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Argus Biofuels & Feedstocks Asia Conference

22-24 April 2025 | Singapore

Pre-conference content: Argus biofuels Asia eBook

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Introduction

The markets have seen significant changes, and this eBook offers you exclusive content on recent developments in the industry. It features industry interviews from experts across the supply chain who discuss Asia's position as a feedstock producer, and provide fresh new perspectives around SAF, key challenges, market regulations, sustainability strategies, and more.

Explore the topics featured in this eBook at the Argus Biofuels & Feedstocks Asia Conference in Singapore this April and join over 400 senior decision-makers at the industry's key networking event in the region.

Richard Dickinson
Managing Director
AMARUS GROUP

Hear more from Richard at the Argus Biofuels & Feedstocks Asia Conference on 22-24 April in Singapore, in a spotlight on China. What's China's position in the biofuels industry and which feedstocks will it export?

"International producers will need to rely on their cost/ benefit advantages relative to competition as well as how to reliably secure their feedstock demand."

How is Asia placed as a feedstock producer in 2025?

Although Asia will remain the largest supplier of waste and residue feedstocks for the US and EU, in tandem with local mandates and increased domestic production in biodiesel, HVO and SAF, we expect to see less volume and a more competitive environment for international producers. The two largest feedstock exporters, namely China and Indonesia, will export less and use more locally. We still see room for marginal growth in exports from other southeast Asian countries such as Vietnam and the Philippines. India and other south Asian countries could also see strong export growth.

We also expect rapid expansion and adoption for new and advanced wastes and residues across Asia as traditional feedstocks such as UCO and POME have little-to-no room for volume growth and cannot satisfy international demand.

How is the origination of feedstocks from China developing on the supply and buy side?

We estimate Chinese total monthly volumes for waste oils such as UCO and BG to be 150,000-170,000t and these to be steady year on year from now on. Increased domestic and international demand for this feedstock, with a significant number of HVO/SAF plants commissioning at the end of 2024 and throughout 2025 as well as Indonesian POME no longer being available for local producers, will mean an increasingly competitive environment in terms of securing volumes. Basically, too much demand relative to available volumes. Within this environment, we are already seeing newly commissioned plants operating at negative margins and we expect the situation to deteriorate this year. International producers will need to rely on their cost/benefit advantages relative to competition as well as how to reliably secure their feedstock demand.

Josh Saxby
Director, Specialised Products
Clarksons

Hear more from Josh at the Argus Biofuels & Feedstocks Asia Conference on 22-24 April in Singapore, where he discusses how trading firms manage risk against a changing environment and the impact on the movement of feedstocks in a panel with Repsol and Mitsui & Co.

"Biofuel producers should think long term about their seaborne logistics and consider making investments in their own tonnage to secure freight cover for the future."

What are the key challenges in biofuel shipping for 2025 and beyond?

Rapid growth (close to 400pc in 18 years)

Transport of biofuels and bio-feedstock remains the single largest area of seaborne volume growth in the chemical tanker market. Volumes have grown by close to 400pc since 2007, when the market totaled 5mn t/yr compared with the 25mn t/yr it represents today. However, the global transport of biofuels globally is faced with a multitude of freight-related challenges.

Tonnage availability

Today's chemical tanker freight market is somewhat more fluid and volatile compared with the last decade, when fluctuations in freight were limited. A combination of geopolitical and macroeconomic factors has led to unprecedented rises in freight rates over the past three years, with the lack of a forward orderbook for new tonnage supporting freight rates further and lending support to the marketplace. Over the past 12+ months, the rerouting of volumes around the Cape of Good Hope, and away from the Red Sea, has shortened tonnage availability yet further leading to even higher freight rates harming trading economics and fueling supply chain disruption.

Increase in regulation

With demand in the biofuels market driven primarily by regulation, the sector faces additional hurdles in securing competitive freight as it strives to meet government mandates and net zero ambitions in a cost-effective manner. Freight is of course a huge part of this equation, with additional uncertainty stemming from the Trump administration's policies only frustrating producer efforts further to mitigate freight risk.

