WHITEPAPER

PURESAF®

The Time Is Now: Accelerating Innovation To Secure Our Energy Future

By Monica Normark

As the global demand for energy security and decarbonization accelerates, the race is on to unlock the full potential of alternative energy feedstocks. Today, over 90 countries have active oil and gas extraction sites worldwide – around 40 countries with proven oil reserves and around 50 countries in the world hold significant oil reserves.[1]

This concentration of resources presents not just a geopolitical risk but a market opportunity to differentiate energy resources.

In 2024, the share of oil in the total energy demand fell below 30% for the first time ever, while the liquid biofuel demand increased by 0.2 EJ (exajoule) in 2024, reaching over 4% of global transport fuel consumption.

Countries paving the way for biofuels growth includes Brazil, India, Indonesia and the United States. Together, they accounted for 90% of this growth, where Brazil alone contributed to nearly half of the expansion, driven by continued policy support for biofuel blending and rising transport fuel demand.[2]

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According to the IATA outlook for 2025, the air transport industry will require approximately 500 million tons (Mt) of sustainable aviation fuel (SAF) annually to achieve net-zero CO_2 emissions by 2050. Yet, as of 2025, global SAF production remains at just 2 Mt – a stark contrast to what's needed[3]. Based on IATA's assessments of global feedstock availability, technology readiness, and regional suitability, projections suggest that SAF production could potentially reach 400 Mt by 2050. While this represents a significant scale-up, it still leaves a shortfall of around 100 Mt.

Bridging this gap is possible, but it requires action today to meet these long-term goals. This includes expanding access to sustainable biomass feedstocks and accelerating the deployment of novel SAF technologies. Although global biomass feedstock potential may exceed 12,000 Mt by 2050, competing demands across sectors mean that only about 35% of this total is realistically available for bioenergy and biofuels. After accounting for these competing uses, IATA concludes that approximately 1,580 Mt could be allocated to SAF production enough to support just over 300 Mt of bio-based SAF[4].

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1 Oil Reserves by Country 2025 – World Population review Global Oil and Gas Extraction Tracker - Global Energy Monitor

2 Emissions Factors 2024 - Database product - IEA

3 G lobal Feedstock Assessment for SAF Production - IATA

4 Supergen Bioenergy Hub; Worley Consulting; IATA Sustainability & Economics, 2025

Investors must prioritize ventures and technologies with clear pathways to commercialization and global deployment of SAF

While bio-based SAF is expected to form a significant portion of the future fuel mix, it alone will not be sufficient to meet the aviation sector's net-zero targets.

A substantial contribution from e-SAF produced via power-to-liquid (PtL) technologies will be essential. Therefore, unlocking the potential of alternative energy feedstocks is no longer a distant ambition; it is a strategic necessity.

From bio-based fuels and green hydrogen to carbon capture and synthetic energy carriers, the next wave of energy innovation is not only technologically viable it's investable. These solutions are poised to disrupt traditional energy markets, create new revenue streams, offer a roadmap to energy resilience, and deliver long-term value aligned with environmental, social and governance (ESG) mandates.

The question isn't whether an investment must be made in energy transition, it is how quickly one can move. Therefore, fast movers need strong technology ownership through investments in innovative technology solutions.

Leaders who act decisively today, those who embrace innovation and reimagine what's possible will shape the resilient, sustainable energy systems of tomorrow.

To capitalize on this shift, investors must:

1. **Back Scalable Innovation:** Prioritize ventures and technologies with clear pathways to commercialization and global deployment.
2. **Support Infrastructure Modernization:** Invest in physical infrastructure projects with strong development potential needed to integrate next-gen energy systems.
3. **Enable Strategic Partnerships:** Fund platforms that foster collaboration to increase commercial viability.
4. **Champion Talent and IP:** Recognize the value of human capital and intellectual property by driving competitive advantage. An idea alone will not lead to success. The people behind an idea drive result.
5. **Align with Policy and Incentives:** Leverage emerging regulatory frameworks and green financing mechanisms to de-risk investments.

Proven Integrated Approach to

De-Risk Project Delivery

Modular and Integrated Design

EPC Risk Mitigation

Reliable Execution Models

KBR's PureSAF: An Integrated and Viable Solution

KBR's experience in de-risking commercial developments in a pragmatic way will help support the acceleration and scaling of SAF facilities globally. By deploying KBR's PureSAF®, a solution that not only scales bio-SAF production but also offers an opportunity to co-process CO2 and syngas in the same plant will provide a cost-efficient solution, reduce overall footprint and mitigate the gap of SAF volumes by 2050 identified by IATA's assessment.

With a structured scale-up model from pilot to commercial and a global supply chain paired with local execution, KBR ensures each SAF unit remains within emissions avoidance thresholds. This is backed by lifetime support, including maintenance guidance and compliance assurance.

- PureSAF, first integrated plant in operation for ATJ supplying fungible jet fuel, developed by Swedish Biofuels AB and licensed exclusively by KBR, represents a breakthrough in sustainable aviation fuel technology, offering a fully formulated, 100% drop-in replacement of synthetic aviation for conventional jet fuel.

