Summary

Impacts of climate policy measures on Norwegian aviation

TØI Report 1878/2022
Authors: Niels Buus Kristensen, Harald Thune-Larsen
Oslo 2022 53 pages Norwegian language

Ambitious CO_2-reduction targets in Norwegian aviation will require significant measures. This report documents a user-friendly tool, the PACER model, for analysis of the impacts of various policy measures on ticket prices, passenger volumes and CO_2-emissions from Norwegian domestic and international air routes toward 2030. In addition, the model calculates the cost distribution between the government budget, passengers and airlines. The features of the model are illustrated by six different scenarios with blending of sustainable aviation fuels (SAF) with and without subsidies, as well as increased CO_2-tax and passenger taxes. In practice, SAF blending is necessary for achieving significant CO_2-reductions from aviation in 2030. The allocation of costs between the government budget, passengers and airlines will depend on the degree of financing the SAF blending by subsidies and the use of taxes, but also on assumptions about the pass-through rate of airlines' cost increases to ticket prices.

Summary

Greenhouse gas emissions from Norwegian aviation have doubled between 1990 and 2020, where the covid-19 pandemic has led to a steep fall due to heavily reduced travel activity, in particular on international trips. After the pandemic travel activity is expected to gradually catch up. The base projection in this project expects almost 30% more international passengers in 2030 compared to 2019, while growth in domestic passengers is expected to be weak.

In the future we will see more fuel efficient aircraft and more energy efficient flight operations but globally these improvements will expectedly lead to CO_2-reductions that will only compensate the demand growth. Significant total reduction will undoubtedly require the use of far reaching policy measures.

The purpose of this project is to develop a model that can quantify the impacts of various climate oriented measures for Norwegian aviation in terms taxes and other means for financing the additional costs of sustainable aviation fuels (SAF) compared to fossil jet fuel. The model is named PACER – *Policies for Aviation Carbon Emission Reductions*, and it aims at assessing the impacts of policy scenarios compared to a base scenario toward 2030.

The PACER model

The PACER model is based on data on departures, seat supply, CO_2-emissions and estimated ticket prices for each of the about 500 air routes within Norway and from Norway to other countries. With assumptions about pass-through rates airlines' cost increases will lead to higher ticket prices. For each route demand reactions to price changes are calculated from price elasticities derived from existing models and literature. Price elasticities are differentiated on domestic and international routes, and price sensitivity is highest for domestic trips and higher for business compared to leisure trips. Simplistically, it is assumed that airlines only adapt to demand changes through yearly departures on the route, which percentagewise corresponds to the calculated demand change on the route which implicitly gives constant load factors. Calculated percentage changes in ticket prices, passenger volumes and CO_2-emissions for the individual routes are aggregated to results for five route segments: Public Service Obligation (PSO), Regional, National, European and Intercontinental routes. In addition, the burden sharing of the policy scenarios in terms of cost distribution on the government budget, passengers and airlines are calculated for each year toward 2030.

Four scenarios for various types of measures

The scenarios A to D analyzes four types of policy measures:

A. SAF-blending: **0% in 2022 → 30% in 2030.**
SAF price is assumed to be 2½ times fossil jet fuel price.

B. SAF-subsidy: **0% in 2022 → 30% SAF in 2030.**
SAF price premium is financed by government subsidies.

C. CO_2-tax: **510 NOK/ton in 2022 → 1198 NOK/ton in 2030.**
(only domestic routes)
≈ 2.000 NOK minus ETS- quota price (80 EUR/ton CO_2)

D. Passenger-tax: **75 resp. 200 NOK in 2022 → 6-doubling in 2030**.
≈ eliminating the total passenger growth of 12% from 2019 to 2030 in the Base Scenario.

The implementation of each measure could of course also have been scaled otherwise with impacts being scaled accordingly, and this can be specified in the PACER-model by the user. However, the results for the scenarios does not only depend on the degree of blending or the level of the tax rates but also on the assumptions regarding other core parameters which should also be specified by the user. Nevertheless, some clear conclusions can be drawn from the scenario.-analyses:

- Only SAF blending will in practice lead to significant CO_2 reductions from Norwegian aviation in 2030 compared to 2019.
- Even considerable increases of the passenger taxes will result in only relatively minor reductions of travel demand and, hence, CO_2-emissions.
- Increasing the CO_2-tax can raise incentives to more energy efficient operations and aircraft. This effect is not included in the model, but airlines already have significant economic incentives to energy optimize due fuel costs' considerable share of total costs.
- Only if the CO_2-tax becomes big enough to eliminate the cost premium of SAF will airlines have economic incentives to shift to SAF, and 100% SAF will then be cost minimizing for domestic routes. Still, this will not induce changes on international routes since fuel taxes cannot be levied on international air routes according to EU legislation. However, this can be altered if the EU-commissions *Fit-for-55* proposal is adopted.

SAF-blending of 30%, which may be considered as quiet significant, will result in moderate price increases of 5-10%. If a 30% SAF-blend is financed by subsidies the PACER model calculates an extra 2,5 bill. NOK expenditure on the government budget with the assumptions about the price premium of SAF. However, the amount is a

Highly dependent on the future SAF price. Without financing the SAF-blend the substantially higher fuel price will cause problems with incentives for tankering and fewer direct international routes from Norway. The total additional fuel costs correspond rather accurately to the total revenue from passenger and CO_2-taxes. However, this revenue is already allocated to the overall government budget, implying that the subsidy will have to be financed from tax increases anyway, either from the aviation sector or other areas, or alternatively by budget cuts.

Two scenarios with combo-measures

Concerning burden sharing of a 30% blend in Scenario A and B represents two extremes: In Scenario A airlines and passengers share the costs according the pass-through rate. In Scenario B the government budget finances the full cost premium, while airlines and passengers get a fuel cost saving on domestic routes because the SAF-share is not subject to CO_2-tax.

Finally, we set up two combo-scenarios between the two extremes, where 30% the SAF-blend is financed by subsidies, and where the government budget pays half of the SAF-share. Airlines and passengers pays the other half via increased passenger taxes (Scenario E) or via increased CO_2-tax supplemented by increased passenger taxes (Scenario F):

E. Combo-scenario: 30% SAF-blend. 15% financed by government budget and 15% by increased passenger taxes (+63%)

F. Combo-scenario: 30% SAF-blend. 15% financed by government budget and 15% by increased CO_2-tax (2.000 NOK/ton) supplemented by passenger taxes (+33%)

Both Combo-scenarios obtain a CO_2-reduction of a little more than 30% and an average ticket price increase and passenger volumes decrease of about 2%. The main difference is that with the increased CO_2-tax (Scenario F) a larger share of the reductions take place on domestic routes. This in turn implies that a larger share of the CO_2-reduction counts is accounted in achieving Norway's reduction targets, but also that domestic passengers bear a larger share of the financial burden.