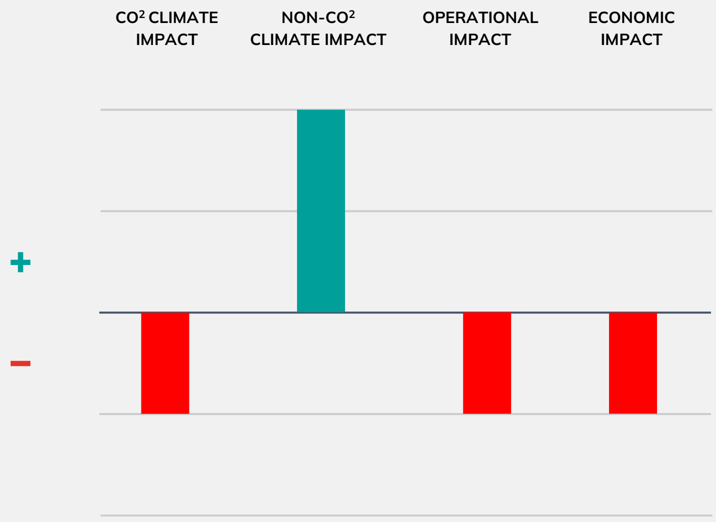
Flying Low & Slow

Flight altitude of emissions is reduced to avoid high altitudes that are more climate-sensitive regarding non-CO_2 effects. Compensation of fuel consumption and CO_2 emission effects is achieved by an additional reduction in cruise speed.



MATURITY LEVEL

BENEFITS

Lower cruise altitudes reduce the climate impact, especially for contrail cirrus and nitrogen oxides. High potential solutions can be derived, where rise in operating cost is small, compared to mitigation potentials.

CHALLENGES

Longer flight times and higher fuel consumption restrict implementation from stakeholder perspective. Higher concentration of air traffic in less climate sensitive altitudes affects air traffic control and crew stress.

IMPACTED STAKEHOLDERS

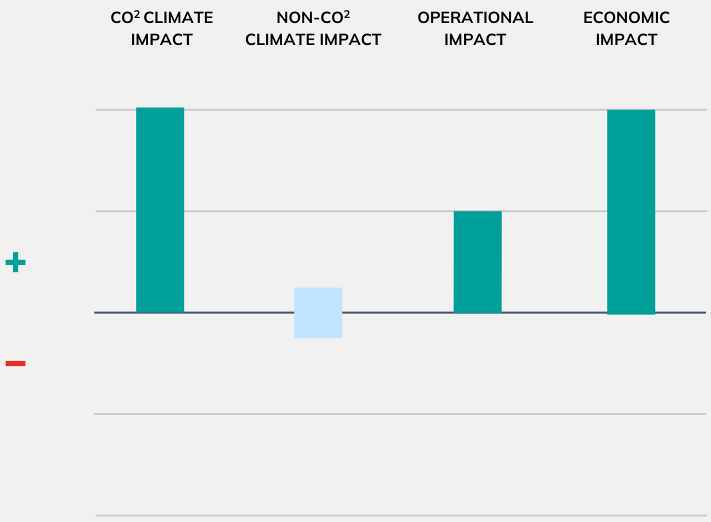
Airlines, passengers, air traffic management

RESULTS LIMITATIONS

Climate impact assessment underlies large uncertainties regarding general scientific understanding of non-CO_2 effects and applied algorithmic climate change functions.

Free Routing and Wind-optimised Flight Planning in High-Complexity Airspace

This OI consists in planning trajectories without the constraints of fixed traffic routes and taking advantage of leading winds.



MATURITY LEVEL

BENEFITS

The OI has the potential of reducing travel duration, fuel consumption, CO2, non-CO2 emissions, and climate impact. Nonetheless, flight planning strategy also impacts the obtained improvements. (e.g., NOx-centralised planning strategy can lead to more reduction in non-CO2 climate impact, but also decrease the economic benefits).

CHALLENGES

A more advanced wind/weather service is required to improve the concept.

