DECARBONISING AIR TRAVEL

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The coronavirus may have slashed demand for air travel but a recovery is expected and, with it, extra growth and extra greenhouse gas emissions. Options to make aviation greener exist but sorely need investment and regulatory support to take off in a big way.

In this Special Report, EURACTIV looks at how aviation’s environmental footprint could be reduced and what technologies are best placed to deliver the emissions savings necessitated by climate targets and growing public awareness.
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The environmental impact of flying may have decreased in 2020 due to the coronavirus pandemic but sustainability is still on the radar of the industry, which is increasingly eyeing greener fuels as a way to reduce greenhouse gas emissions.

Aviation accounts for 3% of the European Union’s carbon emissions and that number is expected to grow over the course of the decade if passenger demand recovers from the chilling effect of the coronavirus outbreak.

At the EU level, overall climate targets are set to be tightened, with extra focus likely to be paid to aviation’s polluting ways, and at the global level, the industry has committed itself to carbon-neutral growth after 2020.

Unlike the road transport sector, which is able to resort increasingly to low-emission technologies like battery-power, hydrogen and, more simply, a modal shift to other options like rail and sail, aviation technology is not so mature.

Aerospace giant Airbus announced plans earlier this year to develop hydrogen-power by 2035 at the earliest and although battery-powered prototypes are taking to the skies more frequently, their technical limitations mean long-haul flights are unfeasible currently.

That is why airlines are turning more towards sustainable aviation fuels (SAFs), a greener alternative to kerosene that can be produced using waste residues or synthesised using renewable energy.

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One of the main advantages of SAFs is that they are compatible with existing aircraft engines and can technically be used to completely replace kerosene. However, current standards stipulate that a 50% blend is the maximum permissible.

Given that their chemical composition is identical to fossil jet-fuel, SAFs still emit carbon when burned. But because those emissions are equal to the CO2 absorbed by the materials used to make the fuels, their environmental impact can be neutral.

The challenge now is scale and cost. SAFs supply around 0.01% of global demand and can cost between two and five times more than kerosene, depending on what raw materials are used in production. Using renewable energy boosts that figure even higher.

“As a result of these higher production costs, SAFs are, in absence of an orchestrated support strategy, not an economically attractive substitute to conventional jet fuel,” writes industry trade body Airlines for Europe in a briefing paper.

Some countries have started to introduce blending mandates to spur supply and there are also calls for the EU to implement a bloc-wide obligation on the industry. That could be announced later this year as part of a new European Commission-led initiative.

Finnish MEP Elsi Katainen told EURACTIV that an EU-wide target would be “an effective tool”. She also called for the definition of what feedstocks can be used to produce SAFs to be made as broad as possible.

A revision of the Renewable Energy Directive (RED II) is scheduled for next year and could be used to widen the scope for what is considered a sustainable raw material and give refiners extra room to manoeuvre.

In terms of the funding needed to develop SAFs further, scale them up and build the extra infrastructure needed to accommodate them, the EU’s carbon market – the Emissions Trading System (ETS) – is set to play an important role.

The Commission’s head of carbon markets, Beatriz Yordi Aguirre, said that billions of euros in revenues generated by the ETS can be funneled by member states into R&D or other initiatives aimed at boosting SAF uptake.

“There is no dichotomy or debate between alternative fuels, innovation and ETS. All three can work together,” Yordi said when asked if the Commission relies too heavily on the carbon market.

She pointed out that the Innovation Fund, a €10 billion-strong reserve fuelled by the ETS, is a funding option. Calls for projects opened this year and the scheme will run until at least 2030.

CLEANER FUELS, MORE ENGINES?

If SAFs are able to take off at the scale needed to make a significant dent in the sector’s carbon footprint, it could spark a virtuous circle of fleet renewal and next-generation ultra-efficient aircraft.

Older planes cannot handle a 100% mix of the cleaner fuels, as the pollutants contained within kerosene actually help seal older engines, preventing leaks. Newer engines do not have that problem.

