

Programme for increased production and uptake of sustainable aviation fuels

Summary



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The goal set by the Norwegian aviation industry - Avinor, Norwegian, SAS, Widerøe, the Federation of Norwegian Aviation Industries (NHO Luftfart) and the Norwegian Confederation of Trade Unions (LO) - is for the sector to be fossil-free in 2050. Increased production and uptake of sustainable aviation fuels will be crucial to achieving this goal, and is the topic of this report.

The challenges are mainly related to scaling up production and reducing the price gap between fossil and sustainable aviation fuels. Both the production and use of sustainable aviation fuels should be stimulated, and a suitable policy framework and close collaboration between the industry and the authorities will be needed to succeed.

Norway is dependent on aviation

Aviation is especially important for Norway due to large distances, challenging topography and its location on the outskirts of Europe. Aviation is crucially important for settlement and health service provision, sports and culture in many parts of Norway. Aviation is also important for the business sector, for export industries, travel and tourism, and for international enterprises being able to establish themselves in Norway. Aviation also constitutes a significant employment sector, in the form of both direct and indirect employment (totalling around 60,000 people in Norway).

Greenhouse gas emissions must be reduced – Norwegian aviation shall be fossil-free by 2050

In 2019, greenhouse gas emissions from domestic civil aviation amounted to 1.1 million tonnes of CO₂ equivalents, while emissions from international aviation (flights to first destination abroad) amounted to 1.7 million tonnes of CO₂ equivalents. In 2019, emissions from domestic civil aviation accounted for 2.2 per cent of total greenhouse gas emissions in Norway, while the total emissions including international aviation corresponded to 5.5 per cent. The additional effect of emissions in upper atmosphere is not factored in.

In October 2020, the Norwegian aviation industry presented "Aviation in Norway. Sustainability and social benefit. 4th Report", in which the industry presented a roadmap to fossil-free aviation in 2050 for the first time. This is based on the goals of the Paris Agreement, which, in effect, stipulate that by 2050 the world should be an almost zero-emission society. The goal means that in 2050, fossil fuels will not be used on domestic flights and flights originating from Norway.

It is possible to achieve the goal of fossil-free aviation in 2050. Sustainable aviation fuel is a solution that can already be used today and in existing aircraft fleets. The use of electrified aircraft and hydrogen will have an increasing significance. Modern aircraft can use up to 50 percent sustainable aviation fuel (current certification level). In January 2021, Boeing committed itself to ensuring that its aircraft would be able to use 100 percent sustainable aviation fuel by 2030. In March 2021, Airbus conducted its first test flight with 100 percent sustainable aviation fuel.

It is also a great advantage that sustainable aviation fuel can utilise the existing supply infrastructure for the transport and storage of fuel. In the short term, this solution is important, but it will also be necessary in the long term, especially on long-haul flights. Sustainable aviation fuels are therefore central to achieving the industry's goal of fossil-free Norwegian aviation in 2050.

A 50 percent blend (the maximum level that aircraft are certified to use today) of sustainable aviation fuel on all aircraft that refuelled in Norway in 2019 could have cut CO₂ emissions from Norwegian aviation by between 35 and 50 percent (depending on whether emissions from fuel production are also included), corresponding to an emission reduction of between 1 and 1.4 million tonnes of CO₂.

Production of sustainable aviation fuel – more methods need to be developed

Sustainable aviation fuel can be produced in different ways and with different types of raw materials. In order to obtain sufficient volumes, production must be based on a wide range of sustainable raw materials from various types of waste and residues,

including from forestry and industry. Currently, at an acceptable cost and with use of available infrastructure, cooking oil and animal fats are the main raw materials used. These are referred to as bio-based sustainable aviation fuels. Sustainable aviation fuel also includes so-called e-fuels (electro-fuels). These can be produced from hydrogen and CO₂ (extracted from the air or from industrial processes). The manufacturing of these fuels requires significant amounts of electrical energy (hence the name).

The value chains for sustainable aviation fuels need renewable and sustainable energy and raw materials to achieve the desired climate effect. The challenges with bio-based aviation fuels are to obtain large enough quantities of sustainable biomass, at an acceptable cost and with use of available infrastructure. Challenges with e-fuels are access to large amounts of renewable electricity, and being able to capture and reuse CO₂ that has a low carbon footprint. There is a need for green or blue hydrogen in both the processes (bio-based and e-fuels).

Today's production of sustainable aviation fuel accounts for less than 0.05 percent of the total global demand for aviation fuel. In the Nordic countries, Neste in Finland produces about 125 million litres annually, but pilot plants and scale-ups are planned in Norway, Sweden and Denmark by various actors. Additional technologies must be developed to reduce risk and to find the solutions with the best climate effect and the lowest cost in the long term.