To overcome these challenges, biofuel producers should think long term about their seaborne logistics and consider making investments in their own tonnage to secure freight cover for the future.

Biofuels are regulatory driven markets, to what extent is regulation to blame for the changes in feedstock flows?

Demand for bio-feedstocks to meet government and supra-national regulation — in the case of the EU — is now more acute than ever. Europe, the largest biofuel market, is in dire need of regular feedstock supply, which until relatively recently was mostly supplied from China. The growth of UCO/UCOME into the European markets rocketed in 2022, peaking at over 2mn t/yr. Europe has subsequently slapped anti-dumping duties on those imports, effectively killing off the trade. Those volumes have been

Josh Saxby
Director, Specialised Products
Clarksons

"Shipping strategies that are not taking regulation into account will come unstuck — building flexibility into long-term logistics plans will ensure you can mitigate risk when the goalposts are changing regularly. "

diverted to the US instead for production of sustainable aviation fuel (SAF) and renewable diesel (RD) — although question marks now arise over the longevity of this given US trade tariffs on Chinese products. The rise in UCO/UCOME volumes to Europe was also, in part, spearheaded by the impending ban on palm oil use in biofuel blending by 2030, with the industry looking for long-term feedstock supply from elsewhere.

Domestic blending mandates in key feedstock producing countries such as Brazil, Argentina, Indonesia and Malaysia also curtail the available volumes of first-generation feedstocks that are available to the global market. This calls for more inventive ways for producers to meet regulatory pressures while serving growing demand for biodiesel, SAF and marine biobunkers.

With Europe continuing to regulate itself out of the global market and domestic blending mandates seemingly increasing, the impact on trade flows and feedstock supply is stark. The ability for end users of biofuel to meet requirements and purchase volumes at a cost-effective level is being somewhat hampered by a seemingly unstoppable torrent of regulation.

Shipping strategies that are not taking regulation into account will come unstuck — building flexibility into long-term logistics plans will ensure you can mitigate risk when the goalposts are changing regularly.

How can Clarksons support biofuel producers and traders in their shipping strategies?

As the world's leading shipping services provider, Clarksons is uniquely placed to offer producers and traders with innovative solutions to cover their shipping needs. Our global footprint and broad experience across all major shipping sectors allows us to draw on an unmatched network and knowledge base to advise, design and execute clients' strategies. Whether it be spot or contract chartering, short or long-term time charter cover, second-hand vessel purchase, financing or new buildings, Clarksons can support and execute these decisions on our clients' behalf.

Considering the growing importance of biofuels in the vehicle, aviation and marine sectors, Clarksons can become an embedded part of our clients' supply chain and logistics planning, helping them to design a sustainable, proactive and competitive seaborne freight solution that ensures flexibility and meets the needs of their customers.

Bram van Santen
Corporate Director
Connex

Hear more from Bram at the Argus Biofuels & Feedstocks Asia Conference on 22-24 April in Singapore, in a panel that explores Asia's position as a feedstock producer, alongside Apeiron Bioenergy and Gamalux Sdn. Bhd.

"As an industry, it is crucial to be cautious about mislabelling, subsidising and blocking certain fuel types and feedstocks. "

If you could communicate one message to the biofuels industry to accelerate the adoption of low-carbon fuels, what would it be?

Tell the honest story!. Renewable fuels are inherently more expensive due to the effort and energy required to collect, transform and utilise them in final products like SAF and RD. The industry and every part of the supply chain must work together rather than against each other. The message does not favour crop-based fuel, Annex IX-A or XI-B, or limiting access to non-biological (RFNBO) fuels. Our goal is clear: Reduction of greenhouse gas emissions and stop wasting valuable resources in waste and residues.

Oil companies are not adversaries; they need incentives from the public — the will — and the government — the clarity — to make the necessary changes. Delivering the real story to the public as producers, governments and investors is crucial. Decarbonisation has enormous potential, but indecisiveness and fraud undermine trust in our industry. We can build a sustainable biofuel future by working together and being transparent.

