CONSULTATION

Measures for accelerated phasing-in of zero- and low- emission aircraft in Norwegian aviation

Introduction

Aviation serves essential transportation needs in Norway, yet it faces exciting challenges to decarbonize its operations.

Norway plans to cut 55% of its overall emissions by 2030 and to be carbon neutral in 2050. There is no sub-target for aviation emissions, but the overall 55% target will be achieved through EU ETS, international cooperation on emission reductions and national mechanisms (Miljømål 5.3).

The EU ETS will significantly increase the cost for Norwegian airlines of emitting CO2 and international cooperations such as RefuelEU will add the cost of mandatory SAF on top. National mechanisms could be necessary to help Norwegian airlines invest in low emission aircraft to save ETS cost and to need less SAF.

Zero emission aircraft may not be available by 2030 and this timeframe could be optimistic given the technical challenges of operating in Norwegian conditions. We will show in this document that even if they do arrive as announced, their contribution to cutting overall aviation emissions in Norway will be limited.

As the world leader in the regional market segment, ATR benefits from a solid experience in every aspect of regional aviation activities, including sustainability and decarbonization.

We are convinced that every step towards lower emissions is crucial and that it is the combined effect of available solutions at any given time that will gradually bring aviation closer to the ultimate goal of zero emissions.

Time is of the essence however, and waiting for a zero emission solution to become available is taking a risk that our planet may not afford. Immediately available solutions can yield significant gains that will allow aviation to bring a meaningful contribution to the 2030 emission reduction target.

ATR is honored to propose to the Norwegian government its contribution on how to implement zero and low emission aircraft, as well as to meet national CO2 emissions targets.

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1. Making sustainable regional aviation in Norway a reality

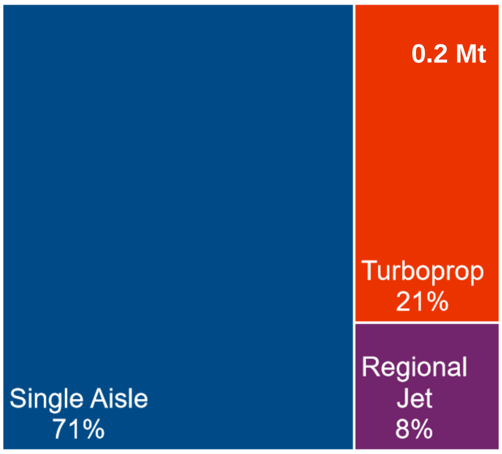
1. Norwegian domestic aviation emission context

ATR has made an estimate of the annual domestic aviation emissions[1] and its breakdown by aircraft type.

The highest CO2 contributor in Norway are the Single-aisle operations represented by A320 from *SAS (including neos)*, and B737 from *Norwegian*.

followed by Turboprops operations, predominantly from *Wideroe* and its fleet of Dash8- 100,200,300 and Q400.

Another aspect of the CO2 emissions is a low load factor: around 65% for *Norwegian*, and around 56% for *SAS* and *Wideroe*[2].



The single-aisle sector has initiated a natural shift to the latest generation models A320neo and B737 Max. This has a potential to reduce total emissions by **0.06Mt**, corresponding to **7%** of the total domestic emissions.

The regional jet sector is operated by CRJ900/E195 (SAS) and E190E2 (Wideroe) aircraft. A shift to the latest generation here would lead to a limited CO2 reduction potential of **0.005Mt**, as new-generation regional jets drops total emissions per flight by only 11% approximately. ATR turboprops would offer a **low-emission** alternative to a regional jet flight, **effectively removing half of the emissions**. *(refer to §1.2. Address today's emissions)*