IMPACTED STAKEHOLDERS

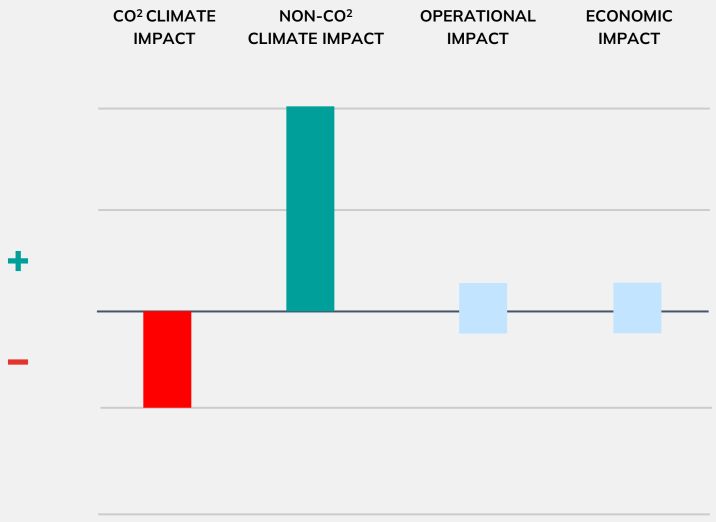
Airlines, ANSPs, Network Manager

RESULTS LIMITATIONS

The case studies focus on selected airspace. By considering all EU airspaces, an in-depth analysis can be carried out to reveal the OI's full mitigation potential.

Climate-optimised Flight Planning

This OI aims to identify alternative flight routes that have a lower overall impact on the climate by avoiding regions of the atmosphere that are particularly sensitive to aircraft emissions.



MATURITY LEVEL

BENEFITS

Strong reduction in the short-term climate impact of aviation

CHALLENGES

Reliable and accurate weather forecasts would be needed way ahead of the operation. Also, a strong computational capability is necessary to model climate impact of operations.

IMPACTED STAKEHOLDERS

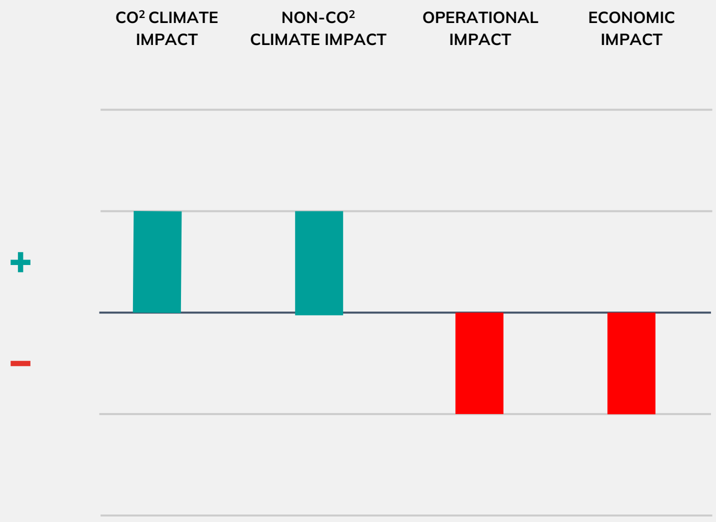
Airlines, Air Navigation Service Provider, Policy Makers

RESULTS LIMITATIONS

This study was limited to four city pairs on one winter day in 2018.

Strategic Network Planning

The OI consists in optimising hub-and-spoke and point-to-point connections to maximise passenger transport efficiency.



MATURITY LEVEL

BENEFITS

The OI will reduce and number of flights, and consequently emissions.

CHALLENGES

Changing the frequencies and departure time in some routes may need a change in the ground support services which should be considered to make the implementation of the new schedule feasible.

