

THE SAF TECHNOLOGY ALLIANCE

Honeywell UOP

JM Johnson Matthey

GIDARA ENERGY

SAMSUNG E&A

TRANSFORMING WASTE TO WINGS

Introducing the SAF Technology Alliance, an industry-leading collaboration dedicated to transforming waste feedstock into sustainable aviation fuel (SAF) through a unified, end-to-end, feed-to-fuel solution.

Energy-transition leaders **Honeywell UOP, Johnson Matthey, GIDARA Energy and SAMSUNG E&A** have come together to empower fuel producers investing in the energy transition with accessible, scalable and efficient solutions to harness the untapped potential of waste materials and convert them into sustainable aviation fuel.

THE FUTURE OF AVIATION FUEL

SAF is a fuel produced from eligible feedstocks derived from various types of waste and by-products of agriculture. With a similar molecular structure and chemical properties to traditional jet fuel, SAF can be blended into existing jet fuel and safely used without the adaptation to aircraft, engines or supply infrastructure. In fact, most aircraft today can handle SAF blends up to 50%[1]

When SAF is produced from municipal solid waste (MSW), the environmental gains are twofold: both from bypassing petroleum use and avoiding the disposal of waste materials into landfills to decompose, creating greenhouse gases (like methane) and contaminating the surrounding environment. SAF allows waste to power commercial flights that would otherwise require fossil-based fuel.

SAF-BLENDED JET FUEL OFFERS SIGNIFICANT ADVANTAGES OVER TRADITIONAL FUEL, INCLUDING:

- A drop-in replacement fuel that requires no changes to aircraft technology or fuel infrastructure.
- Can reduce greenhouse gas (GHG) emissions by up to 88% compared with petroleum-based fuels.[2,3]
- Meets all critical jet fuel specifications, such as flash point, freeze point, stability and heat of combustion

DIVERSIFIED SUPPLY

Fuel is typically the single largest operating cost for airlines and the industry's reliance on fossil fuel means it is heavily affected by a range of fluctuations, such as the changing price of crude oil or problems with supply and demand.

SAF provides a source of energy which is not tied to locations where petroleum is drilled and can take advantage of a wide range of feedstocks from around the world—using waste material as a feedstock has immense value.

Every year, the world generates over 2.1 billion tonnes* of waste, and that number is rising fast. What if waste had value and can help bridge the feedstock gap?

*Source: Global Waste Management Outlook 2024 | UNEP - UN Environment Programme



END-TO-END SAF SOLUTION

From feed to fuel, the SAF Technology Alliance leverages the collective strengths of four industry leaders into one powerhouse system.

The joint initiative creates an end-to-end SAF solution, from feed to fuel, leveraging the collective strengths of each entity:

- GIDARA Energy HTW® Gasification Process
- Johnson Matthey brings FT CANS™ and HyCOgen™ Reverse Water Gas Shift technologies
- Honeywell UOP FT Unicracking™ and HPS Digital and Automated Ecosystem
- Samsung E&A world-class AHEAD Project Delivery

OPERATIONAL BENEFITS

One entity oversees the entire project lifecycle – from design to commissioning – ensuring streamlined communication and decision making.

FASTER TIME TO MARKET

Optimized workflows and modular techniques shorten the time from concept to operation.

TECHNICALLY DIFFERENTIATED

Supports large-scale operations with fewer units reducing complexity and maintenance.

INTEGRATED PROCESS

All components of the SAF production process are interconnected for optimal performance.

BANKABLE FINANCIAL BENEFITS

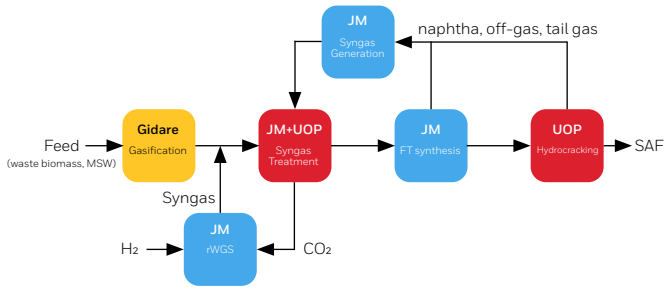
Backed by financially stable and reputable collaborators, increasing investor confidence, while integrated solutions can reduce time from feasibility study to facility startup by more than 15%, and result in a 5-10% capital cost savings[12].

* Based on theoretical schedule and cost analysis when the modularization solution is applied in EPC stage. Schedule analysis based on a project schedule of 77 Months. Cost comparison is against an open ITB, and using standard

RETHINKING WASTE TO ADVANCE THE ENERGY TRANSITION

The SAF Technology Alliance introduces a non-exclusive offering designed for customers wanting a full-service delivery to transform waste feedstocks into sustainable aviation fuel. Our vision is to empower fuel producers with accessible, scalable and efficient solutions that harness the untapped potential of waste materials, converting them into SAF.

SAMSUNG E&A PROJECT DELIVERY



CORE COMPONENT: SAMSUNG E&A AHEAD PROJECT DELIVERY[5]

Connecting elements within the SAF Technology Alliance is SAMSUNG E&A's AHEAD project delivery model, an innovative redesign of the conventional project execution method. This model is based on the Engineering Data Platform (EDP) and brings intelligence and automation to all areas of engineering, procurement and construction (EPC). This cutting-edge project delivery model features three main components:

Design AHEAD

Enables preemptive schedule management by finalizing the design early on using design automation and special procurement and engineering package strategies.