What legislations and policies are driving supply and demand globally and affecting the trade flows of feedstocks?

Various legislation and policies significantly influence the global supply and demand of feedstocks. Since the 1990s, when the first renewable laws were published in the EU, legislation has primarily driven the market. Recent events in the US, such as the withdrawal of the 45z credit on UCO, have shown that demand is still very much driven by policy changes.

New mandates on SAF and maritime fuels are progressing slowly but could provide more support to our market demand. The focus on Annex IX-A in ReFuelEU and RED III could introduce new feedstocks and geographies into the spotlight, with the potential for quantities available for supply. However, legislation can also limit the supply of certain feedstocks, as seen with PFAD or biofuel from the US, South America, and Indonesia, creating barriers to entry.

As an industry, it is crucial to be cautious about mislabeling, subsidising and blocking certain fuel types and feedstocks. These short-term gains may support local initiatives but can harm the industry's overall availability and price. In short: "Deliver the true value and value the truth."

Chris Markey
Deputy Regional Director
Southeast Asia & Oceania
US Grains Council

Hear more from Chris at the Argus Biofuels & Feedstocks Asia Conference on 22-24 April in Singapore, in a session that explores current mandates and policies to create growth opportunities in Asia.

What legislations and policies are driving supply and demand in Asia for bioethanol?

There are several looming legislative initiatives across the region signalling increased bioethanol utilisation, underpinned by government and public appetite to stimulate agrarian economies and value-add manufacturing, boost energy security and mitigate greenhouse gas emissions and urban air pollution. For instance, Japan, India, Indonesia, Vietnam and the Philippines are implementing or evaluating significant policy actions to expand the utilisation of bioethanol for on-road and aviation applications in the 2020s and beyond.

In southeast Asia alone, fuel bioethanol demand for de-fossilising gasoline blending could surpass 5mn t/yr by 2030 based on stated policy objectives, up from current consumption levels of approximately 1.75mn t/yr. Current nameplate production capacity for fuel bioethanol in southeast Asia stands at around 2.5mn t/yr, thus trade and investment will be essential to scaling supply to meet growing demand across the region. With this comes opportunities for both local and foreign investors in the region.

When factoring in swelling demand centered in the broader Asia region, such as India and Japan, 2030 demand forecasts point to demand potentially surpassing 20mn t/yr. Governments and corporates are increasingly identifying bioethanol as a strategic, reliable tool to defossilise transportation fuel mixes parallel to other solutions, chiefly bio/renewable diesel and electrification.

If you could communicate one message to the biofuels industry to accelerate the adoption of low-carbon fuels, what would it be?

Notwithstanding impressive innovation and scaling of transport electrification in Asia, liquid fuels will continue to play a critical role in countries' transportation fuel mixes and economic growth trajectories, particularly in southeast and south Asia, where gasoline consumption is forecast to increase into the 2030s.

The International Energy Agency's (IEA) World Energy Outlook forecasts biofuel demand increases into 2030, tripling even in a net zero emissions scenario. Transport electrification is and will continue to play an essential role in Asia's decarbonisation and economic growth journey, but a binary approach to tenable transport solutions risks significant opportunity costs in greenhouse gas and air toxin mitigation.

"Notwithstanding impressive innovation and scaling of transport electrification in Asia, liquid fuels will continue to play a critical role in countries' transportation fuel mixes and economic growth trajectories, particularly in southeast and south Asia, where gasoline consumption is forecast to increase into the 2030s."

Low-carbon biofuels such as bioethanol provide an immediate, ready-to-use solution for delivering more resilient transportation systems that are conducive to economic growth, sustainability and fuel security. Leveraging all available de-fossilisation pathways — such as utilising bioethanol parallel to electrification — will accelerate Asia's decarbonisation efforts while generating localised value creation opportunities in onshoring fuel production.