Earlier this year, Airbus CEO Guillaume Faury called for a ‘cash for clunkers’ style scheme for aircraft, which would see airlines given some sort of incentive to retire older aircraft before their end-of-service date.

Carriers like Air Baltic have managed to ride out the coronavirus slump by relying on their fleets of newer, efficient, smaller aircraft and the clunkers idea has its advocates in Brussels too.

MEP Marian Marinescu told EURACTIV that “recycling programmes for planes would be very useful, as there are newer engines that are much more sustainable. Airplanes have long operating lives. So this will not be possible without EU or government support.”

The French and Dutch governments are among those that have bailed out their national carriers with billions of euros, setting sustainability criteria in exchange for the support. Renewal schemes could, therefore, go hand-in-hand with increased SAF uptake.
Futuristic flight technologies like battery-power and hydrogen are on the radar but sustainable aviation fuels (SAFs) are an already-available option that should be utilised more, MEP Elsi Katainen told EURACTIV.

Elsi Katainen is a Finnish MEP with the Renew Europe group. She is a member of the European Parliament’s transport committee and vice-chair of its agriculture committee.

She spoke to EURACTIV’s Sam Morgan.

**Does aviation need to be decarbonised urgently or do you think there are other parts of the economy that need attention more pressingly?**

To reach the EU’s ambitious climate targets and make the economy sustainable we need to reduce emissions in all sectors, from energy to agriculture and transport. Decarbonising our transport sector in a fair way is no doubt one of the trickiest tasks. It is clear that we need a broad approach looking at every transport mode, including aviation, which has been, despite the technological progress, one of the faster-growing sources of greenhouse gas emissions before the pandemic. However, I would not prioritise one part over another, we need to act simultaneously in all sectors of our economy. The horizontal approach on climate action taken in the Green Deal is in this regard very welcomed.

**How can the EU help increase the uptake and use of SAFs?**

The EU has to create a stable policy framework that creates certainty for companies to invest. I believe an EU-level blending mandate would be an effective tool in this respect. Secondly, we need a wide perspective on

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**sustainable feedstock defined in the Renewable Energy Directive (RED II).**

**Are you encouraged by what is allocated under the next EU budget? Or is there cause for concern? R&D funding has, for example, suffered.**

The multiannual financial framework negotiations have been more difficult than usual. In the European Parliament, we have demanded a more ambitious EU budget for innovation and research, and I am disappointed to see that EU leaders did not deliver on this during the summer. There are many important research challenges related to aviation that we need to tap into, from sustainable fuels and fuel efficiency to electrification and digitalisation.

**What do you expect from the Commission? There hasn’t been much in terms of detail on this issue as part of the Green Deal as of yet. Would some sort of ‘aviation package’ be a good idea?**

We are expecting a proposal on SAFs, the so-called “ReFuelEU Aviation”, to come out from the Commission early next year. In addition, the Commission recently introduced an upgrade on the European Single Sky regulation (SES 2+) which can help cut emissions in aviation by creating shorter and more efficient flying paths in Europe. I like the idea of a package in a sense that it is very important that we look at all the different proposals affecting the aviation sector as a whole, so that we have a clear picture on what are the effects economically, socially and environmentally.

**What can aviation learn from road transport’s relationship with biofuels over the last few decades, which – at European level at least – was a bit controversial and divisive?**

Member states have been successful in driving the scale up of biofuel use in road transport thanks to regulatory measures that have created the growing market for biofuels, successfully leading to investments in European biofuel production. This can be achieved in aviation as well with the help of a blending obligation. The focus should be on ensuring broad acceptance of sustainable raw materials to achieve full the potential of SAFs, including wastes and residues and novel vegetable oils, such as cover crops and vegetable oils growing on degraded land. These do not involve such land use change risks that have created controversies in the past with biofuels.

