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War-driven oil shocks expose aviation's decarbonisation challenge

No single solution will be sufficient. BY JOHAN SULAEMAN

GEOPOLITICAL tensions have once again highlighted how vulnerable global energy markets are to disruption.

Conflict in major oil-producing regions tends to drive volatility in crude prices, with immediate consequences for sectors that remain heavily dependent on fossil fuels. Aviation is among the most exposed.

For global aviation hubs such as Hong Kong and Singapore, this underscores a deeper challenge.

Decarbonisation is not only about reducing emissions. It is also about managing long-term supply security and price volatility in a sector that depends on fuel supply chains exposed to geopolitical risk.

This context makes Singapore's recent decision to delay the rollout of its sustainable aviation fuel levy more understandable.

Demand-creation policies such as this levy are a necessary step for decarbonisation. They signal commitment, support early market development and begin shifting the sector towards lower-carbon alternatives.

However, cost pressures, industry readiness and broader economic conditions can slow the pace of transition.

More fundamentally, relying on sustainable aviation fuel alone may not be sufficient to decarbonise aviation at scale.

This points to a broader structural constraint. Even with strong policy intent, it will not fully resolve the underlying challenges facing aviation decarbonisation.

If Singapore and the wider region are serious about reducing emissions while preserving connectivity, policymakers will need a more diversified strategy – one that combines sustainable aviation fuel with high-integrity carbon markets, international crediting mechanisms and emerging technologies such as carbon capture and storage.

As a major aviation hub with strong financial and carbon market infrastructure, Singapore is well positioned to help develop these complementary solutions.

Sustainable aviation fuel's dual role and its limits

Unlike many other low-carbon technologies, sustainable aviation fuel can be used in existing aircraft with minimal modifications. This makes it one of the most practical near-term options for reducing aviation emissions.

Moreover, it can help reduce reliance on conventional jet fuel supply chains that are exposed to geopolitical risk.

Amid recent geopolitical tensions, higher fossil fuel prices may narrow the cost gap between conventional jet fuel and sustainable aviation fuel, while also underscoring the risks of relying on a single dominant fuel source.

In practice, however, sustainable aviation fuel supply is likely to remain constrained in the near term, meaning that conventional jet fuel will continue to play a central role in aviation. Moreover, even with a reduced price differential, the gap is unlikely to be sufficiently narrow to enable a full substitution away from conventional jet fuel.

Aviation demand in Asia is expected to grow rapidly over the coming decades. Meeting that demand while lowering emissions will require vast quantities of alternative fuels, far more than current sustainable aviation fuel production pathways can sustainably provide.

For South-east Asia, the transition to low-carbon aviation presents both an opportunity and a structural challenge. PHOTO: BT FILE

Most sustainable aviation fuel produced today relies on limited feedstocks such as used cooking oil and animal fats. These resources are not only finite but also expensive to produce and collect. This is consistent with other e-fuels, such as green hydrogen, which face scaling challenges due to the high operational costs associated with their production.

These constraints suggest that sustainable aviation fuel deployment will expand gradually rather than exponentially. Even with strong policy support, supply growth may not have the pace required to fully decarbonise aviation.

The role of carbon markets

Because alternatives to conventional jet fuel remain limited, carbon markets will continue to play a critical role in aviation decarbonisation.

These markets provide flexibility by allowing emissions reductions to occur where they are most cost-effective. For aviation, this is particularly important, as technological alternatives remain relatively limited compared to other sectors.

At the same time, concerns about the integrity of carbon credits have highlighted the need for stronger governance.

Clear eligibility criteria, robust monitoring and verification, and greater transparency are essential to ensure that carbon markets deliver genuine climate benefits.

High-integrity carbon markets can therefore serve as a bridge. They enable emissions reductions while lower-carbon technologies are still scaling.

Addressing the residual emissions problem

Even with accelerated sustainable aviation fuel deployment, a large share of aviation emissions will continue to come from conventional jet fuel for decades. Carbon capture, utilisation and storage (CCUS) offer a way to address this residual emissions problem.

CCUS technologies capture carbon dioxide from industrial processes or fuel-related activities and store it permanently in geological formations. Under certain conditions, this can generate geological carbon credits that reflect durable emissions reductions.

Carbon capture does not eliminate reliance on conventional jet fuel. Rather, it reduces the net emissions associated with its continued use. In a sector where scalable fuel alternatives will take time to develop, this can play an important transitional role.

While sustainable aviation fuel addresses the fuel substitution challenge, CCUS and geological carbon credits address emissions that cannot yet be avoided. In this sense, they are complementary rather than competing approaches.

Amid the current Middle Eastern crisis, approaches such as these remain necessary to manage emissions associated with continued dependence on conventional jet fuel.

South-east Asia's strategic opportunity

For South-east Asia, the transition to low-carbon aviation presents both an opportunity and a structural challenge.

Across the region, countries have access to biomass, agricultural residues and other potential feedstocks that could support sustainable aviation fuel production. This creates the basis for South-east Asia to become an important supplier of the fuel over time.

Yet even as South-east Asia could play a meaningful role in sustainable aviation fuel production, supply alone will not be sufficient to deliver aviation decarbonisation at scale.

The region's opportunity thus lies in developing a more comprehensive ecosystem that supports multiple decarbonisation pathways. Moreover, South-east Asia is often touted as having some of the highest potential for carbon storage in geological formations.

By linking sustainable aviation fuel deployment with robust carbon markets, as well as CCUS and geological carbon crediting mechanisms, South-east Asia's aviation decarbonisation efforts can be more resilient and scalable.

Within this regional context, Singapore's role is distinct. It could serve as a key platform for regional coordination and market development.

As a global hub for aviation, energy trading and finance, Singapore is well positioned to aggregate demand, mobilise capital and develop trusted market infrastructure, providing a strong foundation for scaling these complementary solutions.

A pragmatic path forward

Aviation will remain one of the most difficult sectors to decarbonise. No single solution will be sufficient.

The current volatility in global energy markets is a reminder that aviation's transition is not only a climate imperative, but also a strategic one.

If Singapore succeeds in building a system that combines fuel diversification with credible emissions mitigation pathways, it will not only reduce aviation emissions. It will also strengthen the sector's resilience in an increasingly uncertain world.

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