Expanding Bioethanol Use in Asia

- **Australia** – Two state mandates (E4 & E6); SAF-ATJ
- **India** – Achieved E10 in 2023; aiming for E20 by 2025-2026
- **Indonesia** – E5 trial project; roadmap for E5 (2025) and E10 (2030) mandate
- **Japan** – Commitment to double ethanol consumption by 2030; E7 pilot projects; SAF-ATJ
- **Pakistan** – Policymaking committee weighing E5 policy
- **People's Republic of China** – Provincial E10 mandates launched in 2010s; announced target E10 mandate in 2017
- **Philippines** – E10 mandate; voluntary E20 policy announced in 2024
- **Republic of China** – Government looking at ethanol solutions for road transport
- **South Korea** – Drafting renewable fuel standard (RFS); possible ethanol trials; SAF-ATJ
- **Thailand** – Annual fuel ethanol consumption target of roughly 370M gallons; SAF/plastics roadmap
- **Việt Nam**– E5 RON92 mandate; evaluating potential policy expansion

Usman Ahmed
Managing Director & Chief Executive Officer
Gamalux Sdn. Bhd.

Usman will be speaking on a panel at the Argus Biofuels & Feedstocks Asia Conference on 22–24 April in Singapore that explores Asia's position as a feedstock producer, alongside Apeiron Bioenergy and Connex.

An interview with Gamalux Sdn. Bhd.

"Asia's growing focus on renewable energy and sustainable practices will boost the production of bio-based feedstocks."

How is Asia placed as a feedstock producer in 2025?

By 2025, Asia is expected to solidify its position as a leading global feedstock producer, driven by its vast agricultural resources, industrial capacity and strategic investments in technology and infrastructure. The region, particularly countries like China, India, and southeast Asian nations, will continue to dominate the production of key feedstocks such as palm oil, rice, sugarcane and natural rubber. Southeast Asia, especially Indonesia and Malaysia, will remain the world's largest producers of palm oil, a critical feedstock for biofuels, food and cosmetics.

Additionally, Asia's growing focus on renewable energy and sustainable practices will boost the production of bio-based feedstocks. Governments and private sectors are investing heavily in biofuel technologies, utilising agricultural waste and non-food crops to meet energy demands while reducing carbon emissions. China and India, with their large populations and expanding industrial sectors, will drive demand for feedstocks in both traditional and emerging industries, such as bioplastics and green chemicals.

However, challenges such as climate change, land-use conflicts and resource scarcity could impact production. To mitigate these risks, Asian nations are likely to adopt advanced agricultural technologies, precision farming and sustainable practices. Overall, Asia's feedstock production in 2025 will be characterised by innovation, scalability and a strong emphasis on sustainability, ensuring its pivotal role in global supply chains.

Given the pushback on palm oil use as a feedstock, what are the key factors for allowing palm oil to be accepted for certification? Is there an opportunity for palm oil companies to trade with Europe in a sustainable way?

Palm oil can achieve certification and acceptance, particularly in markets like Europe, by addressing key sustainability and environmental concerns. The primary factors for certification include adherence to stringent environmental standards, such as zero deforestation, no peatland development and reduced greenhouse gas emissions. Certification schemes like the Roundtable on Sustainable Palm Oil (RSPO) play a crucial role in ensuring these practices are followed. Companies must also demonstrate transparency and traceability in their supply chains, ensuring that palm oil is sourced from responsibly managed plantations. Social responsibility is another critical factor. Companies must respect the rights of local communities and indigenous peoples, ensuring fair labour practices and equitable benefit-sharing. Engaging stakeholders, including NGOs and local governments, can help build trust and credibility.

Usman Ahmed
Managing Director & Chief Executive Officer
Gamalux Sdn. Bhd.

"For palm oil companies, trading sustainably with Europe is indeed possible. The EU's Renewable Energy Directive (RED II) encourages the use of sustainably sourced biofuels, creating opportunities for certified palm oil producers. "

For palm oil companies, trading sustainably with Europe is indeed possible. The EU's Renewable Energy Directive (RED II) encourages the use of sustainably sourced biofuels, creating opportunities for certified palm oil producers. By aligning with these regulations and investing in sustainable practices, companies can access this lucrative market. However, the industry must also address the perception of palm oil as a driver of deforestation. Investing in innovation, such as higher-yield crops and waste reduction, can further enhance sustainability. By prioritising environmental and social responsibility, palm oil companies can not only gain certification but also build long-term partnerships with European markets.

