FlightPath

Sustainable Fuels for Aviation in Europe

Brussels Event Proceedings | 27 November 2019

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Welcome Words

Andrés Arranz Stancel, SENASA President

The conference, titled as "RED II and CORSIA: will they make the EU fly on biojet over the next decade?" was a day-long event where national representatives of the European commercial aviation sector and legislators were present. Besides, the results of the "European Biofuels FlightPath Initiative" project, coordinated by SENASA since 2016, which has as its declared objective to bring Sustainable Aviation Fuels (SAF) to the market through the involvement of the European aviation sector and promoting regional and national measures, were presented. To achieve this, it bases its support on several of the main aviation agents, in addition to the European institutions (Air France KLM, IAG, Lufthansa, Airbus, Eurocontrol, Total, Neste and IATA), which were also present.

Andrés Arranz Stancel, SENASA President

SENASA and Sustainable Aviation Fuel

During recent years, environmental challenges have become one of the great workhorses for the aviation sector, both globally and locally. Mitigating the environmental and adverse effects of air transport activities is one of the five strategic objectives of the International Civil Aviation Organisation (ICAO), in line with the practices and policies of the United Nations system. Besides, in 2050 ICAO's Vision for Sustainable Aviation Fuel, endorsed during the 2018 Council session, it is recognised as the essential and primary role that the states have in the deployment at an industrial scale of the SAF.

SENASA is an institution with recognised national and international prestige within the aeronautical sector and is strongly committed to the aviation environment. This commitment is based on the conviction that environmental benefits are also a stimulus for innovation, productivity, and competitiveness in the aviation sector. Therefore, SENASA has participated as coordinator in the project ITAKA (Initiative Towards SustAinable Kerosene for Aviation), a project launched in 2012 with funding from the European Commission and that was the basis for the expertise and the knowledge that we have been accumulating at a European scale on this precise matter – the sustainable aviation fuel.

Since 2016, SENASA pursued towards that direction and has acted as coordinator of the "EABF FlightPath" between the Commission itself, the Consortium and the so-called Core Team, which is made of sixteen leading companies and organisations in the aeronautical and fuel sectors and whose aim was, from the very beginning, to contribute to the annual production target of 2 million tonnes of biofuels for aviation in 2020.

Andrés Arranz Stancel, SENASA President

SENASA and Public Policies

Since August 2018, the Ministry of Development is working in coordination with the Ministry of Ecological Transition on a proposed Spanish Climate Change Law. Among the measures proposed by Fomento is the promotion of biofuels in air transport, establishing a specific objective using the concept of “balanced compromise”. This objective will be supported by a feasible study to be carried out in coordination with the agents involved (air operators, authorities, producers, etc.), guaranteeing sufficient and adequate availability of biofuel, at a cost that can be borne by air operators, where priority is given to the use of national production resources that also guarantee other additional benefits, such as energy security, promotion of employment or diversification of means of production.

The proposal from the Ministry of Development (MFOM) was introduced by the Ministry of Ecological Transition in the proposed law during the current year.


Philippe Novelli
ONERA

Welcome Words

Erich Valentin, ARC President

As I am speaking on behalf of Airport Regions Council (ARC), I can honestly say that it was a pleasure to organise “Sustainable Fuels for Aviation in Europe” conference, together with SENASA, FlightPath and ARTFuels. Being a growing NGO in Brussels is not always easy to be noticed, especially in the aviation field which is full of big players. Moreover, it is not easy to deliver your point across, but working together with above mentioned projects’ teams, sharing the same aims and goals, we were able to do more and to reach more people with our message. This report is a continuation of us spreading this message further. It is important to say how grateful we are for our excellent colleagues from SENASA and FlighPath teams for the opportunity to become a small part of the project and to organise this final event of FlightPath.

As expected from the beginning, the event was successful and highly insightful. Speakers from all over Europe, representing private and public sectors, gathered to share their knowledge with almost two hundred participants. The event fully evolved around the topic of sustainable aviation fuel – is it possible to make a transition and, if so, when can it become our reality and be used in higher proportions?

Airport Regions Council is the association of regional and local authorities across Europe with an international airport situated within or near their territories, which is also very interested in the topic of sustainable aviation fuel. ARC represents the interests of its members and brings together a wide range of expertise at the interface of airports and air transport with local and regional policies.

Airport Regions Council and Clean Air

ARC and its member regions have been interested in air quality and quality of life around the airport regions since 1994 when the organisation itself was established. We have published several publications concerning air quality and ultrafine particles in the airport regions (Ultrafine Particles in Airport Regions, 2017, A New Environmental Deal for Airport Regions, 2015, Quality of Life in Airport Regions, 2014, 15 Ways to Reduce the Carbon Footprint in Airport Regions, 2008 and others) and have been a part of the project titled "dAIR", which stands for Cleaner Airports and Decarbonised Regions. The goal of dAIR was to improve the surface accessibility to airport zones and the CO_2 neutrality of airport operator activities. The project paid special attention to the optimal involvement of business R&D communities in creating well connected green airports.

As of now, the dAIR project has ended but ARC and its member regions are still highly interested in the topic of accessible clean air around airports as well as all the means that include the betterment of air quality. Sustainable fuel or as it is often said in another way, biofuel, is a matter that we support and care about. Aviation and tourism sectors are only growing, and it is the aviation sector that has to adjust and find ways to make its growth as sustainable as possible.

Airport Regions Council will continue to support and communicate about the topic of sustainable aviation fuel. We hope that in the future our interests and priority topics will again cross paths with SENASA and FlightPath so that this wonderful and productive collaboration would not be the last one.

I invite you to read and enjoy this proceedings report of the event "Sustainable Fuels for Aviation in Europe", which took place in ARC offices in Brussels, 27 November 2019. For more information about Airport Regions Council, visit airportregions.org.

Erich Valentin, ARC President

Catalin Bulgariu, Director General of Iasi Airport (Romania), Sergi Alegre (Director General of ARC), Dr. Lutz Franzke, member of Social Democratic Party of Germany.

About FlightPath Project

Introduction

At the COP21 in December 2015, the United Nations countries massively agreed on a very ambitious objective for climate change mitigation, with a targeted temperature increase below 1.5°C in 2100 compared to the pre-industrial era. For its part, Europe has been for long committed to greenhouse gas (GHG) emissions reductions.

Such ambitious goals will require contributions of all sectors in society. Accordingly, and although the aviation sector is forecasted to enjoy continuous growth over the next decades, aviation CO_2 emissions will be multiplied by more than 3.5 in 2050, compared to 2010, in absence of additional measures. Aviation, that currently represents about 2% of total anthropogenic CO_2 emissions, could reach a share of about 10% in 2050 if all other sectors except aviation were reducing their CO_2 emissions in accordance with the COP21's target.

The political situation and the kind of existing stakeholders allow Europe to take the leading role in SAF production.

This article explores the potential of various policy options to stimulate the uptake of sustainable fuel in aviation.

The model is constructed such that it can be used to illustrate three basic mechanisms:

- the selection of sustainable fuel used;
- the market share of sustainable fuel in the EU and non-EU aviation markets;
- the allocation of sustainable fuel over the different transport sectors.

It allows assessing the impacts of various policy instruments on:

- fuel demand;
- the share of sustainable fuel;
- greenhouse gas (GHG) emissions;
- the welfare impacts for the different stakeholders: the market segments for fuel demand, the fuel producers, the government and society at large.

Three sets of policies are considered:

1. The first set is based on the specifications of the revised Renewable Energy Directive of the European Union (EU). That directive aims at a certain share of renewable energy in road and rail transport, to which also maritime and air transport may contribute. However, no specific targets are set for aviation.