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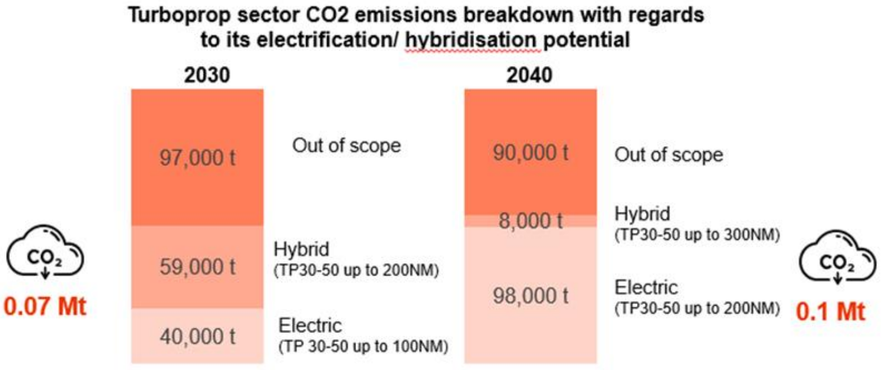
[1] Based on OAG, a database listing all scheduled commercial flights with associated aircraft. Study done on the past running year: JUL22-JUN23.
[2] Based on Sabre data, over the period JUL22-MAR23

As for the turboprop sector, its electrification is contemplated, however it will be limited in terms of capacity and range in a first step. The share of the 30–50-seater with a range of up to 200 NM (370 km) for 2030 and 300NM (560 km) for 2040, represents today about **0.1 Mt** of CO2 emissions annually, and a potential reduction of **0.07Mt** by 2030 (8% of total domestic annual emissions) and **0.1Mt** by 2040 (12% of the total domestic annual emissions).



The electrification combined with the jet engine upgrades has a total CO2 reduction potential of **0.14 Mt** by 2030 [resp. 0.17Mt by 2040], only 15% [resp. 19%] of the current annual emissions. Half of this reduction depends on the availability of electric/hybrid aircraft and corresponding airport infrastructure upgrades.

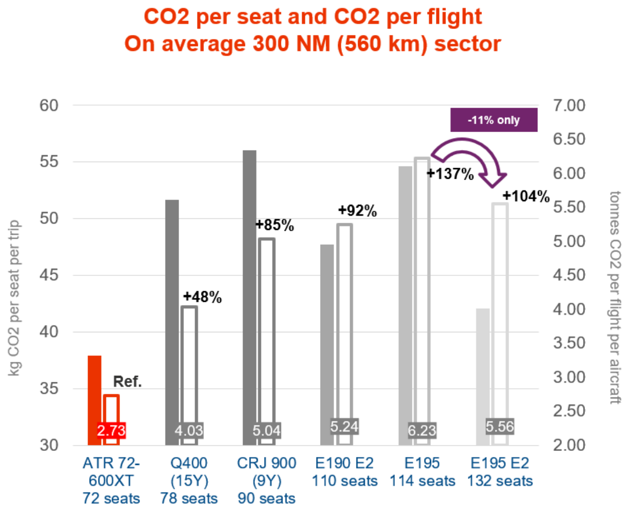
ATR suggests adopting a more progressive and diversified decarbonization that starts with the low-hanging fruit: The replacement of regional jets and Q400 operations by **low-emission** ATR turboprops that are significantly more fuel efficient and has the added benefit of drastically reducing operating costs. *(refer to Annex 1)*

2. Addressing today's emissions

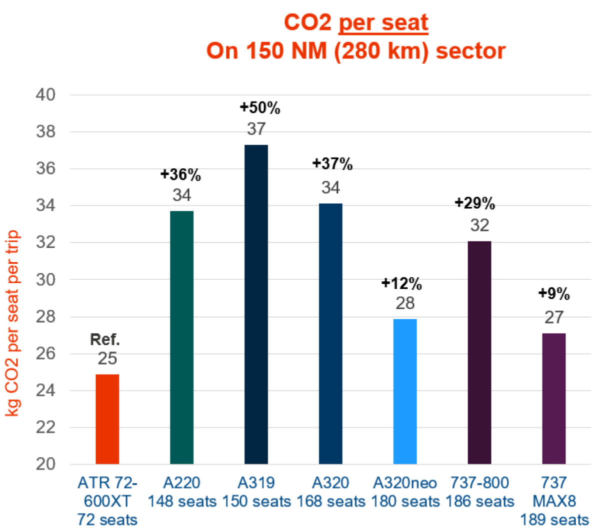
ATR turboprop technology induces a 50% cut in fuel consummation per trip compared to regional jets of similar size and a 30% cut compared to a Q400.

Low load factors give Norway the opportunity to replace 90-seater CRJ900s (54 passengers in average) with 72-seater ATR 72-600s on a one for one basis, with the added benefit of a better asset utilization and less empty seats.

