Economic Fuel Tankering: A Threat to Aviation Decarbonisation

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Introduction and Background

Tankering is a practice whereby an aircraft carries more fuel than required for its safe flight in order to reduce or avoid refuelling at the destination airport for subsequent flight(s). The 2014 edition of the ICAO Doc. 10013, which deals with "Operational Opportunities to Reduce Fuel Burn and Emissions", highlights the economic benefit of fuel. However, it does not highlight its environmental implications.[1] It should be noted that fuel tankering has a significant environmental impact by increasing aviation emissions and should be avoided when undertaken purely for economic reasons. As governments and industry work to address climate change, they should ensure that new policies do not promote tankering, which would have the net effect of increasing aviation emissions.

Airlines tanker fuel for two main reasons:

- When it is operationally not possible or desirable to refuel at the destination airport, due to circumstances such as social disruptions, technical failures of the refuelling facility, shortages of or contaminated fuel, or to achieve short turnaround times or avoid the risk of delays. In that case, it could be called "Operational tankering"; and,
- To save money when the cost of fuel and associated services at the departure airport is significantly lower than at the destination airport. In that case, it is called "Economic tankering".

There are two types of fuel tankering:

- Full (fuel) tankering, when all the fuel needed for the return flight is uplifted at the departure airport to avoid refuelling at the destination airport, and
- Partial (fuel) tankering, when only part of the fuel needed for the return flight is uplifted at the departure airport, followed by partial refuelling at the destination airport.

Under the European Aviation Safety Agency (EASA) regulations (CAT.OP.MPA.150 Fuel policy), before departure, the pilot-in-command must ensure that the amount of fuel on board is sufficient to cover the entire flight, including deviations from the planned operation.

The usable fuel to be on board for departure should be the sum of the following:

- Taxi fuel: The fuel necessary for taxi, which should not be less than the amount expected to be used prior to take-off;
- Trip fuel: The fuel required from the start of take-off, through climb, cruise, descent, and approach to landing at destination;
- Reserve fuel consisting of:
  - Contingency fuel (3 to 5%): This fuel is carried to cover unforeseen variations from the planned operation, for example, different winds/temperatures from forecast or air traffic control restrictions on

1 ICAO Doc. 10013 "*7.5.2 There may be some potential for reducing the amount of tankering. Aircraft operators should take into account the full cost of carrying extra fuel when making decisions on tankering. The full cost includes the additional fuel required to carry the tankered fuel. Aircraft operators should also check fuel prices frequently to ensure that tankering is still justified by any fuel price differentials.*"

levels and speed. It can be used any time after dispatch (once aircraft moves under its own power). It cannot be planned to use before. More likely, it is used for delays on departure or arrival;
- Alternate fuel: The fuel to cover a possible "Go around" or a landing at an alternate airport;
- Final reserve: For 30 min at ISA 1,500 feet above the alternate airport;
- Discretionary fuel (or 15 min of holding fuel) if the flight is planned with no alternate (go-around at destination, climb, cruise, descent, approach and landing at the selected alternate airport); and,
- Extra fuel, which should be at the discretion of the commander.

Fuel tankering is done as part of the "extra fuel" component; this is the amount of fuel in excess of the precautionary part at the discretion of the commander. In other words, fuel tankering is the practice of adding more fuel than what is required by the fuel policy for a safe flight.

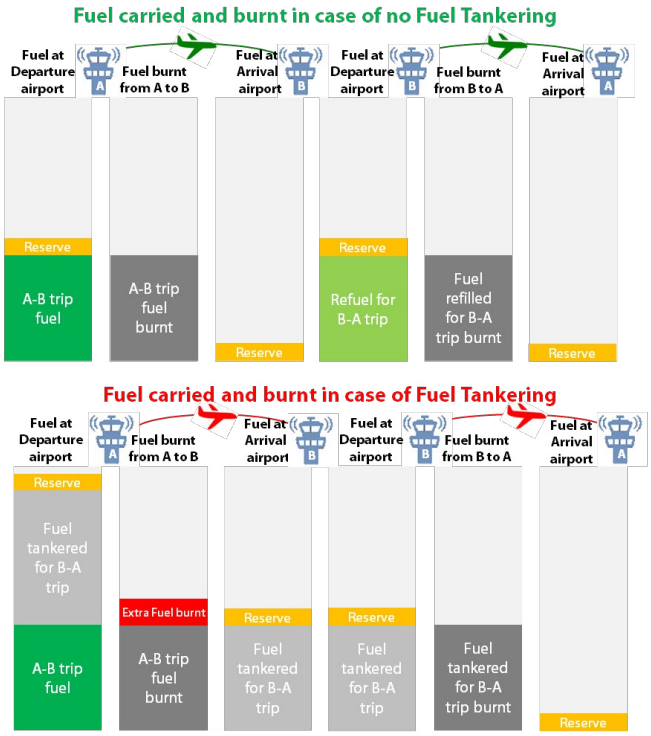

FIGURE 1: Example of extra fuel burn for a return flight between two airports with and without fuel tankering.