Build AHEAD

Maximizes offsite construction to improve productivity and strengthen safety at the site, utilizing key elements of fabrication, modularization and construction-purpose 3D printing.



Integrate AHEAD: Enhances productivity and quality at the site through proactive integrated management. It focuses on systemization, standardization and automation using AI to develop and optimize project schedules.

CORE COMPONENT: GIDARA ENERGY HTW® GASIFICATION PROCESS[6]

GIDARA Energy's High-Temperature Winkler (HTW®) gasification technology offers the most established method for converting waste-based feedstocks into syngas to produce fuels and chemicals.

GIDARA ENERGY HTW® GASIFICATION HIGHLIGHTS

- Successfully tested with over a dozen waste feedstocks.
- Fully optimized and debugged at commercial scale.
- Higher operation pressure increases gasifier performance.
- A simple process that avoids additional processing steps such as tar removal and additional bed materials.

Broad Feedstock Versatility

HTW® has been successfully tested and operated with more than a dozen feedstocks, including diverse biomass streams, municipal solid waste, non-recyclable plastics, agricultural residues and construction debris, making it one of the most flexible gasification solutions available for diverse global waste streams.

Decades of Commercial Validation

HTW® gasification technology has accumulated over 100,000 commercial operating hours across three industrial-scale facilities, with a single plant achieving more than a decade of continuous operation and an average availability above 91%—demonstrating proven reliability and scalability for waste-to-fuel applications.

CORE COMPONENT: JOHNSON MATTHEY (JM) HyCOgen™ REVERSE WATER GAS SHIFT (RWGS) AND FT CANS™ TECHNOLOGIES[7]

JM FT CANS™ technology, co-developed with bp, offers a scalable solution to convert syngas into FT crude and provides up to a 50% reduction in CAPEX8 and a three-fold increase in production for the same size reactor[9].

JM's cutting-edge reforming and HyCOgen™ technologies can boost SAF production by up to 250% without increasing solid feedstock demand[10].

HYCOGEN™ / FT CANS™ HIGHLIGHTS:

- Enables plants to produce both second-generation bio-SAF and e-SAF using a single FT reactor
- Seamless technology integration
- Maximizes use of sustainable feedstocks and improves overall carbon efficiency
- Water produced in the process can be reused to feed electrolysis

CORE COMPONENT: HONEYWELL UOP FT UNICRACKING™ TECHNOLOGY[11]

Leading the way in Fischer-Tropsch hydrocracking science, Honeywell's FT Unicracking™ technology converts FT liquids and waxes into ASTM-approved sustainable aviation fuel or electro-sustainable aviation fuel (eSAF). FT Unicracking™ can upgrade synthetic crude from a variety of non-fossil waste sources like waste biomass, municipal solid waste, biogas, and/or CO_2 and H_2 to produce SAF.

The FT pathway enables low-carbon, carbon-neutral or potentially even carbon-negative eSAF production, and the process was approved under ASTM D7566 in 2009, making it a bankable solution for many operators.

The process uses commercially proven, proprietary hydrocracking and hydroisomerization catalysts to produce 3-5% more SAF, reduce by-product waste and achieve up to 20% cost reduction compared to other commonly used FT hydrocracking methods.

FT Unicracking™ can be used both for new units or retrofits, and it can be delivered as a modular unit to help simplify project execution. In addition to SAF and eSAF, it also enables the production or co-production of other renewable fuels, such as eDiesel.



HIGHER SAF YIELD
Produce 3-5% more SAF



LOWER CAPEX
Enable a cost reduction of up to 20%



LESS WASTE
Reduce by-product waste streams



PROCESS WASTE BIOMASS
90% less carbon intensive

Honeywell UOP's ongoing project development work demonstrates negative carbon intensity can be achieved in some cases by using biomass feedstocks, such as forestry residues, coupled with carbon capture and storage (CCS) to capture process CO_2.

FT Unicracking™ allows fuel producers investing in the energy transition to take advantage of SAF opportunities and transform waste to wings.

CORE COMPONENT: HPS DIGITAL AND AUTOMATED ECOSYSTEM

Honeywell Process Solutions (HPS) has a strong history of delivering best-in-class digital and automation technologies to project developers and established refiners. Our strategic relationships with leading process technology licensors are paving the way in making SAF more accessible, efficient and cost-effective.

By combining HPS automation with UOP's process expertise, facilities can reach full capacity faster. Pre-engineered reactor models, integrated control and safety systems and rationalized alarms streamline deployment and reduce engineering effort—removing automation from the critical path.

As an integrated main automation contractor (IMAC), HPS delivers more than project execution. Our intelligent, end-to-end digital solution connects field devices to business systems, enabling early operator readiness and long-term operational success.

Measuring, monitoring, reporting and reducing carbon intensity is of paramount importance for SAF producers. Utilizing HPS field-proven technology, we enable the calculation of near real-time product carbon intensity, which can be used to support regulatory compliance and the monetization of green premium associated with lower carbon intensive fuels.



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TALK TO AN EXPERT

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