2. The second set of scenarios integrates specific targets for aviation in this framework and also compares different policy instruments that may be used to reach the targets: a blending mandate, a subsidy for sustainable fuel or a tax on fossil jet fuel.

3. The third set of scenarios is inspired by the Carbon Offsetting and Reduction Scheme for International Aviation, or CORSIA, which is the emission mitigation approach for the global airline industry developed by the International Civil Aviation Organisation (ICAO).

FlightPath team

Scenario Results

EU RED II SCENARIO VARIANTS

Table 1 summarises the findings for the EU RED II scenario variants for the year 2030. In these scenarios, the user price of fuel for aviation and EU fuel demand for aviation is almost not affected. In general, it is found that the EU RED II variants only lead to limited uptake of sustainable aviation fuel.

The maximum uptake in the EU RED II scenarios is found in scenario 1C, with 1.6 Mtoe[1] in 2030. That scenario assigns a multiplier equal to 2 to SAFs, compared to a value of 1.2 in the other scenario variants. However, the higher multiplier in scenario 1C also implies a lower total uptake of renewable fuel by road, rail and aviation taken together.

Considering the well-to-wheel emissions of greenhouse gas emissions, scenarios 1A, 1B and 1D lead to similar emissions reductions by 2.4% to 2.6% compared to the BAU scenario in 2030. When the impacts on ILUC are considered as well, the largest emission reduction is found in the EU RED II central scenario (scenario 1A), which imposes a phase-out of food and feed-based fuel by 2030.

The table also presents the welfare cost per ton of greenhouse gas emissions avoided. This indicator is computed by dividing the sum of the change in consumer surplus, producer surplus and government income by the change in CO_{2eq} emissions by road and aviation at the world level. It is calculated considering the impact on both the WTW and WTW with ILUC emissions.

	Units	Set 1: EU RED II (2030)			
		(1A) central	(1B) no phase out	(1C) higher multiplier	(1D) no restrictions
SAFs used in EU aviation	Mtoe	0.6	0.1	1.6	0.01
	% of EU air fuel demand	1.0%	0.3%	2.8%	0.0%
EU aviation fuel demand	Mtoe	57.6 (= BAU)	57.6 (= BAU)	57.6 (= BAU)	57.6 (= BAU)
Change in user price aviation					
Intra-EU	Change wrt BAU (%)	-0.05%	0.0%	-0.14%	0.00%
Extra-EU	Change wrt BAU (%)	-0.06%	0.0%	-0.17%	0.00%
User price road	Change wrt BAU (%)	1.32%	1.25%	1.15%	1.22%
Renewable energy EU road + rail + aviation	Mtoe	19.2	26.1	17.7	28.4
CO2eq (EU road + aviation)	Change wrt BAU (%)				
TTW		-0.4%	-2.6%	0.2%	-3.3%
WTW		-2.4%	-2.6%	-1.4%	-2.6%
WTW with ILUC		-4.3%	-2.9%	-3.3%	-2.4%
Welfare cost (based on worldwide emission reduction road and aviation)	Euro/ton CO2eq				
WTW		294	285	415	271
WTW with ILUC		159	245	176	296

Table 1: summary of findings for the EU RED II scenario variants

1 Millions of tonnes of oil equivalent

The welfare costs are substantially higher than the ETS price that is in place in 2030 according to the EU 2016 Reference scenario, namely 35 euro/ton CO_{2eq}. The EU RED II scenario variants are therefore a costly way to reduce greenhouse gas emissions, compared to the costs of reductions in the sectors covered by the EU ETS. The reason is simple: one imposes a costly technique (using sustainable fuel) to reduce emissions rather than allowing the choice for less costly techniques such as with policy instruments that not impose a priori technical solutions (such as a carbon tax, a permit or offset system).

Of course, the EU may target much deeper reductions of CO_2 emissions in the economy and the aviation sector as the expected climate damage may be much higher than the 35 euro/ton CO_{2eq} (see Tol (2012) for a range of damage estimates[1]). But also, in that case, forcing the aviation sector to reduce emissions via sustainable fuel does not appear to be a low-cost option.

The welfare cost calculations do not take into account the impact on the emissions in the other EU ETS sectors which are not considered in detail in the partial equilibrium model.

EU RED II SCENARIO VARIANTS + SPECIFIC TARGETS

Similarly, Table 2 summarises the findings for the EU RED II Aviation scenario variants for the year 2030. In this case, a specific target is imposed for aviation, leading to a larger uptake of sustainable aviation fuel than in the EU RED II scenarios in which no such specific target is set for aviation. In scenario 2C that imposes a tax, the target share can be met by a lower amount of sustainable aviation fuel than in the three other variants because aviation fuel demand is reduced substantially so that attaining a given share of this total fuel demand implies less SAF. The total amount of renewable fuel in the road, rail and aviation taken together, follows a similar pattern for the four scenario variants considered.

The EU RED II Aviation scenario variants have a different impact on the user price of aviation fuel. The blending mandate (scenario 2A and 2D) increases the user price, while the tax variant (scenario 2C) more than doubles the user price for extra-EU aviation and also leads to substantial price increases for intra-EU aviation. The subsidy variant (scenario 2B) keeps the user price more or less at the level of the BAU scenario. These price changes imply that the blending mandate and especially the tax variant will not only influence the fuel used but also total fuel demand by aviation. In scenario 2C fuel demand is almost halved. In the case of the blending mandate (scenario 2A), there is also a decrease in aviation fuel demand, but it is much smaller. In scenario 2D – with a higher target for sustainable aviation fuel – the user price of aviation fuel is higher than in scenario 2A and the aviation fuel demand falls more than in that scenario.

1 Tol (2012) considers range of values. An important determinant is the social discount factor. He finds a mean valuation of reduced damage of 5 euro/ton CO_{2eq} for a 3% discount rate and up to 76 euro/ton of CO_{2eq} for a 0% discount rate.

	Units	Set 2: EU RED II Aviation (2030)			
		(2A) Blending mandate	(2D) Aviation +	(2B) Subsidy	(2C) Tax
SAFs used in EU aviation	Mtoe	2.0	2.9	2.0	1.0
	% of EU air fuel demand	3.50%	5.25%	3.50%	3.50%
EU aviation fuel demand	Mtoe	56.3	54.7	57.6 (= BAU)	27.5
Change in user price aviation					
Intra-EU	Change wrt BAU (%)	4.26%	10%	-0.2%	100%
Extra-EU	Change wrt BAU (%)	5.45%	12.36%	-0.2%	131%
User price road	Change wrt BAU (%)	1.18%	1.14%	1.17%	1.30%
Renewable energy EU road + rail + aviation	Mtoe	21.9	22.9	22.0	20.8
CO2eq (EU road + aviation)	Change wrt BAU (%)				
TTW		-1.6%	-2.4%	-1.2%	-10.7%
WTW		-2.8%	-3.5%	-2.4%	-12.2%
WTW with ILUC		-4.7%	-5.4%	-4.3%	-13.9%
Welfare cost (based on worldwide emission reduction of road and aviation)	Euro/ton CO2eq				
WTW		314	318	369	177
WTW with ILUC		177	195	194	149

Table 2: summary of findings for the EU RED II aviation scenario variants

The EU RED II Aviation variants lead to a larger reduction of GHG emissions for EU road and aviation than scenario 1A. In the variants with a blending mandate or subsidy, this additional reduction is not very large. However, when a tax is imposed on fossil aviation fuel the reduction is more substantial. This is a consequence of the large fall in aviation fuel demand in that scenario.