What is the importance of aligning international sustainability criteria and certification to facilitate global trade and use of biofuels?

Aligning international sustainability criteria and certification for biofuels is crucial for facilitating global trade and promoting their widespread use. Firstly, harmonised standards ensure that biofuels meet consistent environmental and social benchmarks, which builds trust among trading partners and consumers. Without alignment, differing national or regional criteria can create trade barriers, as biofuels certified in one country may not be recognised in another. This fragmentation increases costs and complexity for producers, hindering market growth and limiting the global availability of sustainable biofuels.

Secondly, unified criteria enhance transparency and accountability in the biofuel supply chain. By establishing clear guidelines for sustainable production — such as reducing greenhouse gas emissions, protecting biodiversity and respecting land rights — aligned standards help prevent practices like deforestation or food displacement. This not only safeguards the environment but also ensures that biofuels contribute meaningfully to climate goals. Moreover, aligned certification systems simplify compliance for producers and exporters, reducing administrative burdens and fostering economies of scale. This encourages investment in biofuel production and innovation, driving down costs and making biofuels more competitive with fossil fuels.

Finally, international alignment supports developing countries by providing clear pathways to participate in the global biofuels market, promoting economic growth and sustainable development. In summary, aligning sustainability criteria and certification is essential for creating a cohesive, efficient, and equitable global biofuels market that supports both trade and environmental objectives.

An interview with Tianzhou International Trading Group

Eason Chen

General Manager

Tianzhou International Trading Group

Hear more from Eason at the Argus Biofuels & Feedstocks Asia Conference on 22-24 April in Singapore, in a session on how SAF producers are managing market demand, alongside EcoCeres.

"Japan has proposed the world's most aggressive SAF blending target, of 10pc by 2030. Singapore has announced a 1pc SAF blending target for all international departing flights in 2026. China launched the first phase of an SAF pilot programme at four major airports from September 2024 and will expand the second phase to more airports and airlines in 2025. "

With various countries introducing SAF policies, what has been the impact and how will they meet their SAF targets?

Although aviation only accounts for 2.5pc of global industrial CO2 emissions currently, it is with the highest growing rate in the transportation sector. If no actions are taken, aviation's share in global industrial CO2 emissions will surge to 20pc by 2050. As a hard-to-abate sector and truly international business, aviation needs efforts across the globe to achieve decarbonisation and sustainable growth. On top of the four areas identified by the International Civil Aviation Organisation that can contribute to international aviation decarbonisation, the successful development and deployment of SAF is vital.

SAF mandates became effective in the EU and the UK from January. The policy introduces long-term volumetric SAF targets for the aviation sector and begins at a 2pc blending ratio. According to the SAF Grand Challenge launched in 2021, the US will produce 3bn USG/yr of SAF by 2030 and 35bn USG/yr by 2050.

At first glance, Asia seems like a fragmented market without solid policy and developed legislation for SAF adoption, but in fact, countries in Asia have not been left behind. Japan has proposed the world's most aggressive SAF blending target, of 10pc by 2030. Singapore has announced a 1pc SAF blending target for all international departing flights in 2026. China launched the first phase of an SAF pilot programme at four major airports from September 2024 and will expand the second phase to more airports and airlines in 2025.

Although there are a lot of challenges to replace fossil jet fuel with SAF, such as higher cost, feedstock constraints and supply chain readiness, for the time being, it is a common goal for all human beings to endeavour to achieve cleaner skies tomorrow and together we are moving towards the right direction.

What is the current production capacity for SAF in Asia-Pacific and what advantages does the region have?