**Given how the pandemic has slashed air travel demand, is there somewhat of an opportunity now for airlines to ‘build back better’ and invest in SAFs or is this too delicate a time for that?**

I believe the time is opportune to build a credible roadmap for greener aviation. An EU-wide mandate would help to reduce the negative competitive effects of growing SAF use. Also the impact on flight ticket prices is modest when the cost of SAF use is based on the entire jet fuel use in Europe. In addition, we would have enough SAFs for greater shares from the beginning as the total use of kerosene will probably be still some years lower than expected.

**Can Europe build a well-functioning domestic SAF value chain or will it have to rely on external suppliers?**

I think Europe is well positioned to build working SAF supply chains with good availability of raw materials and leading companies in the biofuels market. There are several investment projects already in the pipeline from various players, such as Neste, Preem, St1, Total and UPM to build production capacity in Europe.

**How are SAFs approached in Finland? Are there support measures in place and are there any promising trends?**

The Finnish government is aiming to introduce a blending mandate which would increase the share of SAFs to 30% by 2030. This is one of the most ambitious targets in the EU and in line with Finland’s target of climate neutrality by 2035.

Our Nordic friends are also forerunners. For instance, Norway already set a blending mandate earlier this year. In addition, Sweden recently announced that it would introduce a greenhouse gas reduction mandate for aviation fuel sold in Sweden starting next year.

**Do you see SAFs as a stepping stone towards more advanced fuels like synthetic kerosene or even a radical change like hydrogen power (as recently announced by Airbus)?**

Hydrogen-powered aircraft are not expected to play a significant role in commercial aviation in the next decades, so indeed we have to make use of the already available means to get decarbonisation of aviation moving.
The European Commission will soon unveil its ‘ReFuelEU’ initiative, aimed at ratcheting up the amount of sustainable fuel used in aviation. The scheme is eagerly awaited as cheaper access to greener fuels could help reduce air travel’s carbon emissions.

Electric battery-power and hydrogen are two promising technological solutions in the road transport sector’s quest to reduce its environmental footprint but for aviation, those two options are nowhere near as mature.

The range-to-weight ratios of the current generation of batteries limit electric power's potential applications in flight. Although hydrogen promises on paper to go further, lack of prototypes and development makes it more of a prospect for the next decade.

In the meantime, so-called sustainable aviation fuels (SAFs), which work in existing engines and are produced using waste materials or renewable energy, have been touted as a ready-to-use, drop-in alternative.

SAFs have a separate raft of challenges to overcome.

According to the International Energy Agency, “the availability of suitable fuels is low. In addition, uptake is constrained by costs that are higher than fossil fuels at current oil prices, especially since policy support is less widespread than for road transport.”

Under the agency’s sustainable development scenario, low-carbon fuels need to supply 9% of aviation's demand by 2030. However, in 2018 global use topped out at just 0.01%, illustrating the immense challenge the sector faces.

The European Commission aims to boost supply and demand for SAFs with its upcoming ReFuelEU initiative, which is likely to include a blending mandate, increased multipliers to help countries hit renewable energy targets, and better monitoring.

According to the Commission, SAF use in the EU only hits an estimated 0.05%, although the executive admitted in an assessment published earlier this year that limited information makes calculating that

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figure a challenging prospect.

In lieu of extra measures, demand will only increase to 2.8% by 2050, the Commission warned. As part of its new initiative, it plans to impose “a minimum share of SAF, which would gradually increase over time, to be supplied to airlines and/or a minimum share of SAF to be used by airlines.”

Exact details about how ambitious the blending mandate would be are still scarce, although sources familiar with the Commission’s current preferences suggest that one possible option is up to 5% by 2030.

Dr Christoph Wolff, a mobility expert at the World Economic Forum, suggest that “ideally, you would harmonise the blending percentage and prevent ‘tank tourism’. A level playing field is needed for this to work.”

Some countries have already started to deploy blending mandates. Norway introduced an initial 0.5% requirement at the beginning of 2020 to spark demand, while Sweden plans to introduce an emissions reduction target just for aviation next year.

In terms of timeframe, the Commission is set to indicate in a new aviation climate impact study that a SAF mandate could be implemented within two to five years, based on findings collated by the European Aviation Safety Agency (EASA).