Also, in this case, the welfare cost per ton of greenhouse gas emissions avoided has been calculated. The table presents the case where the impact on the emissions of road and aviation at international level is considered, but not the impact on the emissions in the other EU ETS sectors. Compared to scenario 1A the scenarios 2A, 2B and 2D lead to a higher welfare cost per ton of CO_{2eq} emissions avoided. Setting a specific target for aviation, therefore, increases costs in these cases. In scenario 2C a tax is introduced and this lowers the welfare cost. This is because in this case a smaller amount of relatively expensive aviation fuel is needed and emissions are reduced relatively more by reducing aviation fuel demand. However, in this case, the social abatement cost still remains relatively high compared to the social benefits of GHG emission reductions, indicating that the tax on fossil fuel in aviation that is set in order to attain a certain share of sustainable aviation fuel is likely not at its optimal level.

CORSIA SCENARIO VARIANTS

Finally, Table 3 summarises the findings for the CORSIA scenario variants for the year 2030. In none of the cases considered there is an uptake of sustainable aviation fuel. However, the GHG emissions by aviation are reduced due to a reduction in fuel demand by the sector. For the remaining emissions above the 2020 levels, offsets have to be bought in other sectors. The welfare cost per ton of GHG emissions avoided is somewhat below the value of the offset charge and ETS charge (if applicable) and therefore much lower in these scenarios than in the previous two sets of scenarios.

	Units	Set 3: CORSIA (2030)		
		(3A) offset cost 10 euro	(3B) offset cost 50 euro	(3C) offset cost 50 euro and intra-EU ETS
SAFs used in world aviation	Mtoe	0	0	0
Aviation fuel demand				
EU	Change wrt BAU (%)	0.3%	-7.0%	-9.2%
nonEU	Change wrt BAU (%)	-1.9%	-9.2%	-9.1%
Change in user price aviation				
Intra-EU	Change wrt BAU (%)	-9.4%	5.8%	19.0%
Extra-EU and nonEU	Change wrt BAU (%)	4.5%	22.1%	21.9%
CO2eq (world aviation)	Change wrt BAU (%)	-1.6%	-8.9%	-9.1%
Welfare cost (based on emission reductions of world aviation and offsets)	Euro/ton CO2eq			
WTW		7	38	39

Table 3: summary of findings for the CORSIA scenario variants

From these three sets of scenario variants, it can be concluded that reducing CO_2 emissions in the aviation sector by imposing an uptake of sustainable fuel is costly.

If one wants to promote the uptake of sustainable aviation fuel, a specific target should be set for aviation. If a tax cannot be imposed on fossil fuel, then this target can be achieved at the lowest social cost by using a blending mandate. The analysis considered shares of up to 3.5% to 5.3% in 2030, corresponding with 2 to 2.9 Mtoe of sustainable aviation fuel. The blending mandate implies an increase in the fuel cost for aviation that is moderate for the share of 3.5% but increases more than proportionally as the target share increases. The blending mandate is also associated with a high social abatement cost for GHG emissions. This study has used expert estimates for the cost of biofuel. These estimates are valid for the medium term (2020-2030) but costs remain high. In the long term (after 2030) these costs can decrease by learning by doing (scale economies) and by pure R&D. The long term effects of the choice of policy instruments have not been taken into account.

Among the policy scenarios considered in this study, the lowest social abatement costs are associated with the CORSIA scenarios. These scenarios do however not lead to an uptake of sustainable fuel in aviation[1].

1 The references of this article can be found at the end of the publication.


PARTICIPANTS PROFILES
Roundtable and moderated discussion:
Moderator
Angelica HULL, CEO, SWEDISH BIOFUELS
Stéphane THION, Head of Biogas and Sustainable Aviation and Marine Biofuels, TOTAL
SENASA
ENVIRONMENT

Evaluation of Sustainable Aviation Fuel Policy Scenario Variants

Dr. Inge Mayeres, Transport & Mobility Leuven

PREAMBLE

The European Commission has contracted a team of independent experts to support the activities of the European Advanced Biofuels Flightpath (EABF) and provide recommendations to the Commission regarding renewable fuels for aviation. Under the "ESFERA[1]" study, in addition to setting a dedicated Secretariat for the EABF, the ESFERA team has engaged the study of policy options for the deployment of sustainable fuels in aviation (SAFs). The objective is to provide data and analyses to support the EABF's Core Team and the European Commission in reaching the EABF targets. Besides this central axis of work, ESFERA study also monitors the various developments in the field of SAFs, including the emergence of new fuel technologies, the approval of fuel pathways, R&D projects, deployment initiatives as well as policy initiatives.

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1 Contract N° ENER/C2/2016-478, invitation to tender: "Coordination of renewable fuel stakeholders' strategy in the field of aviation", March 2016.

INTRODUCTION

In line with the Paris Agreement, that entered into force in November 2016, the EU has set for itself an ambitious target for the reduction of greenhouse gas (GHG) emissions. For many sectors, ambitious policies are already in place but for aviation, GHG emissions are still expected to grow substantially with the policies currently in place.

There is not yet an alternative propulsion technology for aviation and given the long technical life of aircraft, the only options available in the short to medium term are a slower growth of aviation activity, an increase in fuel efficiency or a switch to sustainable aviation fuels (SAFs). This article summarises part of the results of the ESFERA study on the potential of policy options to stimulate the uptake of SAFs[1].

METHODOLOGY

The evaluation is made on the basis of quantitative analysis, using an economic model for the transport fuel markets that has been developed specifically for the ESFERA study. The economic model considers three types of demand for aviation fuel: fuel used for flights within the European Union (intra-EU aviation), fuels bought in the EU for EU-connected flights (extra-EU), and fuels bought outside of the EU for EU-connected and non-EU flights. In addition, it accounts for the fuel demand by road and maritime transport in the EU and in the rest of the world. The sources of fuel supply are conventional fuels and a selection of sustainable fuels, each characterised by a specific cost structure and environmental characteristics. The following table gives an overview of the fuels that were taken into account for aviation, and their characteristics in terms of GHG emissions.

1 More detailed information as well as additional results and sensitivity analyses can be found in the forthcoming ESFERA deliverable: Mayeres, I., S. Proost, E. Delhaye (Transport & Mobility Leuven, KU Leuven), I. Gómez Jiménez, H. Olcay, D. Rivas Brousse, A. Blanch Romero, M. Sanchezblanco Palomera (SENASA), Ph. Novelli (ONERA), E. Smeets, S. Conijn (Wageningen University & Research), Selection of policy options and definition of plausible targets and pathways, Combined Deliverable 2.1.4 and 2.3.1 of the ESFERA study on "Coordination of renewable fuel stakeholders' strategy in the field of aviation", forthcoming.

Process	**Feedstock**	**WTW GHG emissions**	**WTW GHG emissions with ILUC**
		tonne CO_{2eq} /toe	**tonne CO_{2eq} /toe**
HEFA and HEFA+	Used cooking oils	0.58	0.58
	Animal fats	0.94	0.94
	Camelina	1.76	1.76
	Vegetable oils	1.56	2.79
SIP	Residues	NA	NA
	Sugarcane	1.37	NA
FT	Residues	0.33	0.33
	Woody biomass and herbaceous energy crops	0.47	-0.20
	Municipal solid waste	1.36	1.36
ATJ	Residues	1.11	1.11
	Sugarcane	1.01	1.34
	Sugar beets	NA	NA
Fossil jet fuel		3.73	3.73

Notes:

- HEFA: Hydroprocessed esters and fatty acids; HEFA+ (or HVO): Hydrotreated vegetable oil; SIP: Synthesised iso-paraffinic fuels; FT: Fischer-Tropsch; ATJ: Alcohol-to-jet; ILUC: indirect land use change
- Source for emission factors: Deliverable 2.2.2 of ESFERA study; the WTW emissions of FT based on MSW are calculated for a carbon content of 40% of MSW and a share of 40% of non-biogenic carbon.
- The literature also includes other processes such as hydrothermal liquefaction (HTL), aqueous phase processing, pyrolysis or co-processing. These are not considered, either because they are still in early stages or due to lack of cost information.