Global SAF production reached 1mn t in 2024, representing less than 1pc of global jet fuel production. So compared with traditional jet fuel, SAF is still a nascent market and has huge potential to grow. Current production capacity for SAF in Asia-Pacific is approximately 1.5mn t/yr, largely driven by facilities such as Neste's plant in Singapore and counterparts in China.

With HEFA as the prevailing technology among all commercialised SAF plants worldwide, Asia-Pacific countries have some unique advantages to help with SAF industry development, including feedstock

Eason Chen
General Manager
Tianzhou International Trading Group

"Under the HEFA pathway, a large part of the SAF cost is contributed by feedstock, thus it is an alternative for us to develop other vegetable oils that are non-edible but suitable for biofuel production. "

supply, construction and manufacture. For instance, China itself exported around 3mn t of UCO in 2024 to supply feedstock for biofuel plants worldwide.

With more and more SAF plants starting operations, countries in Asia-Pacific should not only play the role of feedstock contributor but scale up the SAF business across the whole value chain.

With the cost being higher than traditional fuel how can different stakeholders overcome this? How can the price premium of SAF be distributed across the value chain?

The high cost of SAF compared with traditional jet fuel is a significant challenge for its widespread adoption. Policy supports and incentives at this early stage are of great help. Apart from that, both supply and demand stakeholders can work together to create a more sustainable business.

Under the HEFA pathway, a large part of the SAF cost is contributed by feedstock, thus it is an alternative for us to develop other vegetable oils that are non-edible but suitable for biofuel production. Other pathways including FT technology help extend the feedstock to agricultural and urban residues and have great potential to bring down SAF costs, according to our test.

With increased SAF production, the unit cost is expected to decrease gradually. Meanwhile, the innovation of the business model is also important, among which the adoption of book and claim in SAF is a good solution — with physical SAF decoupled from environmental attributes, logistical costs can be greatly reduced, and enterprises can share the cost with airlines while achieving Scope 3 emissions reductions through carbon inset.

Christopher Ong
Managing Director **DHL Express, Singapore**

Hear more from Christopher at the Argus Biofuels & Feedstocks Asia Conference on 22-24 April in Singapore, in a panel that discusses collaboration across the aviation ecosystem, alongside the Asia Sustainable Aviation Fuel Association and Boeing.

What factors are most important when developing sustainability strategies for airlines?

Any successful sustainability strategy requires a long-term vision and commitment from the leadership team. At DHL, we started our sustainability journey in 2009 to drive carbon efficiency, and in 2017, we were the first company in the transport and logistics sector to set a 2050 net zero greenhouse gas emissions target.

Establishing metrics to measure and report progress is also critical in any sustainability strategy, for what cannot be measured cannot be managed. Doing so has not only enabled us to track our own sustainability progress and ensure accountability on our part but allowed us to provide standardised carbon reporting to our customers for their own accountability needs too.

Given that air transportation is an energy-intensive activity with a large carbon footprint, it is important to adopt renewables and rely less on traditional jet fuel. Since 2021, DHL has been actively purchasing SAF through its collaborations with SAF producers, with a target of blending over 30pc sustainable aviation fuels for our operations.

DHL Express operates a global air freight network that comprises our own freighters and partner airlines. To ensure we operate efficiently with a lower carbon footprint, we constantly look at our network demand to improve practices, such as optimising our flight routes by leveraging data analytics. We also invest in more fuel-efficient planes such as the Boeing 777 freighters. For example, DHL's crew and maintenance agreement with Singapore Airlines in 2022 allows us to operate five Boeing 777 freighters, which can cut CO2 emissions by 18pc compared with older models.

Finally, partnerships with stakeholders, like governments, industry partners and customers, are important for the purpose of sharing best practices and developing feasible solutions. It will be challenging for any organisation to do this alone.

With the cost being higher than traditional fuel how can different stakeholders overcome this? How can the price premium of SAF be distributed across the value chain?

Limited supply means SAF is currently up to three times more expensive than conventional jet fuel, mainly due to higher production costs and a lack of economies of scale. To address this growing demand, it is essential to scale up the supply of SAF. However, the nascent state of the SAF market and the volatility of its prices present inherent risks for both producers and buyers that need to be mitigated.