Additionally, if the current trend of reduced travel for business continues, maintaining frequencies and connectivity that are essential for local economies would make more sense on a slightly smaller and more sustainable aircraft like the ATR 72-600.

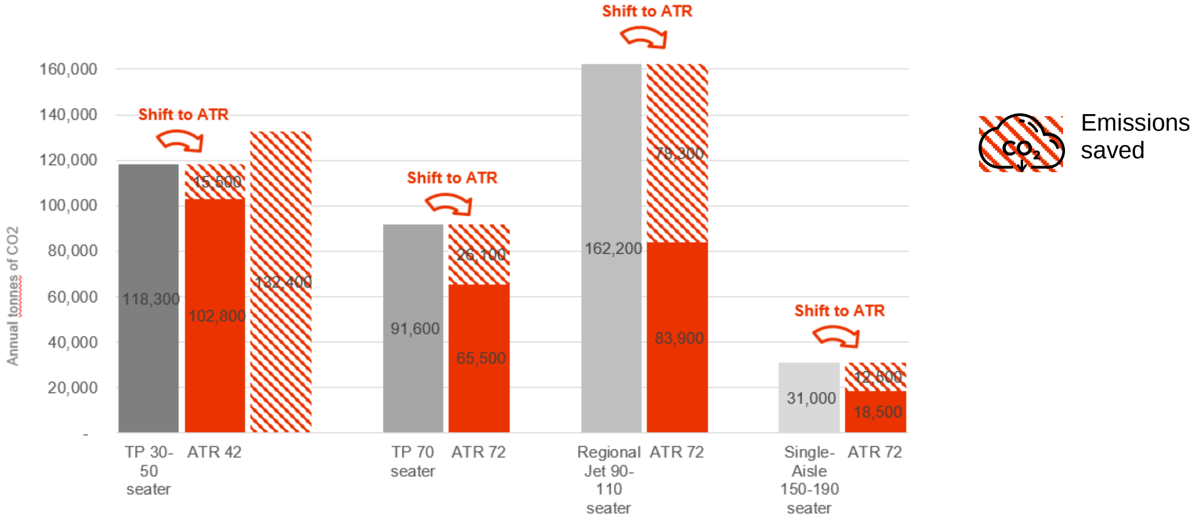


Numerous short routes are operated in Norway, due to its particular topography (e.g. SVG-BGO). Jet aircraft operated on extra-short routes are particularly inefficient and ATR 72-600 can offer a more efficient alternative, even to the new-generation single aisle.



Replacing regional jets, Q400s and a limited number single-aisle jets on extra short routes with ATR aircraft would lead to a significant cut in CO2 emissions. It can be done immediately as the technology is already available and it would pave the way for the next generation even lower emission ATR EVO in 2030. (refer to 2.1. ATR EVO).

The smaller ATR 42-600 and ATR 42-600S aircraft (refer to 2.3. ATR42-600S) could replace the ageing fleet of Dash8 100/200/300 to achieve the synergies of a harmonized fleet, as all ATRs share the same technological platform and can be flown by the same pilots.



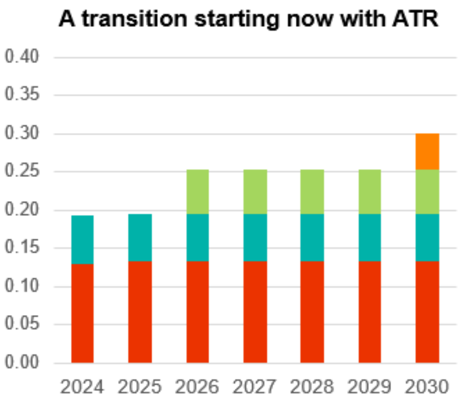
Deploying fuel-efficient ATRs on regional routes, would yield a CO_2 saving of **0.13 Mt** each year, more than the total emissions of the entire TP30-50 fleet in Norway. The gain achieved immediately would hence be greater than the effect of a complete electrification of this segment.