The study is currently in draft form and will reportedly be published in November.

**FURTHER TWEAKS**

Beyond the headline-grabbing blending target, ReFuelEU will also look into changing aspects of the EU’s renewable energy directive (RED II), a vast collection of rules governing clean energy and its deployment into various sectors.

Under the current directive, which was only recently finalised and will run up until 2030, 14% of transport fuels must derive from renewable energy by the end of the decade. To spur countries into action, RED II offers so-called ‘multipliers’ as percentage-boosting perks.

“Currently, with a 1.2 multiplier for aviation, member states where biofuel is supplied to the aviation sector are allowed to count towards their national target 20% more than the SAF volumes provided,” the Commission’s initial assessment explains.

It adds that “the approach could be further specified ensuring a harmonised implementation and the multiplier could be increased”.

However, in its feedback on ReFuelEU, Sweden’s infrastructure ministry warned that “an increased multiplier would likely lead to a decrease in the total use of renewable energy in the transport sector, which goes against the purpose of increasing the use of SAF.”

The ministry also insists that the initiative “should not exclude food and feed-based biofuels that fulfil the sustainability criteria and minimum greenhouse gas savings criteria”, suggesting that there will be a debate between the Commission and member states.

Given the EU executive’s intention to update all of the bloc’s clean energy rules as part of its quest to increase an overall emissions reduction target from 40% to 55%, other pieces of legislation are also likely to come into focus.

Early in 2021, the EU’s carbon market – the emissions trading system (ETS) – will be revised too. Issues like what to do with the maritime sector, whether to include road transport and aviation’s allocation of free pollution permits will all be addressed.

The Commission’s carbon markets director, Beatriz Yordi Aguirre, told EURACTIV that “the ETS is a machine that is designed so that it can invest in things like biofuels”, either through revenue payments to national governments or from its innovation fund.

“There is no dichotomy or debate between alternative fuels, innovation and ETS. All three can work together,” she added. The EU executive has also been urged by airline groups to make sure that whatever changes are made take into account the global context of aviation.

Another important aspect that ReFuelEU aims to address is a monitoring and reporting gap, which currently means that actual SAF usage is often difficult to estimate. That proposed part of the draft initiative is likely to garner widespread support.
Boosting the use of greener jet-fuel is a regulatory challenge but operationally, it is a less complex affair. Airports, airlines and manufacturers have all shown interest in sustainable aviation fuels (SAFs) and are starting to use them more and more. Here are some of the success stories so far.

SAFs are chemically identical to conventional kerosene so can be used in the engines of modern airliners and stored in the same tankers. Blends of up to 50% are currently allowed under international standards.

Price and manufacturing capacity are the main hurdles, as SAFs are between two and five times more expensive than kerosene, while production levels are nowhere near high enough yet to satisfy the potential demand of the global industry.

An upcoming initiative from the executive branch of the European Union will aim to stimulate the entire supply chain, possibly by implementing a minimum target for fuel blends across the bloc.

But the aviation sector has already started to board the green jet-fuel bandwagon, as market-leading airlines, aerospace giants and even technology companies are making use of what capacity there already is.

**PLANE PIONEERS**

In Europe, Dutch airline KLM and Scandinavia’s SAS are among the most prominent carriers that are using SAFs on a regular basis, while Germany’s Lufthansa took the leap back in 2011. Other airlines have trialled the fuels but are yet to deploy SAFs more frequently.

KLM announced last year that as of 2022 it will use 75,000 tonnes of SAF every year, produced at a new factory near its hub in Amsterdam. It is currently the only carrier to use it on transcontinental flights.

“Using sustainable aviation fuel is currently one of the most effective ways to reduce CO2 emissions in the airline industry,” company CEO Pieter Elbers said when the partnership with Finnish refiner Neste was announced.

The Dutch flyer will use the fuel out of its Schiphol base. Airport CEO Dick Benschop told EURACTIV that the hub has invested in Europe’s first SAF plant and has also put money into a pilot project near Rotterdam that aims...
to produce fuel from CO2, water and renewable energy.

