The EU's Green Deal sets out a bold ambition and proposes supportive revisions to three key policy directives

The EU wants a SAF transition, but at what cost?

On 14 July, as part of the European Green Deal, the EU announced a broad new package of policy proposals which aim to accelerate decarbonisation of the aviation sector.

If fully implemented, the measures will have a significant impact on the EU's aviation industry. However, while the initiatives will undoubtedly increase costs for industry participants and passengers, will they achieve their objectives?

The new ReFuelEU Aviation Initiative mandates blending of sustainable aviation fuel (SAF) with fossil fuels at 5% by 2030, 32% by 2040, and 63% by 2050.

The initiative applies to all fuel suppliers providing fuel at EU airports and all airlines, whether EU or foreign, must annually uplift from each EU airport 90% of the fuel required for flights from those airports, to try to minimise unnecessary tankering.

Currently approved processes specify a maximum blending ratio of 50%, but Rolls-Royce has announced plans to make all its civil engines compatible to run on 100% SAF, with tests underway.

The revisions to the Emissions Trading System (ETS) will see fewer free allowances for aviation, further reduction over time and increased auctioning, reflecting the EU's desired 'polluter pays' policy.

This will, undoubtedly, make fossil fuel offsetting harder and more expensive.

The revisions to the Energy Tax Directive will initiate a tax on aviation kerosene and align its rate to motor fuel, as well as differentiate between first generation biofuels (around 50% of the proposed kerosene tax level) and advanced biofuels, including synthetic liquid fuels (around 1.5% of the proposed kerosene tax level).

John Goddard

Philip Meier

SAF to decarbonise aviation

The EU recognises that, in the medium-to-long term, the introduction of new propulsion technologies (e.g. hydrogen, electric hybrids and full electric) will transform the carbon footprint, appearance, performance and engineering of many aircraft.

However, current technology roadmaps suggest these will provide insufficient energy density for larger, longer-range aircraft. Hence, SAF is both the most immediately implementable solution and will be the only solution that addresses the whole industry for a considerable time to come.

Some additional benefits can still accrue from overall aviation system efficiencies not fully addressed in the EU Green Deal, such as the Single European Sky initiative that IATA believes should deliver a 10% reduction in current emissions.

The ongoing launch and rollout of newer more efficient aircraft – new generations of aircraft are typically 15-20% more fuel efficient per flight than the ones they replace from 15-20 years earlier – will also deliver some benefits.

Without SAF, the only other solution to accelerate decarbonisation would be draconian demand management policies, which would decimate the industry and are not a realistic alternative.

So, in the near-to-medium term, SAF, which currently represents less than 0.01% of EU aviation fuel, is the only solution to significantly progress aviation decarbonisation.

SAF currently faces five critical issues

The EU has established a target for SAF blending levels and is proposing to put in place elements of legislation and government support. However, five key issues remain to kick-start a ramp-up in SAF production:

1. There are no incentives specifically designed to drive uptake of SAF;
2. Currently SAF costs two-to-six times as much as kerosene, making it prohibitive for airlines;
3. Limited availability of sustainable feedstock;
4. No refineries are currently operating at a commercial scale and have a very limited total capacity;
5. SAF is not currently an investable proposition, so access to finance is limited.

There are no incentives specifically designed to drive uptake of SAF

Aviation's carbon emissions are a negative externality that society and governments are increasingly unwilling to accept given the need to target net zero. Hence, it seems reasonable that governments help incentivise and fund the start of the transition to SAF, essentially internalising those externalities.

The EU currently provides some financial support to biofuel development through H2020 funding and the European Strategic Energy Technology Plan (SET Plan) but these tend to be early stage and technology focused.

These programmes may lead to new solutions but are, in general, a very long way out.

The EU itself estimates that a price of at least €160 per tonne of CO_2 emissions would be required to make SAF commercially viable for airlines, yet the 2030 Climate Target Plan projects carbon prices for the ETS sector at between €32 and €65 per tonne of CO_2.

Ultimately, the updated EU aviation taxation scheme may have unintended consequences, in terms of relative competitiveness of the sector with other regions, for example, but it is much simpler and quicker to enact.

Note that it has taken 20 years from the start of the 'dot com' revolution for a global digital tax policy to be agreed by the G20 in response to companies optimising where they choose to recognise profits.

Currently SAF costs two-to-six times as much as kerosene, making it prohibitive for airlines

At the current negligible level of volume, the lowest cost pathway is Hydroprocessed Esters and Fatty Acids (HEFA) with costs higher for other less technologically mature pathways. The EU estimates industry cost increases of €15 billion to €20 billion to achieve the blending mandate which is equivalent to an approximate 8% increase in fares by 2050 (based on 77% growth in passengers).

Given that, on average, fuel represents 20-25% of airline operating costs (albeit significantly higher for long haul flights), the EU's estimate is likely to be on the low side.

Absent a significant reduction in SAF costs, there is also a real risk that airlines become 'price takers' in a tight supply market which damages their already sensitive operational economics and leads to higher passenger fares.

