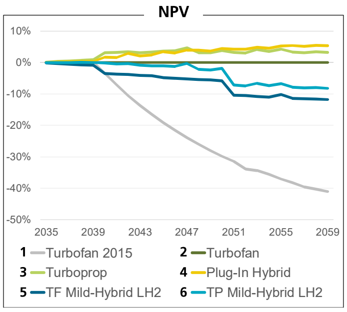
#ArchitectingAviation

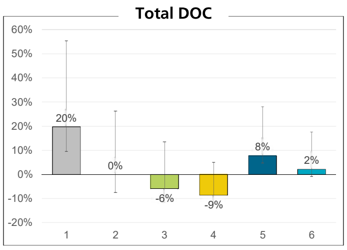
GLOBAL IMPACT ASSESSMENT: OVERALL ECONOMIC EFFICIENCY EVALUATION

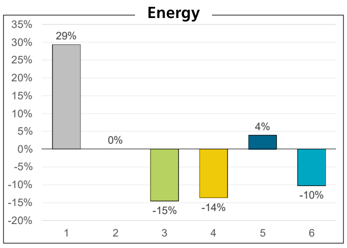
Conducting a comparative economic efficiency analysis of different short, medium, and long range aircraft concepts through discrete event life cycle simulation.

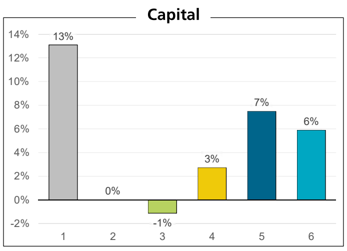
Simulating the Future of Aviation Economics: This study assesses the economic efficiency of various aircraft concepts across short, medium, and long range operations. A global impact assessment is conducted based on representative operating scenarios tailored to each aircraft type. The economic analysis leverages LYFE, a modular aircraft life cycle simulation tool that models the entire operational lifespan through discrete event simulation. By incorporating varying attributes of life cycle events - including duration, cost, and revenue streams - the tool provides a comprehensive evaluation of total and individual cost, Net Present Value (NPV), and other critical financial metrics. The comparative analysis enables data-driven decision-making for research, facilitating the identification of the most economically viable aircraft concepts within the concept development phase under consideration of potential show stoppers.

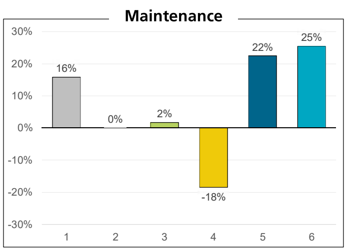
Short Range



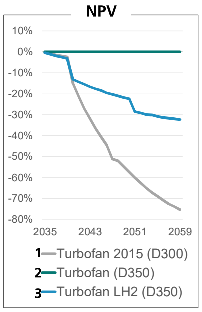


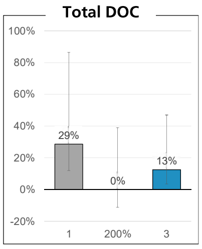


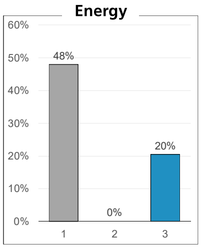


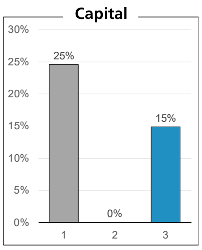


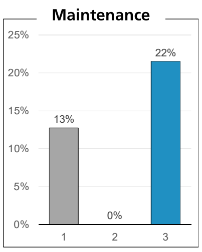
Mid Range



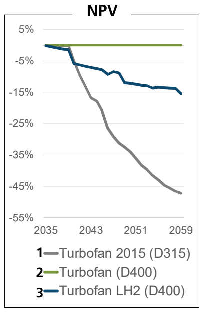


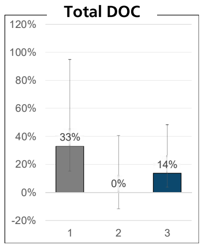


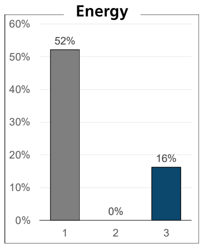


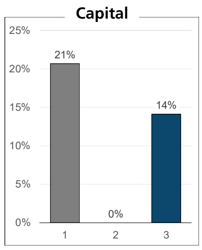


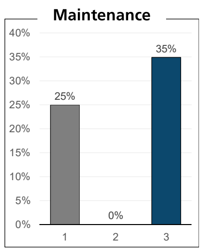
Long Range











Learnings

→ LH2 concepts have cost similar to or slightly higher than PtL concepts.

→ As range increases, the cost difference between LH2 and PtL concepts becomes more significant.

→ Large maintenance events impact overall economic efficiency.

→ Energy cost play a major role in determining economic viability.

ASSUMPTIONS:

- 100% PtL usage
- Same turnaround time for all aircraft concepts
- Same navigation fee cost for all aircraft concepts
- Same maintenance requirements for PtL and LH2 burn
- LH2 tank exchange in the C8-check (10-12 years)
- Mid capital cost and mid maintenance cost
- Medium energy development in all figures, except total DOC
- Medium energy price scenario (2040):
  PtL 0.86 €-2010/kg
  LH2 2.26 €-2010/kg
  Electricity 0.024 €-2010/kWh
- Turbofan Mild-Hybrid or Turbofan PtL optimized networks

ABBREVIATIONS:

- NPV: Net Present Value
- DOC: Direct Operating Cost
- LH2: Liquid Hydrogen
- PtL: Power to Liquid (synthetic kerosene)
- TF: Turbofan
- TP: Turboprop

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Related Publications:
Ramm Et al. (2024) - Assessing the Feasibility of Hydrogen-Powered Aircraft: A Comparative Economic and Environmental Analysis
Ramm Et al. (2024) - Uncertainty quantification in hydrogen tank exchange: Estimating maintenance costs for new aircraft concepts

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