One way to do so is through collaborative agreements between airlines and SAF producers. Partnerships like that can create a stable and predictable demand for SAF while ensuring that airlines are not overburdened by the higher price. Airlines can also proactively engage with SAF producers to signal their demand. For instance, DHL has been purchasing SAF since 2021, with commitments from various producers to ensure a steady supply.

Customer awareness and alignment to utilise SAF is vital in this transition as well. This is essential to maintaining the momentum and driving the demand. We launched our DHL GoGreen Plus service in 2022, allowing our customers to lower the carbon emissions associated with their international air shipments using SAF, and effectively reducing their Scope 3 emissions. To date, we have seen tremendous success with thousands of customers onboard the service.

Lastly, governments play a crucial role in promoting SAF adoption through their policies. For instance, the EU has set a minimum supply mandate for SAF, starting with 2pc in 2025. Singapore has also become the first country to impose a sustainable fuel levy, aimed at signalling demand to SAF producers while maintaining the competitiveness of Singapore as an aviation hub. This initiative not only supports the growth of the aviation industry but also encourages airlines to invest in lower-carbon alternatives.

Sharmine Tan
Regional Sustainability Lead – Southeast Asia
Boeing

Sharmine will be part of a panel at the Argus Biofuels & Feedstocks Asia Conference on 22-24 April in Singapore that will discuss collaboration across the aviation ecosystem, alongside the Asia Sustainable Aviation Fuel Association and DHL Express.

How can southeast Asia utilise its waste feedstocks to meet its SAF targets?

Southeast Asia has sufficient feedstock to meet all its own jet fuel needs to reach net zero emissions by 2050, according to a recent Southeast Asia SAF Feedstock study published by the Roundtable on Sustainable Biomaterials (RSB) and supported by Boeing. The region could produce 45.7mn t/yr of SAF by 2050, with 75pc of the feedstocks coming from agricultural and post-consumer waste like cassava, sugarcane and municipal solid waste.

Among these feedstocks, rice husks and straw stand out as the most abundant and sustainable options for SAF production in the region. This means that countries like Indonesia, Thailand, Vietnam, Malaysia and the Philippines could play a major role in providing the raw materials needed to fuel aviation's green transition. Collectively, these five countries are responsible for about 90pc of southeast Asia's SAF potential, creating an incredible opportunity for regional collaboration.

But the potential doesn't stop at the environmental impact. By developing a local SAF ecosystem, southeast Asia can also boost its economy. This shift not only supports global aviation's carbon reduction goals but also promotes a more sustainable economy and living environments. Boeing collaborates with governments and local partners to develop region-specific SAF roadmaps, scale SAF production and to foster sustainability. It's an exciting time, and the region's waste feedstocks are key to making our net zero future a reality.

In a highly SAF policy active region, what should regulators pay attention to?

With Singapore, Indonesia and Malaysia announcing SAF Roadmaps in 2024, we have observed a positive momentum and more countries announcing their ongoing endeavours in developing their national SAF roadmaps and targets. We encourage a regionally harmonised SAF ambition, and policies should aim to avoid market distortions. Inconsistent SAF mandates implemented across different countries could increase the risk of competitive distortions. It is also equally important for polices to be technology and feedstock agnostic.

How can digital modelling tools identify how aviation's different sustainability solutions affect carbon emissions?

Digital modelling can make complicated topics easier to understand so we can spend more time discussing solutions, with data front and centre in decisions.

Boeing publicly launched the Cascade Climate Impact Model in 2023 to show how each of aviation's five decarbonisation strategies can impact carbon emissions through to 2050. Since then, we've continued to evolve it further in partnership with the Cascade User Community and our stakeholders from aviation, policy, energy and finance. In March, we launched Cascade 2.0, which is more comprehensive, customisable and user-centric to facilitate decision making.

What have we learned so far?