The price gap must be closed

In August 2021, the price gap between fossil and sustainable aviation fuels was NOK 12 per litre for domestic aviation,

NOK 13 per litre for intra-EEA and NOK 15 per litre for intercontinental flights. The price gap varies because airlines pay different carbon prices for the different sector lengths. On domestic flights in Norway, airlines pay not only a Norwegian CO₂ tax but also a European quota price. On intra-EEA flights, ETS quota costs are paid, while intercontinental flights are currently exempt from carbon pricing. This additional cost makes it very unprofitable for airlines to use sustainable fuels. In 2019, for a 50 percent blend, the additional cost for using sustainable aviation fuel in Norway would be about NOK 7.1 billion, divided between domestic and foreign fuel consumption by NOK 2.6 billion and NOK 4.5 billion respectively.

Great potential for sustainable fuel production and value creation in Norway

Fuel consumption in Norwegian civil aviation was about 1.1 billion litres annually in recent years prior to the corona pandemic. A 50 percent blend of all aviation fuel sold in Norway in 2019 would have resulted in a demand of 556 million litres. Today, all sustainable aviation fuel that is sold in Norway is imported.

DNV has provided a factual basis for the report in the form of a technology roadmap for sustainable aviation fuel.

DNV's review of projects under planning shows that the production of sustainable aviation fuel in Norway is expected to be 50 million litres per year by 2025, and 300 million litres per year by 2030, but this depends on whether the production of sustainable fuels is prioritised for aviation. The actors planning production in Norway have ambitions of up to 790 million litres annually by 2030.



The plants that are planned up to 2030 are currently pilot and demonstration plants that will take time to develop. This implies not only exciting opportunities for successful actors, but also risks. Support for the development phase and upgrading to full-scale production is needed.

Norway has a good starting point for producing sustainable fuels thanks to high share of renewable electricity production and substantial natural resources that can be managed in a sustainable way. About 30 percent of fuel consumption in Norwegian aviation can be covered by by-products from Norwegian forests. Marine biomass such as algae (kelp) may be a potential resource in the long term. Furthermore, Norway has a competitive advantage with leading industrial companies, a

strong professional environment and an infrastructure for capturing, reusing and storing CO₂. Norwegian aviation supports a policy of increasing the production of green and blue hydrogen, which will also constitute an important element in the transition to low and zero emissions for aviation. There will also be a need for the generation of more renewable electricity.

For each million litres of fuel produced annually, the production of sustainable fuel creates about 4 jobs in the plants, and 4 to 5 jobs in support functions. The potential for value creation in Norway for the value chains for sustainable aviation fuel is estimated to be about NOK 3.2 billion per year, with 2,500 jobs (for 300 million litres produced per year). In addition, construction and establishment, as well as

other indirect jobs will be created. By being an early mover and utilising and developing the expertise that already exists in the process industry and hydrogen production, Norway can gain important competitive advantages in the transition to a low carbon society.

International measures for reducing greenhouse gas emissions in aviation

Since 2012, flights within the EEA, including flights in Norway and to/from Europe, has been part of the EU Emissions Trading System (ETS) that will reduce emissions in the quota sector by at least 43 percent by 2030. In connection with the EU's Green Deal and "Fit for 55", the European Commission plans to significantly strengthen ETS in the future in line with the EU's reinforced climate goals for 2030 to reduce emissions by at least 55 percent compared to 1990. Quota prices are rising and in August 2021 they were more than EUR 55 per tonne of CO₂. Rising quota prices, together with better technology for the production of sustainable aviation fuels over time will reduce the price gap against fossil fuels. Norwegian aviation recommends that Norway intensify its efforts to strengthen international policy instruments at European and global levels, including the EU Emissions Trading System and instruments through the International Civil Aviation Organisation (ICAO).

Preferably, measures for the uptake of sustainable aviation fuel should be coordinated internationally. In the "Fit for 55" regulatory package presented in July 2021, the EU Commission has proposed an EU wide blending mandate for sustainable aviation fuel starting at 2 percent in 2025, increasing to 5 percent in 2030 and then a sharp increase up to 63 percent in 2050 (ReFuel EU Aviation).

Norwegian measures for lowering greenhouse gas emissions in aviation

Norwegian aviation is self-financed and has had low profitability over time. The Corona crisis has further weakened the finances of airlines. Uptake of sustainable aviation fuel will result in significantly increased costs. In order for airlines to have the financial capacity for green restructuring, it is important to have measures in place that will reduce the price gap against fossil fuels and do not distort competition in favour of foreign airlines.

Norway has been an early mover in uptake of sustainable aviation fuel. In 2016, Avinor Oslo Airport became the first international airport to mix sustainable jet biofuel into the regular fuel supply system and offer it to all airlines that refuelled there. Since 2019, SAS and Widerøe have offered travellers to pay the additional cost of sustainable aviation fuel. Norwegian, SAS and Widerøe have set ambitious targets for uptake of sustainable aviation fuels. Norway is the first country in the world with a blending mandate for advanced biofuels for aviation (0.5 percent in 2020).