For feedstocks used in the production of sustainable fuels, the model accounts for the impact of higher sustainable fuel demand on the feedstock prices, based on relationships drawn from the MAGNET model (see Deliverable 2.2.2 of the ESFERA project).

The economic model allows assessing the impacts of various policy instruments on:

- total fuel demand for the different transport sectors, for the market segments defined above;
- the share of sustainable fuels in each of these sectors
- greenhouse gas (GHG) emissions;
- the welfare impacts for the different stakeholders: the market segments for fuel demand, the producers of conventional fuels and SAFs, the government and society at large.

In this article, we compare the outcomes under various policy scenarios with a reference scenario for 2030 that is based on the EU 2016 Reference scenario (EC, 2016[1]) and the World Reference scenario of the US Energy Information Administration (US-EIA[2]) .

Dr. Inge Mayeres, Transport & Mobility Leuven

1 EC (2016), EU Reference Scenario 2016, Energy, transport and GHG emissions, Trends to 2050. Luxembourg: Publications Office of the European Union.

2 US-EIA (2017), International Energy Outlook 2017. Washington, D.C., USA: US Energy Information Administration.

Evaluation of SAF Policy Scenarios

Three sets of policy scenarios were considered.

SET 1: EU RED II SCENARIO VARIANTS

The first set of scenarios is based on the revised Renewable Energy Directive of the EU[1]. For 2030 the Directive aims at a share of 14% of renewable energy in road and rail transport, to which also maritime and air transport may contribute. A multiplier of 2 applies to fuels based on feedstocks listed in Annex IX of the Directive when used in road and rail transport. This multiplier equals 2.4 if these fuels are used for air or maritime transport. No specific targets are set for aviation or maritime transport. The share of fuels produced from food and feed crops for which a significant expansion of the production area into land with high-carbon stock is observed should be zero by 2030.

Under these specifications the model projects a very small uptake of SAFs, amounting to approximately 0.6 Mtoe in 2030, or about 1% of total aviation fuel demand in the EU. The impact on aviation fuel prices is limited. If no phase out of the food and feed-based fuels is imposed, but a maximum of 5% of these fuels is allowed, the uptake of SAFs decreases to 0.1 Mtoe, as the target of 14% can be achieved in a cheaper way by using food and feed-based fuels in road transport. If no maximum share applies to these fuels, the amount of SAFs falls to almost zero.

If a higher multiplier (with a value of 4 instead of 2.4) applies for Annex IX fuels in aviation, the uptake of SAFs increases to 1.6 Mtoe (or 2.8% of EU aviation fuel demand). However, the higher multiplier implies a lower total uptake of renewable fuels by EU road, rail and aviation taken together, leading to smaller GHG emission reductions than with the original multiplier.

SET 2: EU RED II AVIATION SCENARIO VARIANTS

The second set of scenarios imposes the EU RED II blending mandate for road and rail transport. Also, these scenarios set a specific aviation target of 3.5% for SAFs by 2030. The target applies to all aviation fuels bought in the EU. No food or feed-based fuels are allowed for aviation. The analysis compares three ways to achieve the target: (i) by imposing a blending mandate, (ii) by means of a subsidy for SAFs or (iii) by imposing a tax on conventional aviation fuel.

These different policy instruments have a different impact on the user price of aviation fuel. The blending mandate increases that price by 4.3% for intra-EU aviation and 5.4% for extra-EU aviation compared to the reference scenario (which includes an ETS charge of 35 euro/ton CO_{2eq} in 2030 for intra-EU aviation), while the tax variant more than doubles the user price for EU aviation fuels. The SAF subsidy keeps the user price more or less at the reference level. Increasing the blending mandate from 3.5% to 5.3% raises the EU user price of aviation fuel by 10% and more.

1 Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast)

These price changes imply that the blending mandate and especially the tax variant will not only influence the type of fuels used but also total fuel demand by EU aviation. This is most pronounced in the tax scenario with a substantial reduction in fuel demand. In the case of the blending mandate, there is also a decrease in aviation fuel demand, but it is much smaller.

The second set of scenarios leads to a larger reduction of GHG emissions for the sum of EU road and aviation than the first set. With a blending mandate or subsidy, this additional reduction is not very large. However, when a tax is imposed on fossil aviation fuels the reduction is more substantial. This is a consequence of the large fall in aviation fuel demand in that scenario.

The social abatement cost or welfare cost per ton of GHG emissions avoided (considering also the ILUC impacts) equals 177 euro/ton if a blending mandate is used to achieve the SAF share of 3.5% in 2030, in combination with the EU RED II for the other transport sectors. This cost is substantially higher than the ETS price that would be in place in 2030 according to the EU 2016 Reference scenario, namely 35 euro/ton CO_{2eq}. The policy entails, therefore, a costly way to reduce GHG emissions, compared to the costs of reductions in the sectors covered by the EU ETS. The reason is simple: one imposes a costly technique (using sustainable fuels) to reduce emissions rather than allowing the choice for less costly techniques as would be the case with policy instruments that not impose a priori technical solutions (such as a carbon tax, a permit or an offset system). Of course, the EU may target much deeper reductions of GHG emissions as the expected climate damage may be much higher than the 35 euro/ton CO_{2eq}. But also, then, the social abatement cost remains high.

The social abatement cost with a separate blending mandate for aviation is 11% higher than in the EU RED II framework without such a separate target, indicating imposing such a separate target leads to additional costs. As can be expected, the social abatement cost of the blending mandate also increases with the blending share. If the target share is raised to 5.3% instead of 3.5%, the social abatement cost rises to 195 euro/ton CO_{2eq}.

If instead of a blending mandate, SAF subsidies are used to reach the 3.5% SAF share, the social abatement cost also increases (to 194 euro/ton CO_{2eq}). If a tax on conventional fuel is used to achieve the 3.5% SAF share, the social abatement cost reduces to about 150 euro/ton CO_{2eq}. This is because a smaller amount of relatively expensive SAFs are needed and emissions are reduced relatively more by reducing aviation fuel demand. However, also, in this case the social abatement cost still remains relatively high, indicating that the imposed share of SAFs is not at its optimal level.

SET 3: CORSIA SCENARIO VARIANTS

The third set of scenarios is inspired by the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which is the emission mitigation approach for the global airline industry developed by the International Civil Aviation Organisation (ICAO)[1]. The CORSIA states that offsets need to be bought for CO_{2eq} emissions of international aviation above those in 2020. The CORSIA applies to international aviation only. However, as the model used in the ESFERA study does not make a distinction between domestic and international aviation, the CORSIA scenarios are assumed to apply to all aviation. Given that at this stage the cost of the offsets is not yet known, two values are considered: a value of 10 and 50 euro/ton CO_{2eq}. In one of the scenario variants, the CORSIA charge is combined with the ETS charge for intra-EU aviation.

In none of the cases considered in this set of scenarios, there is an uptake of SAFs. However, the GHG emissions by aviation are reduced due to a reduction in fuel demand by the sector. For the remaining emissions above the 2020 levels, offsets have to be bought in other sectors. The social abatement cost per ton of GHG emissions avoided is somewhat below the value of the offset charge and ETS charge (if applicable) and therefore much lower in these scenarios than in the previous two sets of scenarios.