IMPACTED STAKEHOLDERS

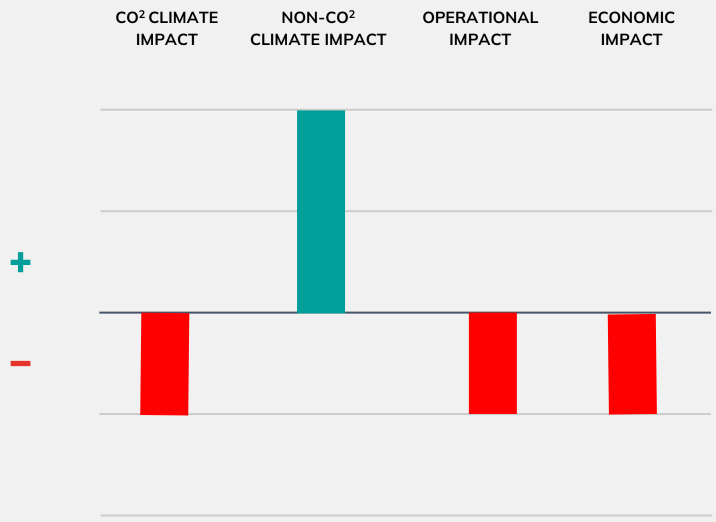
Airlines, Airports, Passengers

RESULTS LIMITATIONS

Assumption of a constant market for the analysis, while it may change by changing the frequency of flight in a route. Having more detailed data about market share per route or incorporating a dedicated model would enhance the analysis.

Climate-optimised Intermediate Stop Operations

Interrupting a long-range mission with an intermediate refueling stop reduces fuel burn, due to reduced aircraft mass. This concept can be optimised towards the climate impact by additionally reducing cruise altitudes and selecting intermediate airports strategically.



MATURITY LEVEL ●●○○○

BENEFITS

High mitigation potentials can be achieved by a climate-optimized selection of refueling airports and flight altitudes.

CHALLENGES

Additional starts and landings as well as longer detours to reach the respective intermediate stop airport influence travel time, operating cost, air traffic and crew workload, thus limiting implementation from a stakeholder perspective.

IMPACTED STAKEHOLDERS

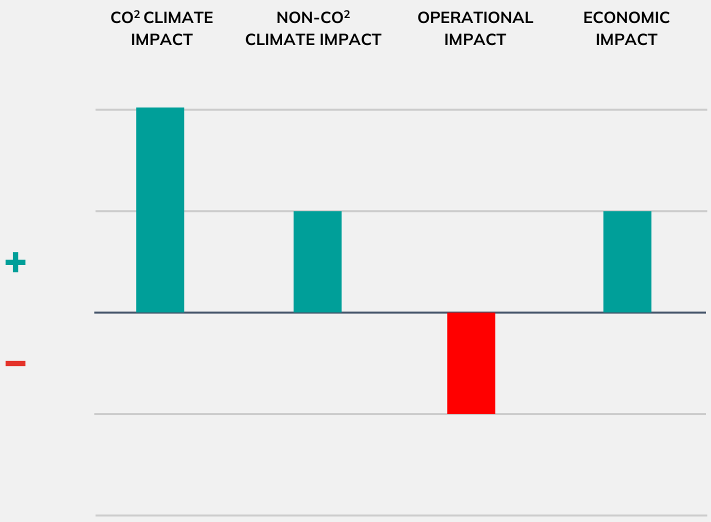
Airports, airlines, passengers, air traffic management

RESULTS LIMITATIONS

Capacity restrictions and infrastructure at intermediate stop airports has not been considered, as well as possible change in passenger preferences due to longer travel times.

Single Engine, Towing and Electric Taxiing

This OI reduces fuel consumptions and thus emissions on the ground by moving the aircraft using fewer or no engines. Without engines, taxiing can be either done using an on-board electric system powered by the APU or by an external towing vehicle.



BENEFITS

Fuel consumption on the ground is limited, as are all related emissions, reducing climate impact.

CHALLENGES

Aircraft engines need to warm up before an aircraft can take off, limiting the savings.

Towing vehicles need to be scheduled and lead to additional movements, increasing operational complexity.

Electric taxiing increases aircraft weight, leading to an increase in fuel burn during flight, limiting savings, and sometimes even increasing NOx emissions.