The Environmental Impact of Economic Tankering

ICAO Doc 10013 4.1.2 indicates that "*The extra fuel burn attributable to additional weight carried on board an aircraft is typically on the order of 2.5 to 4.5% of the additional weight, per hour of flight, depending on the characteristics of the aircraft.*"

As the practice of economic tankering significantly increases the weight of the aircraft, it also increases its fuel consumption during its operation compared to a same flight carrying only the fuel needed for its journey. Figure 1 illustrates this phenomenon. When a return flight between two airports A and B, carries part or all the fuel needed for its return flight (B-A), an "extra" amount of fuel is burnt just to carry that additional fuel on the first leg (A-B). Consequently, this also results in additional carbon dioxide (CO_2) and non-CO_2 climate impacts.

Although only economic tankering performed on a return flight between the same pair of airports is considered in the studies presented below, it can also be performed on a one-way flight serving more than two airports/legs.

EUROCONTROL Research on Current Tankering

In 2018, EUROCONTROL conducted a study limited to flights up to 1,500 and 2,500 NM to/from the European Civil Aviation Conference (ECAC[2]) airspace, corresponding mainly to short and medium-haul flights. According to EUROCONTROL research, operational tankering is considered necessary for the proper functioning of the aviation system and represents only about 10% of fuel tankering performed. On the other hand, economic tankering to reduce operating costs represents 90% of tankering performed. As fuel cost represents 17% to 25% airline operating expenses, and even up to 50% for some

2 ECAC is currently composed of 44 Member States: Albania, Armenia, Austria, Azerbaijan, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Monaco, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Republic of Moldova, Romania, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine and United Kingdom.

low-cost carriers, airlines use tools for identifying the value of performing economic fuel tankering.

It was estimated that fuel tankering could have resulted in a net saving of 265 million € per year for the airlines but would have generated 286,000 additional Tonnes of fuel burnt (equivalent to 0.54% of ECAC jet fuel used) and 901,000 Tonnes of carbon dioxide (CO_2) emissions in the ECAC airspace per year. This is equivalent to about 2,800 round trips between Paris and New York or the annual emissions of a European city of 100,000 inhabitants.

However, the practice of full or partial tankering is not limited to flights between 1,500-2,500 NM (2,780 to 4,630km). Aircraft fuel tanks are usually designed to allow maximum range. As aircraft are not systematically used to fly their maximum range, it becomes possible to carry much more fuel than required to limit or avoid refuelling at the destination airport. For example, some modern and efficient long-haul aircraft could perfectly perform full fuel tankering carrying the fuel for the return flight up to a 7,000-km flight carrying all the fuel (approx. 32 Tonnes to 45 Tonnes) to make the return trip depending on the aircraft types. EUROCONTROL intends to conduct a future study on the use of fuel tankering for long-haul flights.

Therefore, economical tankering goes against the decarbonisation path that aviation is on and should be avoided. Some airlines have apparently already committed to eliminating economic fuel tankering. However, many airlines may be tempted to maintain it to save money.

The decision to use economic tankering is based on the savings that can be made from arbitraging the negotiated fuel price between the departing and arriving airport. Consequently, any measure that influences the increase in the cost of fuel uplift in the EU compared to the cost of fuel outside of the European Union (EU) risks promoting economic tankering and undermining the decarbonisation of aviation.

International Council on Clean Transportation (ICCT) Research on Tankering Under a Sustainable Aviation Fuel Mandate

Sustainable Aviation Fuels (SAFs) are expected to play a major role in decarbonizing aviation. SAFs are renewable "drop-in" hydrocarbons that can be used in existing planes and engines as an alternative to fossil jet fuel. SAFs remain expensive (2 to 5 times fossil jet fuel) and rare (~0.05% of global jet fuel supply in 2020), so European Union (EU) policymakers are developing a mandate for their use. ReFuelEU, when finalized, will require jet fuel providers to blend an increasing share of SAF into their fuel supply at EU airports starting in 2025.