1 https://www.icao.int/environmental-protection/CORSIA/Pages/default.aspx

Conclusions

Reducing GHG emissions in the aviation sector by imposing an uptake of SAFs is costly. If one wants to promote the uptake of SAFs a specific target should be set for aviation. If a tax cannot be imposed on fossil aviation fuels, the target can be achieved at the lowest social cost by using a blending mandate, which however implies a high social abatement cost for GHG emissions. Among the three sets of policy scenarios considered, the lowest social abatement costs are associated with the CORSIA scenarios. However, these do not lead to an uptake of SAFs. ■

The Future of Sustainable Aviation Fuel in Europe

Robert Mauri, French member of the ICAO Committee on Aviation and Environmental Protection

As you know, France is strongly committed to sustainable fuels, and we are very excited to share with you the state of French reflections. Our table is about strategy in Europe. Before, allow me to say a few words about the way for decarbonization in the air sector in France.

Efficiency gains are a priority area in the short term. We know that European airlines should first be encouraged to renew their fleets, the latest generation of aircraft (A320neo, A350, A330), these new aircraft consume on average 15% less fuel than the previous generation. The gradual renewal of aircraft in service by these latest-generation aircraft will thus make it possible to maintain the energy efficiency gains of the world air transport fleet by around 1.5% per year until 2025-2030.

Hydrogen and net-zero – the way for long term solutions. Because we must, in parallel, find the answer for the day after tomorrow. Our horizon must be decarbonised and reach zero-emissions by 2050. Our sector has met many challenges, this one will not be the easiest, but it is not impossible. We know that technological revolutions in this sector require a long time. Airbus confirmed this in September – we must aim for "zero-emissions" by 2050. Hydrogen is the fuel with the cleanest combustion. France is mainly focusing its aeronautical research on preparing the decarbonized aircraft, firstly – hybrid, then – hydrogen.

But between today's answers and those of the future at 30 years old, let's say the day after tomorrow, we have just tomorrow, that is, the decade that is about to begin. And France is betting on sustainable aviation fuel to reduce the impact of air transport because aviation has no choice to use a liquid fuel with a high energy content for a few more years.

To this end, it relies on economic players which are in the heart of French strategy.

Cooperation and Strategic Views

COOPERATION WITH THE PRIVATE SECTOR

France intends to develop the use of sustainable aviation fuel whose use is still too limited. The sector's actors are mobilised in this area, as shown by the increasing number of initiatives.

Recent initiatives:

- 78 scheduled flights operated by Air France between Toulouse and Paris, and Nice and Paris as part of the Lab'line experimental programme demonstrated that the use of biofuels was neutral for an airline's operations;
- Airbus aircraft delivery flights using biofuel (from Toulouse grounds);
- The recent flight to Northern Europe by an ATR 72-600 incorporated 50% of a fuel made from cooking oil, reducing emissions by up to 80% over its life cycle and helped to reduce emissions related to this flight by nearly 50%.

Involvement of all the economic actors – a balanced dialogue between the regulator and industry representatives for the deployment of SAF has to be promoted with achievable objectives allowing industrial development of SAF.

To support this mobilisation and bring together the sector's stakeholders, the 'Commitment to Green Growth' was signed in 2017. Bringing together the major players of the sector (Air France, Airbus, Safran, Suez and Total) around the State, this programme aims to set up a sustainable aeronautical biofuels sector in France.

Other work is underway, such as the National Alliance for the Coordination of Energy Research (ANCRE), which has produced a research-oriented roadmap for the progressive development of biofuel sectors in the coming years.

Based on these various experiments and works, a roadmap has been initiated, which should be soon presented by the government, to specify the ambition and strategy that France could develop from 2025.

FRENCH STRATEGIC VIEWS ON SAF

Some fundamental principles:

- SAF should be firstly produced from sustainable feedstocks, for advanced biofuel and circular economy to achieve significant emissions reductions;
- We have to maintain an optimal level of safety, which underlines the importance of technical certification;
- The business model should promote a competitive and lasting market to ensure the economic viability of all players along the commercial chain;
- Deployment must be based on simple and economical supply chains, if possible existing;
- We wish to ensure coherence between French policies and supranational initiatives and policies, avoiding distortions of competition.

Challenges to overcome – how to initiate production?

• We need to have enough feedstock at our disposal;
• We need to integrate the competition with other sectors, road transport;
• We need to promote investment in production facilities;
• We have to limit the impacts on the competitiveness of air transport;
• We have to ensure the economic viability of all actors in the commercial chain;
• We have to try to limit additional costs for air carriers.

These are open-ended questions, which remain at the heart of our work.

In spite of this, we look for a pragmatic and reasonable short term objective – 2% of fossil aviation fuel replaced by sustainable aviation fuel in 2025.

Looking from a more long term perspective, The French National Strategy for the Reduction of Carbon Emissions aims to achieve carbon neutrality by 2050 and is based on an ambitious target of 50% of the SAF by 2050.

In the center: Robert Mauri, CAEP member, France

PROMOTING INTERNATIONAL COOPERATION

At the European level, we consider that the development of the use of sustainable aviation fuel requires the creation of a minimum production capacity which is currently lacking at European level as well as the definition of a European deployment trajectory to send a clear signal to the market.

To achieve this, European action is necessary:

- Europe was the driving force behind the emergence of CORSIA, so it must be the initiator of a shorter term movement for the deployment of sustainable fuel;
- Funding support for the industrialisation of new advanced biofuel technologies is needed to reduce the additional cost and risk to an investor;
- It would be appropriate to provide a coordination platform or a structure to facilitate exchanges between states in order to optimise the use of available capacities;
- Finally, it is important to quickly consider setting a shared incorporation target at the European level (it should be recalled that the International Air Transport Association (IATA) and the main players in the sector have set an incorporation target of 2% in 2025 in order to make progress with this deployment). A harmonised mechanism, at European level appears important in order to achieve high levels of renewable energy, while avoiding carbon leakage and fuel tankering.

CONCLUSION

As mentioned before, urgent action is needed. We are convinced that this movement must be initiated by federating the emerging supranational European initiatives.

There are existing collaborations that we wish to develop, convinced that we need to share our thoughts to answer the technical questions mentioned that are still in front of us, but also in the spirit of our common market. ■

Sustainable Aviation Fuels, ICAO's Recent Developments and State of the Art

César Velarde Catolfi-Salvoni, Environmental advisor to the Spanish Aviation Safety Agency (AESA) and Spanish appointed expert at the ICAO Committee on Aviation and Environmental Protection (CAEP)

César Velarde Catolfi-Salvoni, AESA and CAEP

ICAO's Focus on Sustainable Aviation Fuels

The International Civil Aviation Organisation (ICAO) has actively encouraged the Member States and industry in the development of sustainable aviation fuels (SAF) and significant progress has been achieved since then, especially developing global standards for its use and demonstrating its technical feasibility.

ICAO 39th Assembly recognised the introduction of SAF as one of the key measures to achieve ICAO's climate goals and to the carbon-neutral growth aspiration set in ICAO Assembly Resolution A39-2, while may also bring economic, social, and environmental advantages. The Assembly also requested the Council to consider the necessary policies and actions to ensure an increasing percentage of emissions reductions accruing from non-MBM measures over time.

The Second ICAO Conference on Aviation and Alternative Fuels (CAAF/2, 2017) approved the CAAF/2 Declaration which endorsed the 2050 ICAO Vision for Sustainable Aviation Fuels, and called on States, industry and other stakeholders, for a significant proportion of conventional aviation fuels to be substituted with SAF by 2050, as well as the need to promote policies to ensure the competitiveness of SAF. The CAAF/2 Declaration was endorsed by the ICAO Council during the sixth meeting of its 213th Session.

CORSIA and the ICAO CAEP Fuels Task Group (FTG)

The adoption of the ICAO Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) in 2016, established a mechanism to incentivise the use of SAF.