Norway is one of the few countries in the world to impose a CO₂ tax on domestic aviation. In 2021, the tax is NOK 592 per tonne of CO₂, which, in a normal situation, would give the government a revenue of about NOK 650 million a year. A significant increase in the CO₂ tax has been signalled up to 2030. In addition, aviation is subject to an air passenger duty (which has been suspended throughout 2021 due to the pandemic). In 2019, Government revenues from the air passenger duty were in excess of NOK 1,9 billion.



Recommendations from Norwegian aviation regarding sustainable aviation fuel

Norway will be dependent on aviation also in a low-emission society, and can take a leading role in uptake of sustainable aviation fuels. Norwegian industry is well positioned to produce sustainable fuels with high greenhouse gas emission reductions. Many look to Norway for inspiration when it comes to the transition to fossil-free aviation - this can give good opportunities to reduce greenhouse gas emissions far beyond Norway's borders.

Until now, efforts have largely been about showing how it is possible to phase in sustainable aviation fuel, through the development of knowledge and test-/pilot projects. In the future, scaling of efforts will be key to provide significant reductions in emissions and to contribute to realising the goal of fossil-free aviation in 2050. This will result in costs of a completely different magnitude.

Aviation is a sector with high CO₂ abatement costs and with few alternatives to today's fossil fuels, while, at the same time, the industry is directly exposed to international competition. In order for Norway to continue taking a leading role in the transition to fossil-free aviation, it will be necessary to rethink and assess key enabling measures and incentives and to establish closer collaboration between the aviation sector and the authorities. The challenge is to increase production and reduce the price gap between fossil and sustainable aviation fuels.

Avinor, Norwegian, SAS, Widerøe, the Federation of Norwegian Aviation Industries (NHO Luftfart) and the Norwegian Confederation of Trade Unions (LO), have joined forces to develop this programme for increased production and uptake of sustainable aviation fuel.



Norwegian aviation has the following clear recommendations on what must be done to increase production and uptake of sustainable aviation fuel:

- ➔ **Increased production** can be incentivised in several ways, including by strengthening Enova's role in establishing and developing production facilities for sustainable fuels. Norwegian aviation also sees that instruments that provide risk relief in the early phase such as Carbon Contracts for Difference may be appropriate for sustainable aviation fuel.
- ➔ **Increased uptake incentivised through an aviation fund** that also takes into consideration the financial health of airlines is proposed as the main instrument for increased use of sustainable aviation fuel. In such a model, some of the fees that aviation currently pays to the state (the CO₂ tax is best suited) can be allocated to the early uptake of sustainable aviation fuel. The scheme can be administered by the NOx fund, which has established administrative procedures.
- ➔ **Public sector business travel, commitment to Public Service Obligation (PSO) routes and voluntary uptake** can also play an important role. The public sector can take on a role as an early customer. The state should pay the additional cost of sustainable fuel for its own employees' business trips. It should also be considered to require a high proportion of sustainable aviation fuel when procuring Commitment to Public Service routes (PSO) routes. Airlines will facilitate voluntary purchase of a blend of sustainable aviation fuel and provide documentation of the greenhouse gas emission reduction.
- ➔ **Accounting** and reporting is currently challenging. The industry calls for clear regulations for accounting and documentation of the greenhouse gas emission reduction when using sustainable aviation fuels. The regulations should reward companies that phase in sustainable fuels.
- ➔ **Emission reductions and sustainability** will be key factors also in the future. Norwegian aviation has been clear that the sustainable aviation fuel that is used must meet the EU's sustainability criteria, and that palm oil and palm oil products are not acceptable. Incentives that can help strengthen the competitiveness of new types of fuel (based on by-products from forests or from algae) and fuels with particularly high greenhouse gas emission reductions should be considered. This can contribute not only to value creation in Norway, but also to reinforced sustainability over time.
- ➔ **Implement a collective effort** across value chains and various government areas. On its own, the Norwegian aviation industry does not have the capacity to undertake the investments needed for the transition to a low carbon economy. Collective efforts will require a high degree of coordination. Norwegian aviation proposes an Aviation 21 process that can ensure a knowledge-based and well anchored realistic, cost-effective and predictable path towards fossil-free aviation in 2050. Close cooperation between representatives from aviation, commerce and industry, academia and the authorities is required to achieve this.

Strong commitment from Norwegian aviation

Aviation is central to Norwegian society, but needs predictability and profitability over time. This includes expectations to the regulatory framework as well as a dialogue between the industry and the authorities. Technological development, the establishment of new industries and a transition of the aviation sector take time; it is therefore important to begin this work now. For its part, Norwegian aviation will commit to continuing and strengthening its efforts to phase in sustainable aviation fuels and a transition to fossil-free aviation. The industry will contribute with a factual basis and participate in national and international processes that promote sustainable aviation fuel, and also invites Norwegian producers to a dialogue around supply and contracts.

Work on the report was coordinated by Avinor and carried out in partnership with Norwegian, SAS, Widerøe and the Norwegian Confederation of Trade Unions (LO) and Federation of Norwegian Aviation Industries (NHO Luftfart).

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