Comparison of conventional and electric aircraft for short-haul flights regarding environmental and socio-economic impacts

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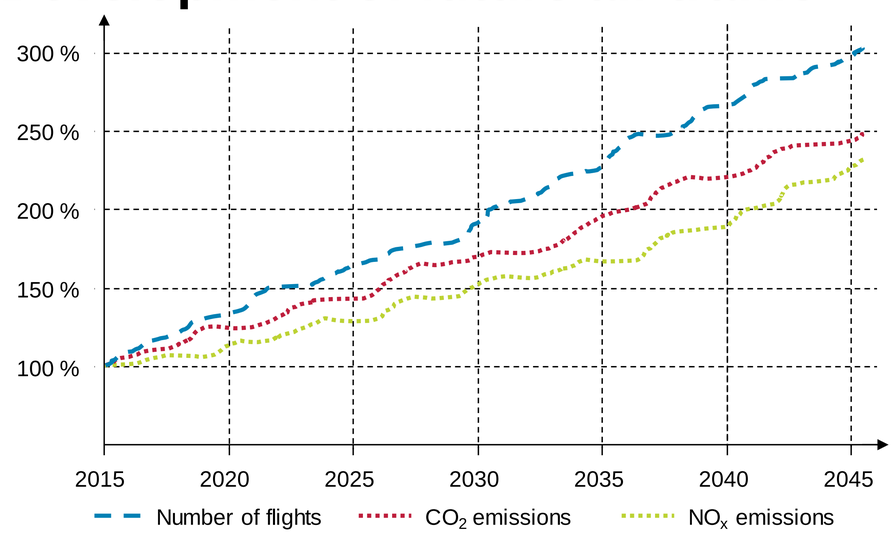
Motivation and objective

- Flight volume will increase by up to 4.5% annually; air traffic doubles every 16 years
- Increase in air traffic causes the aviation-induced CO_2 emissions to triple until 2050
- Aviation sector set itself ambitious reduction goals with the Flightpath 2050 strategy
- Electric aircraft and the use of alternative fuels can significantly reduce climate and health-damaging emissions during the short-haul flight operation of aircraft
- **But**: The production of the electric powertrain and alternative fuels causes high environmental and socio-economic impacts, which must be considered

Objective: Sustainability assessment of a short-haul flight operation under consideration of the powertrain production and the energy carrier life cycle

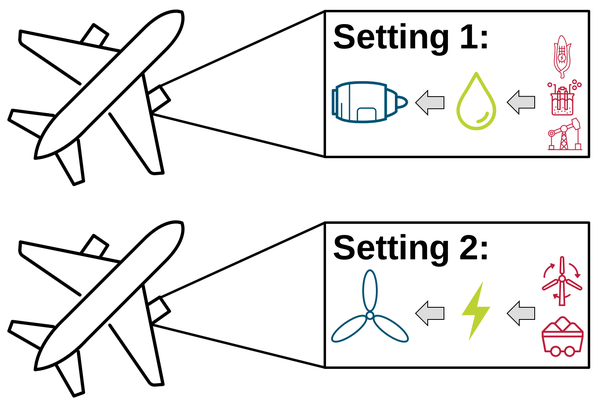
Development of future air traffic



Case study and assessment methodology

Case study:

- Flight operation on a short-haul flight
- Using conventional and electric powertrain
- Considering the powertrain production
- Considering different types of fuel (fossil, bio-, and synthetic kerosene)



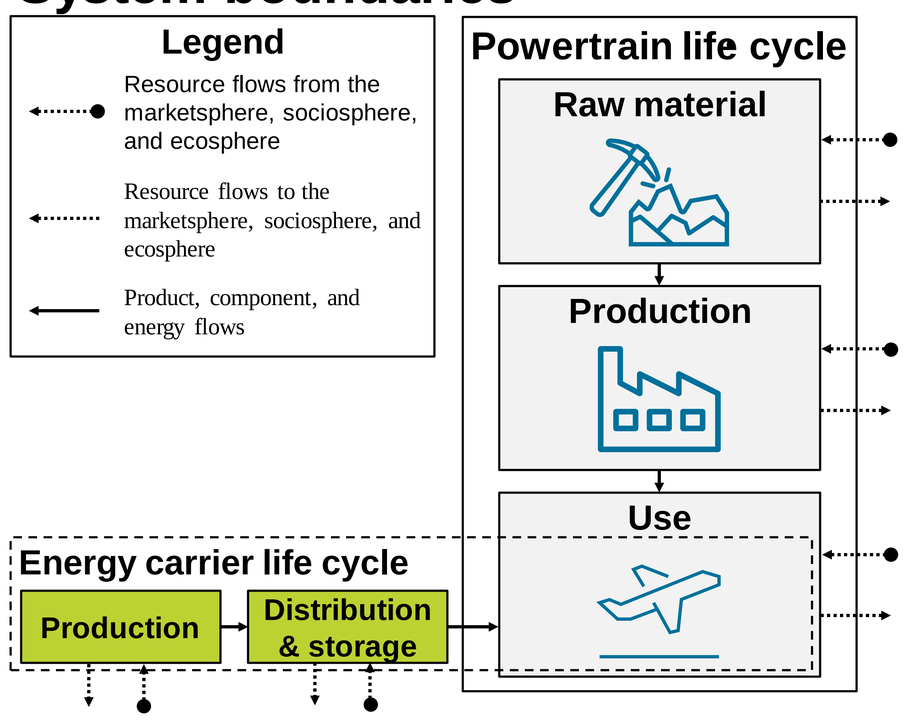
Assessment methodology:

- Life Cycle Sustainability Assessment approach is used for the environmental and socio-economic assessment

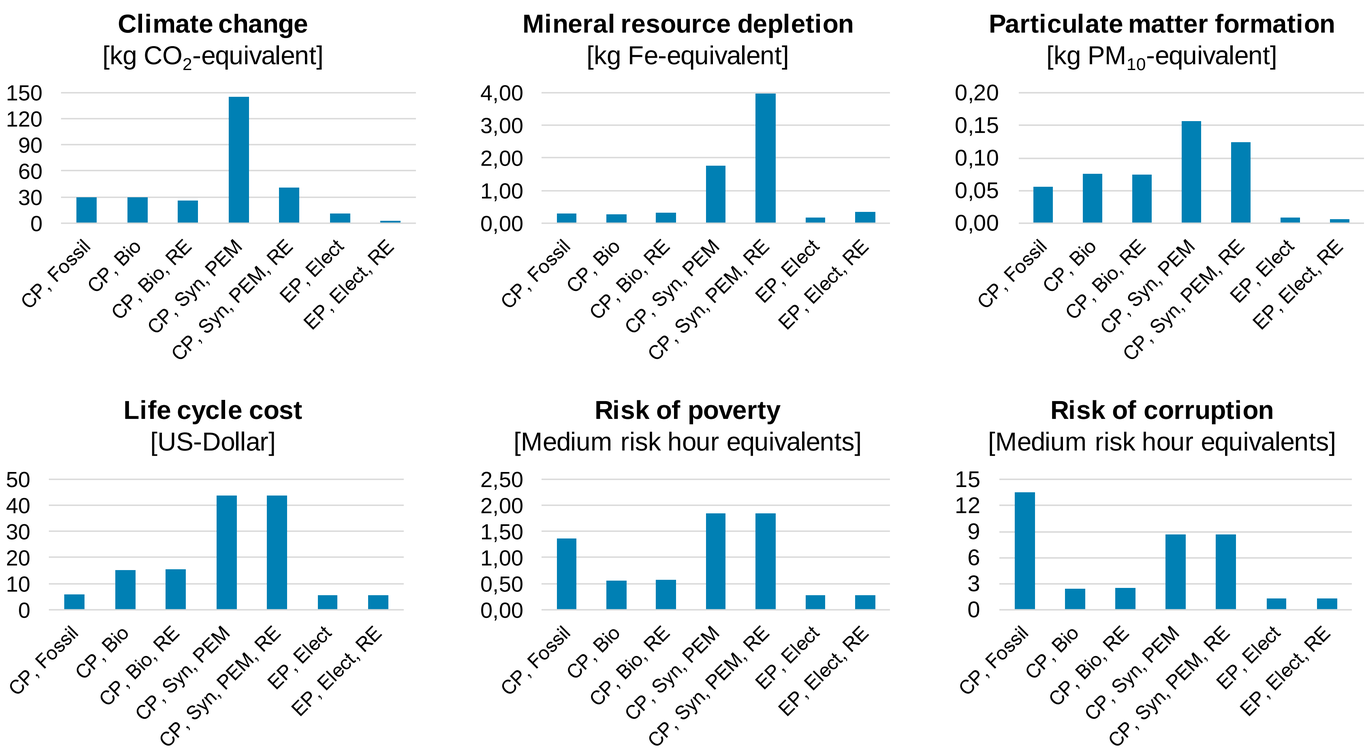
Functional unit:

- 100 passenger kilometer traveled (pkm) on a 1.000 km short-haul flight with a load of 100 passengers, including luggage

System boundaries



Assessment results for 100 pkm



CP: Conventional powertrain
EP: Electric powertrain
Bio: Biokerosene
Syn: Synthetic kerosene
Elect: Electricity
RE: Produced by renewable energy
PEM: Proton exchange membrane electrolysis

Conclusions

- Electric aircraft offer advantages for flight operation, especially when using electricity from renewable sources
- Fossil kerosene has advantages in some impact categories, which is due to its optimized production
- Biofuels can be used to reduce the environmental impacts of conventional aircraft in the short term
- Synthetic fuels cause negative impacts because of their energy-intensive production

Outlook

- Research on synthetic fuels must be intensified to make them a promising fuel alternative
- Electric aircraft and alternative fuels will be required to achieve the reduction goals of Flightpath 2050