IMPACTED STAKEHOLDERS

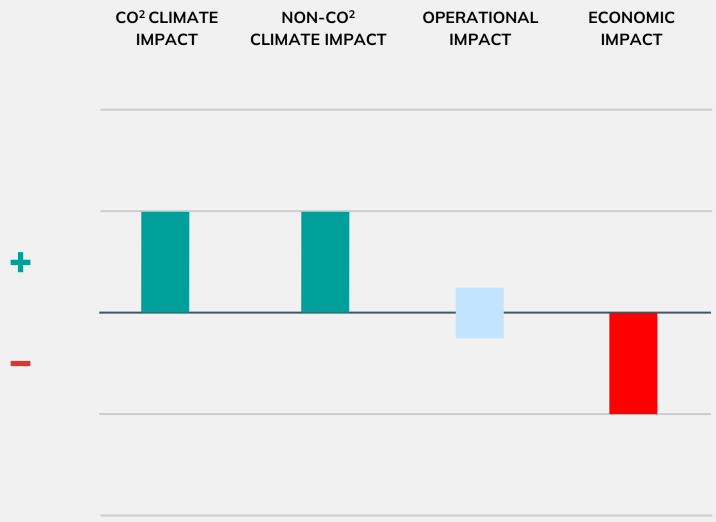
Airports, Airlines, ATC

RESULTS LIMITATIONS

Only a single flight schedule day from 2018 and average taxi times were used for the analysis. Aircraft fuel consumption and emissions were represented by only four types (E190, B738, A320, A359).

Electrification of Ground Vehicles and Operations

The OI consist in replacing the current, fossil-fuel-based fleet of ground vehicles at the airports with electric analogues to reduce the emissions of ground operations.



MATURITY LEVEL

BENEFITS

Lower emissions at the airport level, reduced climate impact, improved air quality

CHALLENGES

A large initial investment is required for the necessary infrastructure and vehicles, not all vehicle types have an electric alternative, hazards from batteries, engines, charging stations and operations should be assessed.

IMPACTED STAKEHOLDERS

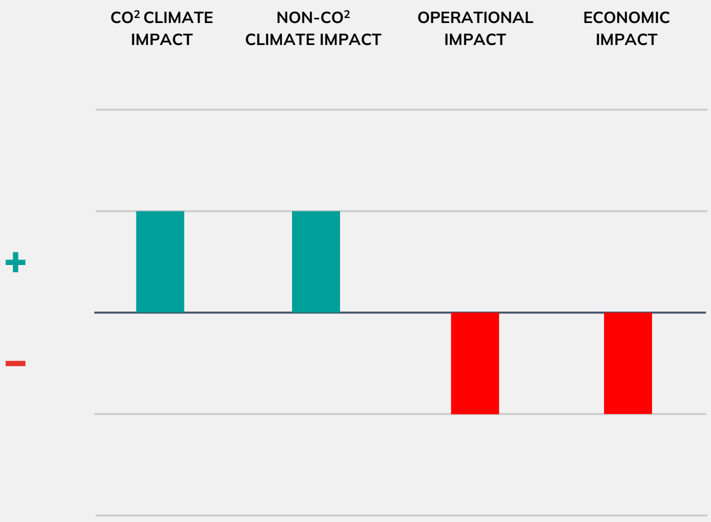
Airports, Ground Handling companies

RESULTS LIMITATIONS

The ground fleet of any airport is extrapolated from SEA Milan data using airport traffic as a proxy for fleet size, composition, and mileage. Detailed airport data would increase the accuracy of the model predictions.

Upgrade of the airport infrastructure according to energy efficient criteria

The improvement of the airport infrastructure according to energy-efficient criteria is expected to significantly reduce the energy consumption of airports, and hence their GHG emissions. The considered energy-efficiency measures include insulation of exterior walls, optimization of windows, and installation of LED lights.



MATURITY LEVEL

BENEFITS

Reduction of energy consumption (and relative costs), and consequently CO_2 emissions. Immediately feasible and effective over the long term.

CHALLENGES

Conspicuous initial investment. Implementation of energy efficiency measures to the terminals might cause problems to the operations.

IMPACTED STAKEHOLDERS

Airports

RESULTS LIMITATIONS

The assessment focuses on office buildings and on a limited range of energy efficiency measures. Energy consumption is calculated for a conceptual building and extrapolated for each airport in EU on a number of flights basis.