- **Lifecycle emissions across the whole value stream must be considered, as it's the total climate impact of emissions that determines the sustainability impact.**
- **Our industry's collective journey to net zero is dependent on the renewable energy transition, and the use of SAF on today's aircraft will play a critical role in that.**
- **Introducing new airplanes at a higher rate will reduce global emissions noticeably within a decade, as they offer better fuel efficiency.**
- **Electric and hydrogen aircraft will only make smaller contributions to aviation's emissions reduction until 2050 due to range constraints for electric-powered aircraft, and long development cycles, certification requirements and production timelines for hydrogen-powered airplanes.**
- **The path to decarbonising aviation is complicated and two things are essential to discuss solutions and make important decisions: credible data and collaboration.**

Marco Bonvini
Fuels, Chemicals Licensing & Business Development Director
NextChem

Marco will discuss new technological pathways at the Argus Biofuels & Feedstocks Asia Conference on 22-24 April in Singapore, in a session with Axens.

With various countries introducing SAF policies, what has been the impact and how will they meet their SAF targets?

Meeting the demand and mandates for SAF is challenging with a single universal solution. A more effective strategy is to diversify production methods and utilise various feedstocks available in different regions. NXC advocates for regional-scale plants, which can optimise logistics costs for feedstock, achieving sustainable commercial scale. Feedstock costs often represent the highest operational expenditure, accounting for 70-80pc. Reducing significant logistics costs will greatly benefit the overall business model. Furthermore, regional-scale solutions allow new industrial players, beyond the conventional oil and gas sector, to enter the market, enhancing the robustness and reach of SAF production targets.

How is the industry looking at synergising the different elements of the value chain to overcome the existing barriers around SAF production and offtake?

Given that feedstock is one of the most critical elements, vertical integration — such as NXC's approach in the North Sumatra Project in Indonesia — provides much greater solidity to the overall business plan. In North Sumatra, TPE, the main investor, is linked to the feedstock supplier and co-investor, the EPC contractor (part of the TPE group), NXC as the technology supplier and co-investor, and the SAF offtaker. This integration mitigates all risks by assigning each responsibility within the supply chain to the player best equipped to handle it.

"Given that feedstock is one of the most critical elements, vertical integration — such as NXC's approach in the North Sumatra Project in Indonesia — provides much greater solidity to the overall business plan."

How are existing refineries across the region adapting to contribute to SAF production? What is the feasibility and challenges of integrating SAF production facilities with existing refineries?

Transforming a fossil refinery into a biorefinery can seem more effective from a unit of capital expenditure ($/t of SAF) perspective. However, the costs associated with shutdowns and production halts must be factored into the overall investment. Additionally, since SAF relies mainly on second-generation feedstocks, converting a fossil refinery to a biorefinery would necessitate large-scale SAF production, which increases logistics costs and the risk of feedstock shortages. This could lead to a price race to secure the necessary feedstock, potentially jeopardising economic outcomes.

In some cases, it may be easier and more effective to add a new HEFA SAF plant. This approach benefits from existing infrastructure and utilities and can be sized according to the accessible feedstock basin. In the future, SAF production can be further expanded through alternative pathways, such as power-to-liquids, which utilise captured CO2 from HEFA and other processes on site. This would truly transform the refinery into a complex of renewable technologies, each targeting specific feedstocks.

Will HEFA continue to be the dominant technology in Asia?

Certainly, for at least the next 15-20 years, HEFA will remain a dominant technology. While other technologies will become effective over time, they will all face the same limitation of feedstock availability, whether it be waste, alcohols, green hydrogen or CO2. It is important to note that HEFA offers the largest variety of feedstocks. In this context, NXC is continuously investing in research and development to enhance its pretreatment processes and develop alternative technologies. This will enable the use and production of new feedstocks that are currently not usable or available with existing solutions.

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Managing Director
Amarus (Shanghai) Trading Limited

Daniel Brebner
Senior Manager, Global Energy
Rio Tinto

Felicia Ng
Senior Green Fuel Originator
Maersk

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