Airlines are generally free to broker their own fuel deals with suppliers, although there is still a role to play for airports in greening aviation. London’s Heathrow recently announced that it would waive charges for electric aircraft.

Asked if Schiphol is considering something similar for SAFs, Benschop replied they are “considering to stimulate it through our charges, but there are more options. We haven’t made our mind up yet.”

Scandinavian offers flygskam-wary travellers another option: passengers can choose to pay extra for their flights, similar to how other carriers allow frequent flyers to offset their emissions, although these payments are used to buy blocks of SAF for use on other flights.

Further afield, non-European airlines have also started using the greener fuels. Japan’s ANA, the country’s main carrier, started using SAFs in October and is the first airline to operate flights out of Japan using them.

“While COVID-19 has forced us to make adjustments, we remain committed to meeting our sustainability goals,” said ANA executive Yutaka Ito. The airline insists that sustainability certificates show that life-cycle CO2 reductions will top 90% compared with kerosene.

Tech giant Microsoft, meanwhile, will pay extra for employee flights between its Redmond, Washington, headquarters and destinations in California, as part of a deal with Alaska Airlines. Microsoft aims to go carbon-neutral by 2030.

“We hope this sustainable aviation fuel model will be used by other companies as a way to reduce the environmental impact of their business travel,” said Microsoft’s Judson Altschaff. In a statement, both firms said they hope the deal will “send a positive price signal”.

**BUILDERS BACK BETTER**

The global aerospace duopoly of Airbus and Boeing is also backing cleaner fuels more and more, although the former sees a future beyond the combustion engine, having recently unveiled plans to develop hydrogen-fuelled aircraft by 2035.

As of 2016, Airbus has started offering its airline customers the option of fuelling their new jets with SAFs for their delivery flights. In October, SAS took delivery of three new planes that were filled with a 10% blend.

In July, Airbus started offering the service from its Hamburg plant. The first delivery of aircraft using SAFs flew across the Atlantic and were carbon-neutral when combined with an offsetting scheme.

The European aerospace firm is also driving the market in other ways. Indirectly, its newer generation of efficient engines makes SAF uptake technologically possible, as the more advanced tech makes higher blends perfectly feasible.

Directly, Airbus has started fuelling its fleet of massive ‘Beluga’ transport aircraft – specially designed cargo planes that ship components, wings and even fuselages between the firm’s vast network of factories – with green fuel on select routes.

US rival Boeing, hit hard by both COVID-19 and the ongoing headache of the MAX grounding scandal, has also ramped up its efforts as part of its long-running ecoDemonstrator project.

In September, an Etihad 787 was fuelled with a 50/50 blend of SAF and kerosene, the maximum currently allowed, for a test flight across the US. The green fuel was produced from non-edible plant material grown in the desert.

Etihad CEO Mohammad Al Bulooki called the flight a “monumental step forward for the sector to prove the viability of producing a 50/50 blend of SAF at a high volume.”

World Economic Forum expert Christoph Wolff explained to EURACTIV that the Middle East carriers and hubs have an important role to play in the global landscape, given the region’s importance in long-haul transit flights.

Airlines are generally in agreement then, and if the price of SAFs can be reduced to a comparable level with kerosene, by deploying clear long-term regulatory measures, there is little standing in the way of an enthusiastic uptake.
Towards climate-neutral aviation: Blending mandate for the European Union

By Thorsten Lange | Neste MY - Sustainable Aviation Fuel

Aviation is the fastest growing transport sector, and it will continue to grow despite the current COVID-19 crisis. Regulatory support is needed to achieve the sector’s emission reduction targets.

Thorsten Lange is the Executive Vice President, Renewable Aviation of Neste.

With a view to the EU’s short- and long-term climate targets, the aviation sector needs solutions for decarbonisation today. The ambition level needs to be high to achieve the EU’s climate neutrality by 2050. Existing solutions, sustainable aviation fuels, can help the sector to get there, if necessary regulatory decisions are made.

