing SAF, IMO and IRA Credits

Analyzing Market Opportunities Arising from Tightening Green Energy Regulations

Regulatory Framework	Purpose	Key Highlights	Market Opportunities
SAF (Bio-Aviation Fuel)	Transition to eco-friendly aviation fuel and carbon reduction	• Sustainable use of resources for 100% bio-based green production	End goal: Bio-aviation fuel certification Certification with Petroleum Quality Management Service
IMO (International Maritime Organization)	Reducing the environmental impact of marine fuels	• Tightening ship fuel rules & global standards for green marine oil	Medium Opportunity: Producing Green Marine Oil Winter availability is required
IRA (American Inflation Reduction Act)	Promoting Green Energy Development and Investment	• Provide tax credits • Support eco-friendly tech development	Immediate Opportunity: Entering the Domestic Market Gain market share with competitive price

Marketing and go-to-market strategies

Step 1: Initial Market

Targeting alt-fuel markets with energy and cost efficiency

Step 2: Medium-term market

Entering green marine fuel market driven by IMO & EU CBAM

Step 3: End goal

Partnered with Petroleum Agency for SAF certification and premium market entry

Step-by-Step Market Entry Strategy

Early Market

Industrial Alternative Fuels

- Targeting alt-fuel markets with high energy and cost efficiency
- Simultaneous promotion of domestic production and overseas bio-oil import plans
- Optimized characteristics for industrial equipment

- Domestic Production Scenario:

Annual net profit of KRW 2 billion, investment payback in 5 years

- Overseas Bio-oil Import Scenario:

Annual profit of KRW 9 billion, investment payback within 2.5 years

Medium-term market

Marine Biofuels

- IMO's Tightening of Marine Fuel Regulations
- Development and production of biodiesel optimized for marine engines
- Building partnerships with ocean carriers
- Winter-ready Arctic shipping with -40°C fluidity

- Additional profit from entering the marine biofuel market
- Expansion of overseas production and import options

Long-term market

Bio-Aviation Fuel (SAF)

- Partnered with Petroleum Quality Agency for SAF certification
- Optimized for aviation engine performance
- Entering premium markets with price competitiveness
- Complying with global rules like EU CBAM using eco-proof

- Increased corporate value through bio-aviation fuel certification
- Final goal: Investment recovery and corporate value growth

Where to spend your money and how to build your factory

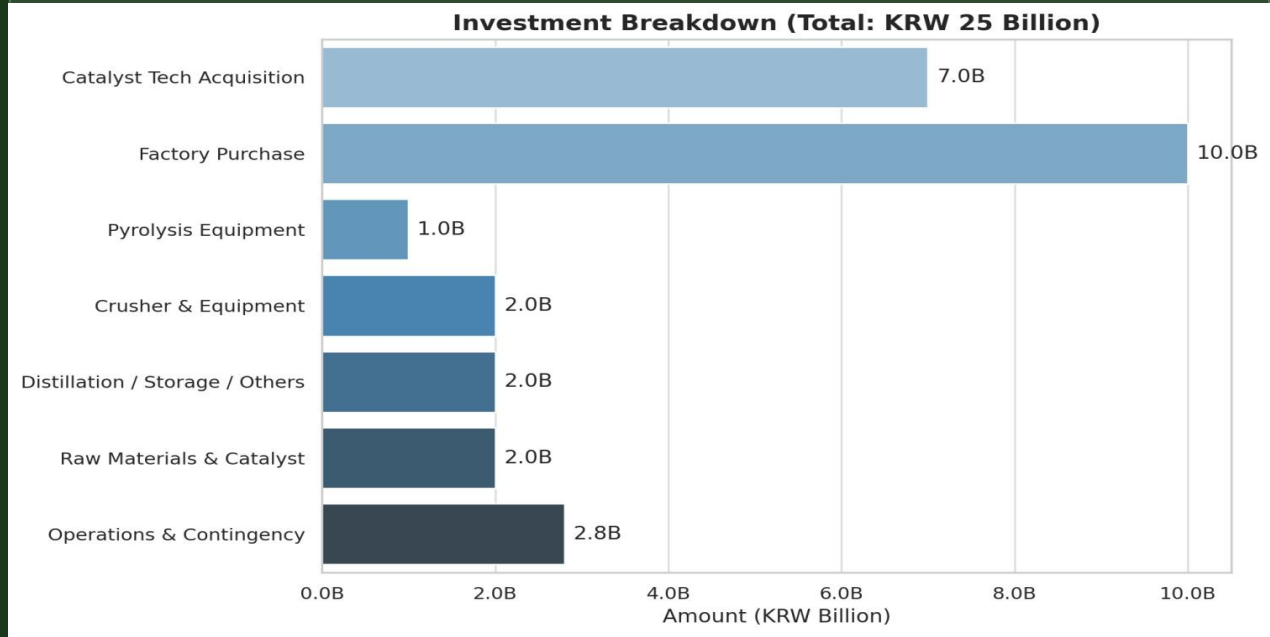
East Sea City Factory Construction Plan

- land area: 10,000m²
- building area: 3,000m²
- location: East Sea City, near the port
- production capacity: 10 tons/day

Main Facilities

- Pyrolysis Reaction Equipment Crusher and Related Equipment
- Distillation/Storage/Other Equipment

Investment Details (Total: KRW 25 billion)



Biodiesel Plant Layout & Process Flow

① Facility Overview
- Site Area: 160 m × 120 m (19,200 m²)
- Key Zones: Raw Warehouse, Wood Shredder Hall, Production Plant, Tank Farm
- Capacity: 10 tons/day

② Process Flow
- Raw Material Intake → Shredding → Processing → Storage → Distribution
- Optimized one-way traffic flow for safety & efficiency

③ Operational Advantages
- Compact layout for reduced internal transport time
- Dedicated tank farm with separate biodiesel & wastewater storage
- Integrated Biodiesel Deodorizers to ensure product quality

④ Sustainability Features
- Green belt & rainwater drainage system
- Energy-efficient process equipment
- Reduced VOC emissions via closed-loop design

⑤ Future Scalability
- Space reserved for expansion of storage and additional processing units