Under CORSIA, operators would reduce their CORSIA offsetting requirements by claiming emissions reductions from "CORSIA Eligible Fuels". A CORSIA Eligible Fuel is defined as a CORSIA sustainable aviation fuel (a renewable or waste-derived aviation fuel that meets CORSIA Sustainability criteria) or a CORSIA lower carbon aviation fuel (a fossil-based aviation fuel that meets CORSIA Sustainability criteria), which an operator may use to reduce their offsetting requirements.

These CORSIA eligible fuels can be produced and uplifted anywhere in the world, but to claim emission reductions against their offsetting requirements, the operator will need to demonstrate compliance with a number of sustainability criteria defined by ICAO, through sustainability certificates issued by third parties called sustainability certification schemes.

To develop all CORSIA Eligible Fuels requirements, the ICAO Committee on Aviation and Environmental Protection (CAEP) established in 2013 the Alternative Fuels Task Force (AFTF). The CAEP/11 meeting in February 2019, converted it into a permanent Fuels Task Group (FTG). AFTF and the FTG have delivered the content of all sections of the ICAO CORSIA Standard related to CORSIA Eligible Fuels.

Among them, the ICAO Document "CORSIA sustainability criteria for CORSIA eligible fuels" is the first global approach to Sustainability for any industry sector. The ICAO Assembly has already endorsed criteria related to greenhouse gasses reductions requirements and the protection of carbon stocks such as rainforest or peatlands. FTG work on additional Themes is on-going under CAEP to be ready by the end of the CORSIA pilot phase (2023).

For an operator to claim emissions reductions from the use of SAF, those must be based on its emissions Life Cycle Assessment (LCA) value (in gCO_2e/MJ) compared to a baseline of aviation fuel ($89gCO_2e/MJ$ for jet fuel). The total LCA value (LSf) has two components: Core LCA value and ILUC LCA value.

The ICAO document "CORSIA Default Life Cycle Emissions Values for CORSIA Eligible Fuels" that is available on the ICAO CORSIA website will contain those default values. Actual core life cycle values can be calculated if a fuel producer can demonstrate a lower core LCA compared to the default core LCA values or has defined a new pathway.

OVERVIEW OF SAF TECHNICAL OPTIONS

In June 2009, the American Society for Testing and Materials (ASTM) International, issued the ASTM D7566 for Aviation Turbine Fuel Containing Synthesised Hydrocarbons.

In a decade, six technology pathways have been already approved:

1. D7566 Annex A1: Fischer Tropsch (FT) Synthetic Paraffinic Kerosene (FT SPK), approved in 2009;
2. D7566 Annex A2: Hydro-processed Esters and Fatty Acids (HEFA SPK), approved in 2011;
3. D7566 Annex A3: Hydro-processed Fermented Sugar (HFS-SIP) approved in 2014;
4. D7566 Annex A4: SPK plus aromatics (FT-SPK/A), approved in 2015;
5. D7566 Annex A5: Alcohol to Jet (ATJ-SPK), approved in 2016 for isobutanol feedstock and updated in 2018 for ethanol feedstock;
6. D1655 Annex A1: co-processing of fats and oils in a conventional refinery, approved in 2018.

A significant number of additional pathways are under approval process. Three of them in a very advanced phase:

1. Algae-based HEFA-SPK (Bb-oil HEFA). New feedstock; existing pathway;
2. Catalytic Hydrothermolysis Synthetic Kerosene (CH-SK). Feedstock: oils, fats, and greases;
3. Co-processing using bio-crude from Fischer-Tropsch (Co-Processing FT). Feedstock F-T Biocrude (focused on Municipal Solid Waste)[1].

FUTURE SUPPLY LANDSCAPE IN EUROPE AND SHORT-TERM CHALLENGES

Over the next five years, the main production capacity for renewable fuels in Europe will come from HEFA (oils and fats). Part of that capacity, currently dedicated to road transportation, can, in fact, cover SAF demand. Additional HEFA biorefineries are planned in Europe and most of them are considering the option of producing SAF.

SAF production from the Fischer-Tropsch process is being a pathway more adopted in North America, especially from Municipal Solid Waste and can offer big potential. Co-processing offers immediate significant production capacity but still, the EU has not defined how to allocate the life-cycle emissions reductions to the final products.

Production capacity should not be a significant challenge for SAF supply if the adequate incentive frameworks are established in Europe.

Several European States are considering the establishment of SAF supply objectives as part of national plans to implement the revised Renewable Energy Directive. But different RED II implementation national regulations can drive to different regulatory frameworks and applicable SAF incentives within the European States.

There is currently a lack of coordination and discussion among European states regarding the implementation of SAF related policies and possible market interactions. A key European need is to establish the right platform to enable sates to discuss and coordinate the establishment of such policies in a manner that no market distortions are driven and states can learn from each other.

1 Note: under ASTM D1655


SENASA
ICAO focus on SAF
CORSIA
ATM TRAINING


FlightPath

A Balanced Compromise for Sustainable Aviation Fuels Supply Scale-Up

Alfredo Iglesias Sastre, Chief Environmental Unit at Spanish Aviation Safety Agency (AESA) and Spanish member of the ICAO Committee on Aviation and Environmental Protection (CAEP)

During the last months, we have seen an increasing social-environmental pressure over civil aviation sector linked to the impacts of climate change of air travel, what is driving aviation environmental regulatory proposals to reduce air travel demand, such as the establishment of environmental taxes on air tickets.

This measure is very disliked by the aviation industry but to respond to social pressure it is necessary to offer society credible measures to achieve sectorial climate commitments such as carbon neutrality after 2020.

One of the more reliable solution to tackle aviation's carbon emissions is the large-scale use of Sustainable Aviation Fuels (SAF) produced from renewable and strictly sustainable feedstock.

Aviation growth requires introducing new and ambitious measures to reduce CO_2 emissions and the Spanish Ministry of Transportation is considering a new set of policy measures as part of new climate change national regulatory frameworks, putting a special focus on the promotion of SAF also framed on the EU RED implementation.

The introduction of SAF needs to match supply with demand. Without warranting demand, producers would not invest to generate supply capacity and currently, it does not exist a large demand due to the higher price of SAF compared to fossil jet fuel.

The Balanced Compromise

In February 2019 Spain presented – jointly with France – a paper in ICAO Committee on Aviation and Environmental Protection (CAEP), proposing the Balanced Compromise approach, as a mean to establish national supply objectives to be defined through a dialogue between the regulator and the industry. Those objectives should have been showed feasible from supply side and economically acceptable from the user side.

Recognising that there are several policy options to incentivise SAF production, Spain initiated a dialogue with key national stakeholders from the airline and fuel production industries after which it was acknowledged that, including among the national bioenergy objectives a 2% binding supply of SAF in 2025 would not put in risk the competitiveness of the aviation industry nor distort national market, while would ensure the competitiveness of SAF and reduce the risk of SAF investments, driving to a future reduction of SAF price gap with fossil aviation fuels.

The industry stakeholders acknowledged that the lack of ambitious measures such as SAF supply would boost pressure to worst measures for the aviation sector, such as carbon or fuel taxes.

To avoid any competitive distortion, such supply objective should be equally required by national regulation to all aviation fuel suppliers and would be established only after studying the feasibility of reaching sufficient supply capacity at a reasonable cost by the date proposed to enter into force. Such an approach would ensure the necessary investments of fuel producers.

It is understood that creating the market through a small percentage mandate will serve as a booster to improve technologies and lower prices to increase a competitive use in higher percentages.

This regulator-industry compromise to promote SAF deployment through dialogue is proposed as a “balanced compromise” versus the “mandate” concept, which has traditionally been rejected by the aviation industry as a preferred policy option.