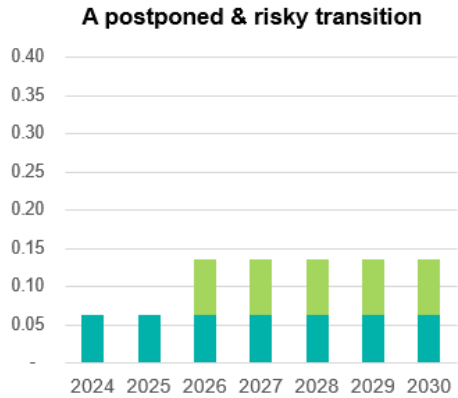
3. Immediate low-carbon transition versus a delayed transition

Several decarbonization levers have been mentioned previously, except for the ATR EVO *(refer to §2.1. ATR next generation aircraft: ATR EVO).* The CO_2 reduction potential of each of them are summarized here.

Proposed decarbonation building blocks

These levers will be activated in different point in time. Positioned on a timeline below, the resulting CO_2 saving is shown. Having a more diversified approach results in a higher carbon reduction in 2030, **0.3 Mt** annually, but also on the cumulated carbon. The difference between the 2 scenarios is **0.9Mt**, which is equivalent to the total domestic CO_2 annual emissions.





- 0.3 Mt annually in 2030
- 1.7 Mt cumulated by 2030

- 0.14 Mt annually in 2030
Only **- 0.8Mt** cumulated by 2030

2. ATR's coming products

1. ATR's next generation aircraft: the ATR EVO

The current ATR -600 version is the lowest emission aircraft on the regional market, consuming twice less fuel and emitting twice less CO_2 than regional jets aircraft of similar size.

The value proposition of the ATR EVO is to offer a competitive low-emission electric hybrid aircraft to airlines with affordable cutting-edge technology. The ATR EVO feasibility study is expected to start in 2024.

It seeks to provide an additional 20% fuel improvement compared to today's ATR -600 family and an equivalent cut in CO_2 emissions. The engines will be 100% SAF compatible and maintenance costs will be lowered by 20%. A mild-hybridization capability with battery will be introduced, and used as a boost for high-energy flight phases (takeoff, climb).

As for its current aircraft, ATR is putting a strong emphasis on eco-designing its products. The ATR EVO will be manufactured with at least 20% of composite material and a strong attention on implementing an end-to-end lifecycle.

The entry into service of the ATR EVO is expected in 2030.

2. Hybrid electric benefits

Considering today's zero and low-emissions aircraft entry into market challenges, the ATR EVO will be designed to:

→ Address the actual range limit of current zero and low-emissions aircraft. The ATR EVO will benefit from the same range of the ATR72-600 as of 740 NM (1,370km).

Offer flexible operations regarding infrastructure readiness to propose electric charging stations, being operable only with fuel (CAF and SAF).

→ Address economic viability of operating costs and investments needed. Offering the same range of the ATR72-600, the same seat capacity and reduced operating costs (-20%), the ATR EVO will be affordable and economically viable to operate.

→ Be certified on time, as the certification process (CS25) will benefit from the existing ATR72-600 type certificate.

3. ATR 42-600S for Short Takeoff and Landing

ATR launched the ATR42-600S program in October 2019, to enhance the capability on short runways of the current ATR 42-600. The 42-600S will operate on runways as short as 800m with the same passenger capacity as the existing aging Dash8 -100/-200 aircraft. The program is on track for certification in early 2025 and entry in service the same year.

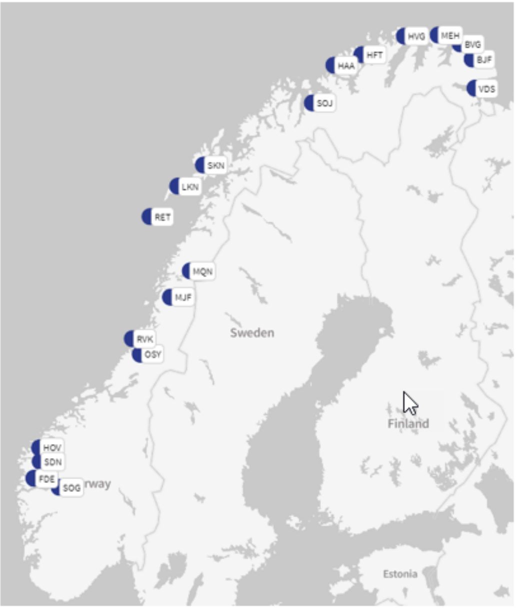
The ATR 42-600S will be certified to the latest EASA standard CS25 amendment 24 released in 2020, ensuring the highest level of safety ever achieved – including from an aircraft performance point of view.

