

Master Thesis Proposal

Towards Sustainable Skies: Innovations in Airline Operations for Environmental Conservation

In an era marked by growing concerns over climate change and environmental sustainability, the aviation industry faces increasing pressure to minimize its carbon footprint and adopt more eco-friendly practices. This thesis seeks to explore strategies and initiatives aimed at making airline operations more sustainable. By examining concepts, models, and real-world cases, the aim is to shed light on innovative approaches that can mitigate the environmental impact of air travel while ensuring the industry's viability in the long term.

This research will employ a mixed-method approach, combining qualitative analysis and quantitative modeling. Data shall be gathered from scholarly articles, industry reports, case studies, and – if possible – interviews with industry experts. The qualitative analysis will involve thematic coding to identify key themes and trends in sustainable airline operations, while quantitative analysis will focus on mathematically modeling and optimization airline operations subject to environmental considerations, and assessing the environmental and economic impacts of various sustainability initiatives.

Objectives:

- Analyze current challenges and environmental impacts associated with traditional airline operations.
- Examine key strategies, best practices and major challenges from real-world case studies of airlines implementing sustainable practices successfully.
- Explore conceptual frameworks and optimization models in the scientific literature for integrating sustainability into airline operations.
- Discuss any gaps between theory and practice, in particular between state-of-the-art optimization approaches for sustainable airline operations and important practice requirements;
- Discuss a suitable state-of-the-art optimization model in detail and make suggestions on how to extend it to make it more applicable to practice.
- Discuss potential methods to solve the proposed optimization model and choose a suitable one;
- Implement and solve the proposed model for an academic example in a suitable modeling environment, e.g. in Excel or AMPL (optional);
- Give recommendations, draw conclusions and show future research opportunities.

Requirements

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- OPM 781
 - Good knowledge in Operations and Revenue Management
 - Analytical skills and an ability to transform real-world business problems into Operations Research models

Administrative information for writing a master thesis at the Chair of Service Operations Management can be found [here](#).

Selected Literature Recommendations:

Chen, H., & Solak, S. (2015). Lower cost arrivals for airlines: Optimal policies for managing runway operations under optimized profile descent. *Production and Operations Management*, 24(3), 402-420.

Cui, Q., & Li, X. Y. (2021). Which airline should undertake a large emission reduction allocation proportion under the "carbon neutral growth from 2020" strategy? An empirical study with 27 global airlines. *Journal of cleaner production*, 279, 123745.

Dodd, T., & Yengin, D. (2021). Deadlock in sustainable aviation fuels: A multi-case analysis of agency. *Transportation Research Part D: Transport and Environment*, 94, 102799.

Jalalian, M., Gholami, S., & Ramezani, R. (2019). Analyzing the trade-off between CO2 emissions and passenger service level in the airline industry: Mathematical modeling and constructive heuristic. *Journal of cleaner production*, 206, 251-266.

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Krömer, M. M., Topchishvili, D., & Schön, C. (2024). Sustainable airline planning and scheduling. *Journal of Cleaner Production*, 434, 139986.

McKinsey & Company (2023): Decarbonizing aviation: Executing on net-zero goals, <https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/decarbonizing-aviation-executing-on-net-zero-goals>

Migdadi, Y. K. A. A. (2018). Identifying the best practices of airlines' green operations strategy: A cross-regional worldwide survey. *Environmental Quality Management*, 28(1), 21-32.

Toffel, M., & Riedel, R. (2024): Decarbonizing Aviation with McKinsey, Climate Rising – Harvard Business School Business & Environment Initiative, <https://www.hbs.edu/environment/podcast/Pages/podcast-details.aspx?episode=7133431465>

Walker, T., Bergantino, A. S., Sprung, N., & Loiacono, L. (2019). *Sustainable Aviation*. Cham: Springer Nature Switzerland.

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Wen, X., Chung, S. H., Ma, H. L., & Khan, W. A. (2023). Airline crew scheduling with sustainability enhancement by data analytics under circular economy. *Annals of Operations Research*, 1-27.

Winston, A. (2008): Innovating for Sustainability: What's Your Heresy? *Harvard Business Review*, 2008, December 19. <https://hbr.org/2008/12/innovating-for-sustainability-whats-your-heresy>.

World Economic Forum & McKinsey (2020): Clean Skies for Tomorrow – Sustainable Aviation Fuels as a Pathway to Net-Zero Aviation, Insight Report, November 2020, https://www3.weforum.org/docs/WEF_Clean_Skies_Tomorrow_SAF_Analytics_2020.pdf

Zhao, X., Ke, Y., Zuo, J., Xiong, W., & Wu, P. (2020). Evaluation of sustainable transport research in 2000–2019. *Journal of cleaner production*, 256, 120404.