Since ReFuelEU will raise the cost of fuel, it raises concerns that airlines may uplift additional fossil fuel at non-EU airports to avoid purchasing more expensive SAF blends at EU airports. To assess the likelihood of this occurring, ICCT researchers used their Global Aviation Carbon Assessment

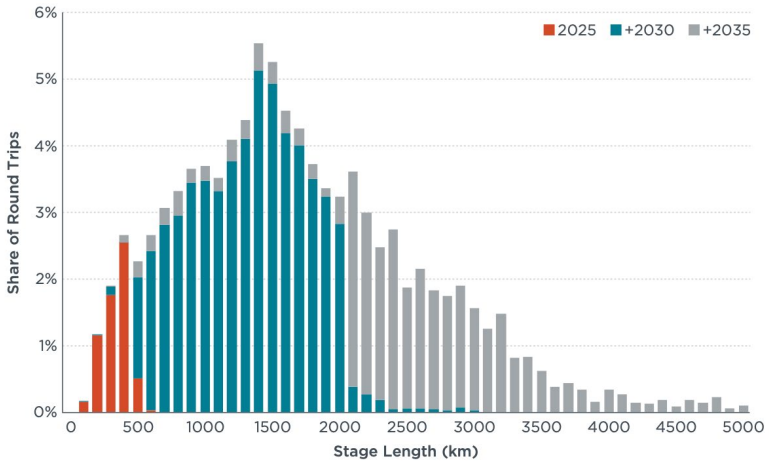

FIGURE 2: Stage length of international tankered flights by year (ICCT, 2021).

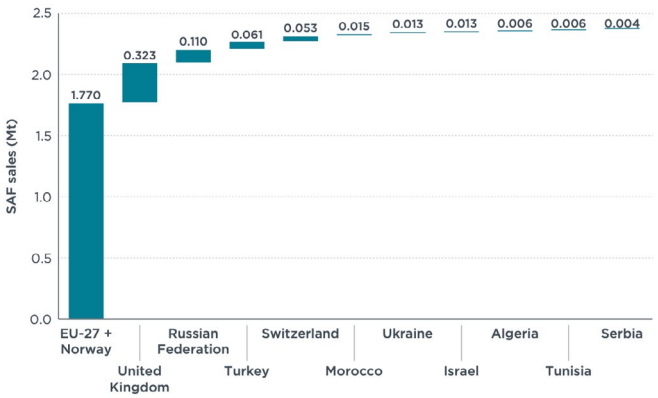

FIGURE 3: EU SAF sales under a 2030 mandate by eliminating tankering from select nations.

(GACA) model to estimate the emissions and fuel sales impacts of additional economic tankering on flights arriving at EU airports through 2035. Only full tankering, not partial tankering, was considered.

ICCT found that economic tankering should be minimal in 2025 but could increase substantially as the relative share of SAF in the fuel mix increases; by 2035, tankering could reduce SAF sales by 22% at EU airports and increase system wide fuel use by 0.9%. Considering both reduced SAF sales and increased system wide fuel consumption, CO_2 reductions attributable to an EU SAF mandate could fall by about one quarter as a result of tankering fossil jet fuel into the EU. This assumes that adjoining countries do not adopt similar mandates for SAF at the same pace as the EU.

The ICCT study investigated which flights are likely to tanker fuel into the EU to avoid purchasing SAF. It concluded that tankering could occur on most flights under 500 km in 2025, expanding to 2000 km flights and beyond starting in 2030 as the cost of fuel rises in tandem with required blend volumes (Figure 2). The study concluded that flights originating from the United Kingdom could be responsible for about half of tankered flights (52%) and excess fuel (49%) consumed (Figure 3). The study concluded that the integrity of the EU SAF mandate could be safeguarded by obligating airlines to purchase SAFs; by defining, and then prohibiting the carriage of, "excess" fuel; and if neighbouring countries like the United Kingdom and Switzerland adopt comparable SAF mandates. Ultimately, the EU adopted a first approach under ReFuelEU by proposing that at least 90% of the fuel used on flights departing EU airports be purchased locally.

Conclusions

Tankering is an existing practice under which airlines upload excess fuel at their departure airport to avoid purchasing fuel at their destination airport for continuing operations. The study conducted by EUROCONTROL showed that economic tankering is a common practice used by airline operators that reduces operational costs but results in higher than necessary fuel consumption, and a significant increase in aviation emissions. This runs against the efforts that the whole aviation sector is making to meet the targets set by the EU Aviation Green Deal and should therefore be banned. Only operational tankering is acceptable. As ICCT research has shown, economic tankering could expand and ultimately undermine regional SAF mandates that increase the cost of blended fuels above that of conventional fossil jet fuel.

Although both studies presented here are based on European traffic and the possible implementation of future EU green aviation policy measures, the climate threat posed by economic tankering is global. The authors therefore advocate that similar studies be conducted in other countries/regions of the world and that appropriate measures be put in place to limit or even ban the use of economic tankering. As further evidence is gathered on its impacts, and as policies like SAF mandates that raise the price of jet fuel expand, ICAO might consider developing an international Standard and Recommended Practice (SARP) to strictly limit tankering to avoid carbon leakage and undermining regional climate policies.

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