- Meeting ASTM specifications including required aromatics this platform is not only compatible with existing aviation infrastructure but also validated by leading defense agencies such as DARPA, the U.S. Air Force, and the Swedish Air Force for use in military jet operations.

- It is designed for flexibility and scale. It supports a wide range of certified feedstocks such as energy crops, agricultural and forestry residues and other CORSIA eligible feedstocks together with CO2 and syngas.

- PureSAF is a modular and refinery-compatible platform, which integrates seamlessly within the existing infrastructure, reducing capital intensity and accelerating deployment timelines.

- From commercial flights and cargo operations to military missions and regional hubs, PureSAF continues to enable diversified usage across the aviation ecosystem.

Investors can partner with KBR to scale SAF confidently through a collaborative, stepwise investment approach. The platform supports different feedstocks and end-products, enabling strategic flexibility and long-term resilience.

KBR has quantified that the PureSAF platform delivers best-in-class Alcohol-to-Jet (ATJ) technology with the following attributes:

Rather than offering a single SAF product, PureSAF enables the development of a circular, integrated carbon utilization ecosystem with multiple high-value products

- **High optimized SAF yields** with the **highest greenhouse gas (GHG) reduction** at the **lowest installed cost** and **lowest energy consumption** in the market.
- Streamlined design with the **lowest number of equipment,** which translates into lower capex and reduced utility consumption.
- The most suitable option for **back-integration potential with both existing and next-generation bioethanol facilities.** Integration allows for efficient use of ethanol and its derived CO_2, significantly improving the overall carbon conversion efficiency from solid biomass to SAF.
- Rather than offering a single SAF product, **PureSAF enables the development of a circular, integrated carbon utilization ecosystem with multiple high-value products.** KBR's technology experience in refining, chemicals, olefins, ammonia, methanol, enable diverse production options.
- **Flexible, certified feedstock compatibility** covering both the ATJ-SPK and ATJ-SKA pathways.
- KBR **modular design** for rapid and de-risked deployment.
- **Diversified applications** across commercial aviation, military operations, cargo, and regional hubs.
- **Digital twin and simulation tools** for precision optimization and emissions control.

This positions KBR uniquely to introduce the ATJ SAF pathway at the lowest total cost of production and the highest project net present value, verified by a recent independent third-party analysis.

Today, KBR licenses over 80 technologies forming a robust backbone that drives continuous innovation. This foundation enables KBR to stay ahead of the curve by enhancing our learning, expanding our capabilities, and optimizing technology solutions that reduce energy consumption and lower the carbon footprint of our clients' existing assets.

When we introduce first-of-a-kind solutions, they benefit from this legacy of scalable, innovative technology development ensuring reliability, efficiency, and impact from day one.

Since 2019, we have moved beyond simply tracking our greenhouse gas footprint by committing to carbon neutrality and accelerating progress year after year. By 2023, sustainability-driven projects accounted for more than one-third of our revenue, and in 2024, we achieved a significant milestone: 100% renewable energy across all operations.

Why is this important? Because when customers choose to invest in alternative energy production, they can trust that their projects are delivered with a carbon-neutral footprint. reinforcing their own sustainability commitments. This alignment not only strengthens customer trust but positions us as a leader in driving the transition to a low carbon emission future.

It's not just about meeting expectations, it's about leading the way toward a cleaner, more sustainable future.

Conclusion

The importance of diversifying our energy portfolio has never been more critical with the global challenges of climate change and geopolitical tensions.

As the SAF market emerges and is predicted to expand beyond the current 0.7% of the total jet kerosene fuel pool by 2025, investing in a flexible platform is wise. KBR's PureSAF technology offers exceptional flexibility in feedstock processing, positioning it as a truly transitional platform bridging second-generation biofuels and emerging e-fuels.

The system can utilize a wide range of inputs including ethanol, higher alcohols, CO_2, syngas, and hydrogen enabling multiple, adaptable pathways for SAF. KBR's proven ability to scale technologies reliably while minimizing execution and operational risks is a cornerstone of our value proposition. Our integrated approach combining R&D, engineering, supply chain, and project execution ensures plant integrity and enables continuous performance optimization.

With modular design delivery and broad range of engineering services, KBR is capable of supporting customers from concept, engineering design, to delivery through consulting, Pre-FEED, FEED, proprietary and detailed engineering, EPCM, digital solutions and lifecycle support services. KBR is proud to be a trusted partner in scaling bankable SAF solutions.

PureSAF is not just a fuel, it's a foundation for energy security, climate leadership, and future-ready aviation.

Investing in KBR's PureSAF technology delivers a unique platform, **delivered with a carbon-neutral footprint** that produces sustainable fuels and various bio-based molecules to ensure stable future proof products, mitigating fluctuations related to policy, regulations, and price mechanisms.

At KBR, being a responsible company isn't just a value; it's how we lead. **Let's not wait. Let's lead.**

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