The EU needs to make sure that its aviation industry is not left behind by providing requirements that create a credible long-term market with intermediate targets, and attract the needed investments. Additionally, incentives for the development of new technologies are needed.

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**SUSTAINABLE AVIATION FUEL – THE ONLY VIABLE ALTERNATIVE TO FOSSIL LIQUID FUELS FOR POWERING COMMERCIAL AIRCRAFT**

Neste’s sustainable aviation fuel (SAF) provides a cleaner alternative to fossil fuels, achieving up to 80% reduction in greenhouse gas (GHG) emissions compared to fossil jet fuels, over the lifecycle and in its neat form. In addition, SAF also provides additional climate and public health benefits through substantially reduced particulate emissions. According to recent research, the non-CO₂ effects of aviation can have equal or even higher climate impact than carbon emissions.

Neste’s biofuel for aviation – Neste MY Sustainable Aviation Fuel™ (SAF) – is made from 100% renewable waste and residue raw materials. It is a fully compliant drop-in solution for existing jet engines and can be blended with conventional fossil jet fuels up to a maximum level of 50% according to present standards. There are no large-scale alternatives to liquid hydrocarbons, i.e. sustainable aviation fuels, in aviation in the foreseen future.

Airports and airlines agree that SAF is the only available way for the aviation industry to reduce its net carbon emissions, together with more efficient aircraft and operational improvements. It is key to work together to offer the private consumer and corporate passengers a way to actively choose to reduce their carbon footprint and thereby cover the higher cost of SAF. However, regulatory support is required to stimulate both the demand and supply of SAF.

**WHY DO WE NEED A BLENDING MANDATE?**

SAF is still at least 3-5 times more expensive than fossil fuel, depending on the technology pathway used. Therefore, incentives are needed for airlines to be able to take this step. A blending mandate for the EU would support this development and create a credible market to attract investments.

The ramping up of global and European SAF production has already started and can continue rapidly, provided that the necessary regulatory decisions are made. Lead times for new biofuel plants are long. Thus, a mandate (1) needs to be decided as soon as possible, (2) ramp-up trajectory needs to be gradual, and (3) be designed for the long-term to provide the certainty needed to trigger investments and give enough time to accumulate returns.

A SAF blending mandate of a minimum of 10% is needed by 2030 to get the aviation sector along in contributing to the climate neutrality goal. If decided soon enough, this ambition level corresponding to the amount of 5-6 Mton of SAF in 2030 (uptake of the European jet fuel) can realistically be achieved. In addition, new plant oils (e.g. intermediate crops and crops from contaminated and degraded land) could bring more availability.

**WIDE FEEDSTOCK POOL IS KEY**

Sustainable feedstocks are available, but their eligibility in the EU legislation cannot be limited only to a narrow pool of ‘advanced biofuels’ as defined by the Renewable Energy Directive (RED II). All sustainable waste and residue feedstocks under the RED II need to be accepted for SAF; there are e.g. plenty of sustainable waste and residue feedstocks which are not explicitly listed in Annex IX of the RED II. For the uptake of sustainable aviation fuels and the decarbonisation of the sector, the sustainability criteria of the RED II need to be the basis for all SAF specific regulations in Europe.

Experience from on-road is clearly demonstrating that a mandate ensures most efficiently the desired uptake, while being market-based and thus cost-efficient. A stable policy framework over a sufficient time horizon would also provide airlines to pursue an efficient and more climate-friendly fuels policy.

Research and Development support and additional incentives are also needed for the future, but they alone cannot decarbonise the aviation sector soon enough nor trigger the SAF production investments needed. For example, power-to-liquid (PtL), i.e. using renewable electricity to produce liquid hydrocarbons from CO₂ and hydrogen, is a good solution, but meaningful volumes are going to be available earliest towards the end of the decade. We need to both start reducing emissions today, while also investing in new technologies for the future. Doing one but not the other is not enough.