On this basis, the Spanish Government is planning the establishment of a national regulation establishing a short-term supply objective of sustainable aviation fuels from the total national aviation fuel delivery. The final objective is to be determined in cooperation with industry stakeholders to ensure its technical and economic feasibility, without compromising the competitiveness of air transport neither introducing fair competition distortions.

Several technology options are under consideration by different industry stakeholders in Spain.
Among them, special interest from both the energy and aviation industries is taking the possibility of producing SAF from Municipal Solid Waste, as some Spanish regions have a challenge with the management of MSW.

In that framework it has been proposed the ARTEMISA project, aiming to identify available conversion technologies targeting MSW use, perform a costs analysis and identify requirements of the facilities, detect potential partners and investors and work with the responsible municipalities and local administrations to identify potential waste management facilities capable to supply waste.

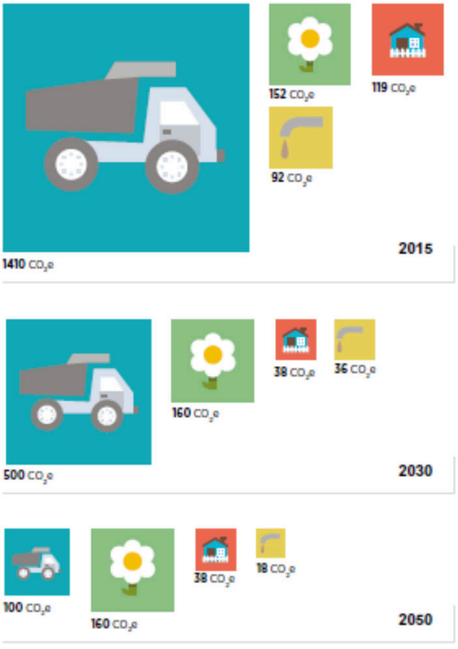
Spain expects to become among the foremost European countries in the promotion of SAF use, hoping other partner countries will join such direction, to achieve a large-scale supply in our region.

Pollution-free Airport as a Regional Goal

Stig Hvoslef, Scientific Coordinator Climate and Environment, Akershus County Council

The last 20 years, Akershus County Council has been a driving force towards reducing greenhouse gas (GHG) emissions in Norway. With a common climate strategy for the Larger Oslo Region adopted by the parties in 2002-2003 and an action plan set into forces from 2005, we aimed to reach the Norwegian Kyoto goals in our part of Norway, in partnership with the City of Oslo and Buskerud County Council. Among the targets was the promotion of zero-emission vehicles, to reduce GHG emissions and local pollution. The continued collaboration with the City of Oslo in 2014 leads to a new strategy (2014-2025) for the Capital region to help early introduction of fuel-cell based electric vehicles (FCEV) in the Capital Region. Among the goals are 10.000 FCEVs on the road by 2025.

In 2018 Akershus County Council adopted a regional plan for climate and energy. The plan has ambitious targets for emission reduction, according to the Paris Agreement: 55% reduction of direct climate emissions by 2030 compared with the 1991 level. By 2050 the plan´s goal is that Akershus has developed to a low emission society.



In line with the overall goal, the transport sector must reduce its GHG emissions with 50% by 2030. This is a big challenge because the Capital Region has been one of the fastest-growing capital regions in Europe for many years. The projections are ca. 300,000 new residents within the next 20 years. To help reduce the need for car usage a regional plan for land use and the transport was adopted in 2014 for the Oslo Region. The intention is to stimulate a polycentric development, better public transport and facilitation of pedestrians and cyclists.

About 70-80% of GHG emissions in the Capital Region is due to the use of fossil fuels. The Climate and Energy Action Plan in Akershus (2019-2022) therefore focuses on transport measures and low emission fuels. It promotes zero-emission technology for passenger cars and light and medium-sized commercial vehicles, while biogas (preferably from waste and wastewater) and hydrogen are the preferred fuels for heavy vehicles. National incentives work well together with the regional measures for passenger cars, and the Oslo Region has today Europe's highest density of EV cars.

A successful measure implemented in 2019 was a funding scheme for charging infrastructure in condominiums and housing cooperatives, which alone gives a possibility to a 30% growth of EVs in Akershus. In line with the action plan, the county council now supports an initiative to get one hundred or more heavy-duty fuel cell cars on the road over the next 4-5 years. From 2019 the public transport company owned by the City of Oslo and Akershus County Council has more than 100 EV buses in operation and has eight years of experience with fuel cell buses.

LOCAL POLLUTION – A STATE ISSUE AND A REGIONAL ONE

The extensive traffic causes health problems and has been a strong driver to replace road traffic with other types of mobility. In the Oslo region, several urban areas frequently have a smog problem during winter periods due to air pollution from transport. Achieving climate targets will make Akershus a low-emission society in 2050, reducing 85-90% of the direct GHG emissions and most of the local air pollution.

The highest direct GHG emissions from fossil fuels can be found in Ullensaker municipality in Akershus, where Oslo Airport is located, about 50 km from Oslo City Hall. The origin of these emissions is mainly from transport sector, which also causes local pollution and public health challenges. The airport is growing, and the problem will not disappear without focused actions.

Since its opening in 1998, Oslo Airport has grown rapidly, from 14.1 million passengers in 1999 to 28.5 million passengers in 2018, almost half of the total Norwegian air traffic. Therefore, a new terminal was opened in April 2017. Estimates show that the capacity requirement in 2034 will be about 38 million passengers, and a third runway is planned to meet expected traffic growth.

Oslo Airport is operated by Avinor, a 100% state-owned company with high environmental ambitions. Among them are electrification of all domestic aviation by 2040, a target for the development of biofuel from forestry waste and 30% fossil-free aviation fuel by 2030, and higher energy efficiency in the operation of the airport. Of special importance for the Akershus County Council is the targets of 50% reduction of the GHG emissions from 2012 to 2022, continuous noise reduction, prevention of new groundwater pollution and avoidance of reduced environmental status of the aquatic environment, and, not least, the target of getting a public transport share of 70% within 2020 and 75% by 2030. In 2018 the share already was 71%.

Even where the state (by Avinor) and the regional community developer (Akershus County Council) have common interests and shared responsibilities, the second is in little or no extent mentioned in the first actor's strategies and plans, and vice versa.

Regional Plan for Climate and Energy in Akershus states that more than a third of the fossil fuel sold in Akershus is destined for the aeronautical sector. Calculations indicate that domestic and international air travel is responsible for almost 12.5% of Norway's total climate gas emissions. Emissions from domestic air traffic accounted for 1.4% of the national climate gas emissions in 2015."

The regional plan proposes to introduce measures to reduce the need for flights – it states: “The aeronautical sector is important to the local business community and the labour market as a whole. At the same time, the sector is working actively to identify more eco-friendly fuels and to develop more efficient aircraft. The increase in the number of flights will, however, generate more climate gas emissions at the national and global level. Reducing the need and demand for aircraft as a means of transport, for private and commercial purposes alike, is, therefore, a measure that will help cut climate gas emissions. The need to travel by air on business can be reduced by establishing conditions for videoconferencing and streaming conferences and seminars. Employers can also do more to encourage staff to travel by train rather than by plane where possible”.

This is why the only aviation-related activity in the Climate and Energy Action Plan is: Demand for air travel – both private and business-related – to be reduced by 2030.

In the regional climate and energy plan, aviation has two short sub-chapters. The reason why the discussion of aviation is given so little space is that GHG emissions from aviation are to a very small extent charged to Akershus.

GHG emissions from the aviation sector is a controversial issue in itself. Furthermore, as a national aviation hub, reducing GHG emissions from Oslo Airport is largely a national responsibility that gives the county council and municipalities limited scope for action. Aviation activity is also closely linked to commercial interests and international trade, which makes regional and local environmental goals even more complex.