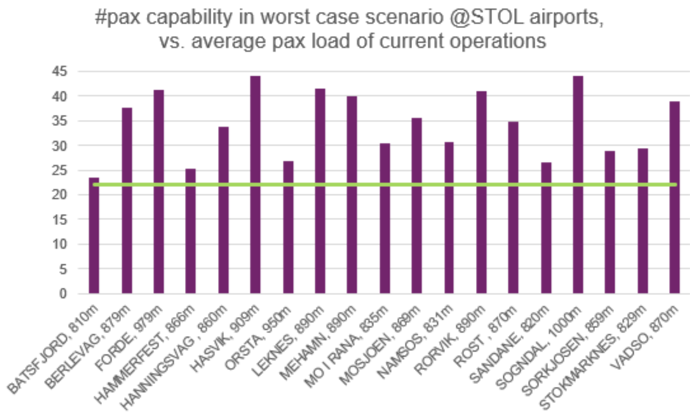
ATR aircraft have consistently demonstrated a dispatch reliability of 99,7%. Their ability to ensure reliable operations under challenging and/or extreme conditions is a key component of their operational profitability and the 42-600S will inherit the same reliability.

4. ATR 42-600S performance in Norway

ATR assessed the ATR 42-600S performance on Norwegian short-runway airports, for a worst-case scenario of 5°C outside air temperature, atmospheric icing conditions and wet (grooved) runway conditions. This results in the following passenger capability for a standard 150 NM (280 km) are as shown below.

The passenger load capability (in the worst-case scenario) is above the average passenger load of 22 passengers[3] currently observed for these routes, making the ATR42-600S a great match for the Norwegian STOL market requirement.





OAT 5°C, icing conditions, wet grooved runway, 150 NM route

[3] Sabre date JUL22-MAR23

3. Recommendations

With the right incentives, the Norwegian aviation sector could have a meaningful contribution to the overall emission reduction target of 55% by 2030. Aircraft fleet transformations take time however and our strongest recommendation is to act immediately to start the transition. The following recommendations can all be implemented now and will prove that aviation can be part of the solution to reduce overall emissions by 55% in time for 2030.

1. Reporting

A good place to start is to measure the emission efficiency that airlines deploy to transport passengers.

We recommend to start monitoring the following indicator on an annual basis for each airline:

CO2/RPK (revenue passenger kilometer)

This indicator captures both the advantage of low emission aircraft designs (CO2/km/seat) and the right-sizing efforts made to avoid using too large aircraft with empty seats.

The CO2/RPK score and its evolution over time is already being published in full transparency by Air New Zealand[4].

In Norway, it would be an excellent tool to monitor and compare the emissions of each airline on an apple-to-apple basis but also the evolution of the combined Norwegian fleet from year to year as we approach milestones like 2030.

2. Taxation

Several taxes apply to airlines in Norway today, but not all are designed to avoid global warming. We recommend regrouping them in a single tax with a clear target to favour the lowest emission solution at any point in time.

To effectively lead to a fleet transition, such a tax must be significant. We would recommend a progressive tax based on CO2 emissions to strengthen the effect on the highest emission solutions while preserving the economic sustainability of the best performers.

The CO2/RPK indicator would be perfect to establish categories of low-, medium- and high emission airlines.

The low emission category airlines would then pay a lower price per ton CO2 than the others, reflecting their effort to invest in low emission aircraft and using them efficiently.

2.1 Going further

One can imagine future iterations of the unified tax to consider more complex indicators such as:

- Non-CO2 global warming effects like contrails
- Global impact over the aircraft full lifecycle, from production to dismantlement, knowing that battery can have a significant impact over its complete lifecycle.

[4] https://p-airnz.com/cms/assets/PDFs/2023-air-new-zealand-sustainability-report.pdf in section “Metrics and targets”

Companies like Estuaire[5] propose comprehensive climate impact assessment over entire lifecycle for in-production aircraft, as well as for future technology aircraft.