Limited availability of sustainable feedstock

Feedstock availability is challenging in the near-term and while cooking oil or animal fat can be utilised by the HEFA pathway, its availability is the limiting factor and it will not be a scalable solution.

Longer term advanced biofuels and synthetic liquid fuels are the only real solution, but the technology readiness of the processes and resource availability are expected to remain challenging for some time to come.

No refineries are currently operating at a commercial scale and have a very limited total capacity

Current SAF production is negligible and while plans for new facilities in the EU and UK have been announced, for example Altalto Immingham's waste to fuel plant and SkyNRG's HEFA facility, in the last couple of years, the current plans represent capacity of about 3 Mt in 2030 – just 6% of EU fuel requirement.

There are also a growing number of existing refineries producing biodiesel and bioethanol to meet demand from road transport that could be used to produce SAF.

In the near term, blending mandates, such as E10 in the UK, are likely to increase demand from road transport, albeit this capacity may be available for SAF longer term, as road transport transitions to electric vehicles or fuel cells. This, however, cannot be a planning assumption for SAF.

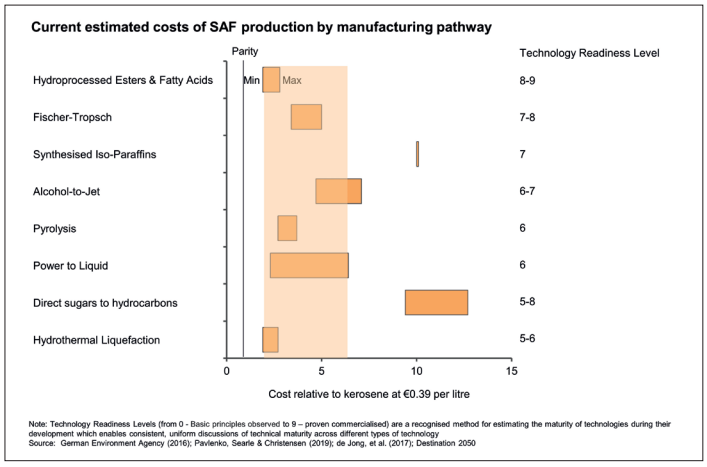
The EU assumes that around 100 additional SAF plants will be built by 2050 with a capacity of 25 Mt rather than the current rate of 0.1 Mt per annum.

This requires a step change in industry investment.

The EU estimates the required capex at just an incremental €10 billion in the aviation sector – this excludes the capex required to create new hydrogen and power generation infrastructure, which will also be needed to support production.

The €10 billion equates to just €420 per tonne of production capacity versus the €800 to €3,000 per tonne estimated by the International Civil Aerospace Organisation (ICAO).

The EU appears to be assuming a rapid technological development and a sharp reduction in capital and operating costs, as new larger facilities are built. These assumptions look very optimistic and, therefore, it is highly likely that actual industry costs will be much higher.



SAF is not currently an investable proposition, so access to finance is limited

Investing in SAF refinery capacity is currently perceived to be high risk and insufficiently attractive. Oil and gas majors have lucrative kerosene businesses that SAF would cannibalise and are waiting for the opportunity for SAF to become attractive and/or regulatory impetus.

Today, it is also perceived too risky for infrastructure type investors and airlines and airports lack the financial strength (particularly post COVID-19). The key risks are:

- Technologies remain unproven at commercial scale;
- Capital cost overruns are likely on the first wave of new refineries;
- Potential to be very uncompetitive on cost (vs kerosene);
- Risk that hydrogen or electric propulsion replaces jet engines in the 2040s resulting in only a 20-25 year lifespan for SAF assets.

It is important to recognise if the oil and gas majors decide to act, significant capital could be brought rapidly when one recognises annual refinery capex pre-COVID averaged $150 billion (€126 billion) and many oil majors now have emerging or new energy funds but are waiting for incentives and opportunities to leverage existing capacity.

Recent announcements from Chevron and Exxon that they are studying SAF production using existing refineries are signs of progress.

The EU's SAF blending targets will help provide some certainty, but fundamentally, there is still significant technology risk with a major cost differential to reduce.

There are significant barriers to establishing a scale SAF industry and further bold actions are required to deliver the EU's objectives.

The EU has rightly set ambitious objectives and is proposing to put in place some of the necessary legislative and government support, but addressing these five key issues to deliver the target reduction in aviation emissions is a massive challenge which will require:

- Developing new or substantially improved technologies to meet the cost and emission targets;
- Mobilising a broad industry coalition including both the aviation sector and critically the downstream supply chain to secure feedstock and the biorefineries to process it;
- Further policy and financial support from governments. ●

For more information:
This article was written by John Goddard, senior partner in L.E.K. Consulting's industrial practice and a founding member of the L.E.K. Consulting Sustainability Centre of Excellence's executive board, and Philip Meier, senior principal in L.E.K. Consulting's industrial practice. Visit: lek.com