COORDINATION AND COLLABORATION

Oslo Airport is a strong motor for a lot of the business activities in the Oslo Region, because of the large number of business and leisure travel, but also as an important freight terminal. Therefore, the Avinor is a strong force in the work for ambitious but necessary climate, energy and environmental measures. In 2018, Avinor had a total operating income of the airport business of NOK 10.3 billion. Thus, Avinor has a considerable strength to accelerate and implement the introduction of green technology and stimulate to green choices in collaboration with business partners - not least in the Oslo Region where almost half of the airport activity takes place.

On the other hand, Akershus County Council is influential in several ways; as the regional transport as the road authority, as the owner of most of the public transport in Akershus. Further, as the regional plan authority, making plans and strategies which the municipalities use as a basis for their own planning. The County Council owns and runs the public high schools and takes care of adult education and vocational training. At the environmental arena, the County Council is the regional authority for the EU Water Framework Directive, for management of game and inland fish, and for facilitation for outdoor activities.

Finally, Akershus County Council is a community developer, with the goal of stimulating to innovative business activities and bring it to, and maintaining it at, a high international standard – while working to develop Akershus towards a low-emission, sustainable society.

The common climate and environmental interests should facilitate close and effective collaboration between the two actors – for faster development to make the Oslo region a sustainable low-emission society. Today's failure to cooperate slows down this process.

Akershus County Council thus challenges the Government to establish mechanisms that promote effective coordination and collaboration between Norwegian airports and the county municipalities. This will certainly help to accelerate the transition to fossil-free, zero-emission and environmentally friendly solutions – for all sectors of the society!

Stig Hvoslef has been coordinating the climate and environmental unit at Akershus County Council since 2005. He is a graduate biologist and has experience from research institutions, the communication sector and from national and international environmental NGOs, including work as chairman of WWF International´s Global Arctic Programme and as the CEO of WWF Norway.

Video of the Event

For the FlighPath final event, on which this proceedings report is based, Airport Regions Council, together with the European Commission, SENASA and ARTFuels, have created a promotional video of the event. The video includes insights and interviews of many speakers and attendees on the topic of sustainable aviation fuel.

The video, as well as the presentations of the speakers and pictures of the event can be found at

biofuelsflightpath.eu/final-event

References

Alonso, G., A. Benito, L. Lonza & M. Kousoulidou (2014), Investigations on the distribution of air transport traffic and CO2 emissions within the European Union, Journal of Air Transport Management 36, 85–93.

Bann, S.J., R. Malina, M.D. Staples, P. Suresh, M. Pearlson, W.E. Tyner, J.I. Hileman and S. Barrett (2017), The costs of production of alternative jet fuel: A harmonized stochastic assessment, Bioresource Technology 227 (2017) 179–187.

Boeing (2016), Current Market Outlook 2016-2035. Seattle, WA, USA: Boeing.

Brueckner, J.K. & C. Abreu (2017), Airline Fuel Usage and Carbon Emissions: Determining Factors, mimeo Department of Economics (University of California at Irvine) and Department of Industrial Engineering (Federal University of Rio de Janeiro).

Davidson, C., E. Newes, A. Schwab & L. Vimmerstedt (2014), An Overview of Aviation Fuel Markets for Biofuels Stakeholders, Technical Report NREL/TP-6A20-60254. Golden, CO, USA: National Renewable Energy Laboratory.

De Jong, S., R. Hoefnagels, A. Faaij, R. Slade, R. Mawhood, M. Junginger (2015), "The feasibility of short-term production strategies for renewable jet fuels – a comprehensive techno-economic comparison", Biofuels, Bioproducts and Biorefining 9, 778–800.

De Gorter, H. and D.R. Just (2009), The Economics of a Blend Mandate for Biofuels, American Journal of Agricultural Economics 91(3), 738–750.

DG Energy, Oil Bulletin, Prices over Time, 2005 Onwards. (http:/ec.europa.eu/energy/observatory/reports/Oil_Bulletin_Prices_History.xls consulted on 8 May 2017)

DG Internal Policy (2015a), Emission Reduction Targets for International Aviation and Shipping. Brussels, Belgium: European Parliament.

DG Internal Policy (2015b), The Impact of Biofuels on Transport and the Environment, and their Connection with Agricultural Development in Europe. Brussels, Belgium: European Parliament.

EC (2016), EU Reference Scenario 2016, Energy, transport and GHG emissions, Trends to 2050. Luxembourg: Publications Office of the European Union.

EEA (2017), Trends and projections in the EU ETS in 2017, The EU Emissions Trading System in numbers, EEA Technical Report 18/2017. Copenhagen, Denmark: EEA.

EEA, EU Emissions Trading System (ETS) data viewer (https://www.eea.europa.eu/data-and-maps/data/data-viewers/emissions-trading-viewer-1 Consulted on 8 May 2017)

US-EIA (2017), International Energy Outlook 2017. Washington, D.C., USA: US Energy Information Administration. Eurostat, Complete Energy Balances, http://ec.europa.eu/eurostat/en/web/products-datasets/-/NRG_110A.

GIZ (2014), International Fuel Prices 2012/2013, Deutsche Gesellshaft für Internationale Zusammenarbeit, Bonn and Eschborn, Germany.

Goodwin, Ph., J. Dargay & M. Hanly (2004), Elasticities of Road Traffic and Fuel Consumption with Respect to Price and Income: A Review, Transport Reviews, 24:3, 275–292.

IATA (2008), Air Travel Demand, IATA Economics Briefing no. 9.

IATA (2016), Fact Sheet Fuel.

ICAO Environment Advisory Group (2016), Results of Technical Analyses by CAEP, January 20-21, 2016.

IEA (2015), Energy Balances of non-OECD Countries, 2015 Edition, Paris, France: IEA.

IEA (2015), Energy Statistics of non-OECD Countries, 2015 Edition, Paris, France: IEA.

IEA (2017), World Energy Outlook 2017, Paris, France: IEA.

IEA (2018), Energy Prices and Taxes, Fourth Quarter 2018, Paris, France: IEA.

IMF & World Bank (2011), Market-Based Instruments for International Aviation and Shipping as a Source of Climate Finance, Background Paper for the Report to the G20 on Mobilizing Sources of Climate Finance.

IRENA (2013), Road Transport: The Costs of Renewable Solutions, Preliminary Findings. Abu Dhabi, United Arab Emirates: IRENA.

IRENA (2017), Biofuels for Aviation, Technology Brief. Abu Dhabi, United Arab Emirates: IRENA.

JRC (2014), Well-To-Wheels Analysis of Future Automotive Fuels and Powertrains in the European Context.

Lokesh, K. V. Sethi, Th. Nikolaidis, E. Goodger, D. (2015), Life cycle greenhouse gas analysis of biojet fuels with a technical investigation into their impact on jet engine performance, Biomass and bio energy 77, 26-44.

OECD-FAO (2017), OECD-FAO Agricultural Outlook 2017-2026.

Subgroup on Advanced Biofuels, Sustainable Transport Forum (2017), Final Report, Building Up the Future, Luxemburg, European Union.

Tao, L., J. N. Markham, Z. Haq and M.J. Biddy (2017), Techno-economic analysis for upgrading the biomass-derived ethanol-to-jet blendstocks, Green Chemistry 19, 1082-1101.

Tol, R.S.J. (2012), A cost-benefit analysis of the EU 20/20/2020 Package, Eneregy Policy 49, 288-295.

UFOP (2015), UFOP-Marktinformation Ölsaaten und Biokraftstoffe, Editions January to December 2015. https://www.ufop.de/medien/downloads/agrar-info/marktinformationen/

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