3. Investment support

The unified tax would generate significant capital resources that could be returned to airlines in the form of subsidies to either purchase or lease low emission aircraft. Typical lease durations for low emission aircraft like the ATR is 10 years.

An investment support could reverse the current tendency of Europe's legacy Q400s finding shelter in Norway. The leading regional aircraft lessor Nordic Aviation Capital states in its latest ESG report[6] that they are phasing out old and inefficient designs (Q400 and E190 mentioned) in favor of modern and more sustainable aircraft like the ATR 72-600 and Airbus A220. The Q400 in particular is being removed from service in Poland, Latvia, Portugal, UK, Germany, Austria, Croatia and Greece. NAC has already disposed of more than half of their portfolio, some for dismantling and some to increase the Q400 fleet in Norway.

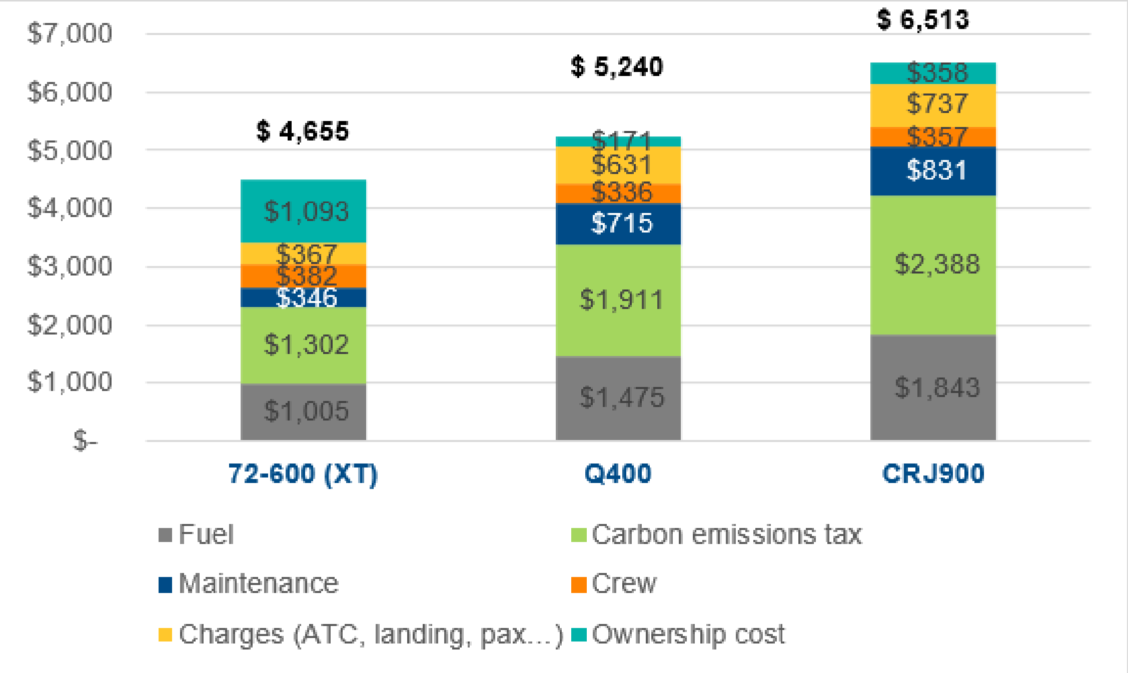
4. Infrastructures

Runway extensions have a negative impact on nature and often paves the way for larger and more polluting aircraft. A detailed assessment of the ATR 42-600S STOL aircraft and other potential candidates should be performed first.

We recommend monitoring the development of aircraft based on new and disruptive technologies in order to define the mature moment when airports could start preparing for their entry into service based on certifiable designs.

[5] https://estuaire.dev
[6] NAC, ESG Report 2022, https://www.nac.dk/wp-content/uploads/2023/03/NAC-ESG-Report-2022-1.pdf

Annex 1: Direct Operating Costs of ATR 72-600 XT vs. Q400 (15Y) and CRJ 900 (10Y)



Direct operating costs for a 300 NM reference route with the following assumptions.

- EU-ETS tax: 85 €
- Norway domestic CO2 tax: 545 NOK
- Fuel price: 1.1 €/kg