# Quantifying passenger acceptance of behavioural incentives in sustainable aviation: a discrete choice experiment

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## SHORT SUMMARY

The aviation industry faces increasing pressure to decarbonize as air traffic growth outpaced past efficiency gains. Sustainable Aviation Fuels could reduce emissions, yet adoption remains limited due to currently high costs and infrastructure constraints. As such technological progress alone will not achieve short-term results, behavioural interventions, particularly those targeting passenger choices, characterize an underrepresented lever. Existing research has focused mainly on nudges, while incentive mechanisms remain largely unexplored. This study empirically investigates the impact of incentives on passengers' willingness to choose more cost intensive sustainable flight options. Building on previous qualitative findings, a large-scale Discrete Choice Experiment with 1250 recent passengers from the DACH region quantifies trade-offs between green premiums and incentive packages. Hypotheses predict that time saving and socially visible rewards increase uptake better than monetary incentives. The present study aims to identify how incentive-based interventions can enhance voluntary climate engagement in air travel and complement ongoing regulatory and technological efforts.

**Keywords:** behavioural interventions, decarbonization, discrete choice modelling, incentive mechanisms, passenger behaviour, sustainable aviation

## 1. INTRODUCTION

The commercial aviation industry stands at a critical stage in its decarbonization journey (Lee et al., 2009). Contending with emissions that constitute 2-3% of global anthropogenic $CO_2$ (IPCC, 2023), the industry experiences projected demand growth that could double traffic and capacity within two decades. Despite steady fuel efficiency improvements, absolute emissions have increased due to passenger volumes, which exceed past technological advances (Gössling & Humpe, 2020). One possible transformative technological advancement could be Sustainable Aviation Fuels (SAF), potentially reducing flight emissions by up to 80% (Dietrich et al., 2024). Yet, their adoption lags due to production costs up to seven times higher than conventional jet fuel as well as infrastructural bottlenecks (Dodd & Yengin, 2021). Another common approach to handle aviation emissions are regulatory instruments, including SAF blending quotas and emissions trading schemes. They establish helpful guardrails but are often criticised in the industry for marginal impacts which potential to distort competition (Pérez-Calderón et al., 2021). Although technological progress might be the highest potential for future flight emission reductions, a widespread implementation of transformative technologies is not expected earlier than in 20-30 years (Swiss Federal Council, 2024).

A largely unused potential lies in leveraging passenger behaviour. Many airlines routinely present voluntary sustainable options, such as carbon offsetting (VCO), SAF surcharges, $CO_2$ reduced tariffs, or direct flights instead of connections with additional flight segments and detours (Zhang et al., 2022). Yet, uptake rates of voluntary climate engagement of air passengers lie between 1% and 2% of passengers today (IPCC, 2023), even as public climate concern accelerates. This can mainly be attributed to green premiums, the additional cost burden to be paid by the passenger for emission reduced options (Choi & Ritchie, 2014). To leverage passenger behaviour and increase the voluntary uptake rates of sustainable options, behavioural research strongly focussed on conventional nudges, such as emissions visualizations or default opt ins, and highlighting desired choices during the booking process (Mello, 2024). Although research elaborated potential impacts of nudging (Mello, 2024), the critical climate situation profits from stronger interventions to change passenger behaviour (Cohen, 2019).

According to economic theory, the next deeper intervention level after nudges are incentives (Ebner et al., 2022). Whereas nudges usually do not change the cost-benefit structure of choices, incentives target exactly this mechanism. By attracting certain choices with e.g., additional benefits, the structure of the choice is manipulated in the direction of desired choices (Ebner et al., 2022).

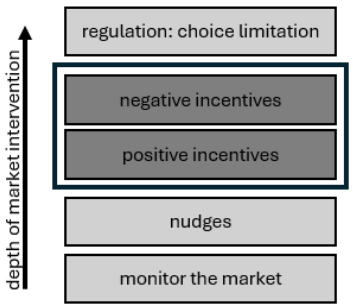



**Figure 1: Typology of policy instruments by depth of market intervention**
Source: Own illustration based on Ebner et al. (2022, p. 37)

The strong body of literature on behavioural interventions in sustainable aviation contexts relies strongly on nudges and regulation, which limits the number of available options (Ebner et al., 2022). To the best of our knowledge, we conduct the first quantitative study to elaborate on the effect of incentives to increase voluntary uptake rates of sustainable flight options among passengers.

This short paper displays the research design and rationales of the underlying study. The data collection phase is ongoing. The authors will be ready to present the result at the hEART26 conference.

## 2. METHODOLOGY

### *Study design and procedure*

This research follows a sequential design. Our previous study employed a qualitative research design based on 18 semi-structured expert interviews spanning behavioural science, environmental behaviour, and aviation industry practice. Its objective was to identify key barriers that inhibit passengers from adopting sustainable air travel behaviours and to explore the potential of targeted (dis)incentives to increase voluntary uptake of options such as SAF contributions and VCO. The interviews revealed four central barriers: cognitive abstraction of climate impacts, lack of personal benefits, low social visibility, and distrust in offsetting mechanisms. Experts highlighted comfort-related incentives (e.g., time savings), financial benefits, visibility-enhancing measures, and soft disincentives as promising approaches to foster more sustainable passenger choices and overcome the adoption barriers. This previous study qualitatively elaborated hypotheses through expert interviews, which the present study now tests via a large-scale Discrete Choice Experiment (DCE). This quantitative field study transfers those insights into measurable trade-offs between price surcharges (green premiums) and incentive packages for $CO_2$-reduced flight options.

Three major testable hypotheses (H) emerge directly from the expert insights which were collected in the qualitative phase:

1) *Time saving incentives* including e.g., fast lane security access, and priority baggage handling exhibit higher utility weights and willingness-to-pay equivalents than purely financial perks such as public transport tickets (H1). This reflects experts' consensus that immediate personal comfort benefits dominate monetary compensation.

2) *Social visibility mechanisms* including green (luggage/seat) tags increase tolerance for green premium surcharges versus baseline booking scenarios (H2). Public signalling activates normative reinforcement and social approval motives otherwise absent in private digital booking processes.

3) *Incentive bundles* overall elevate acceptance probabilities for target behaviours including VCO uptake and SAF contributions versus standard and green premium-only alternatives (H3). Incentives have the potential to systematically address all identified adoption barriers that hinder the uptake of environmental behaviour in commercial aviation.

The present quantitative study employs a Discrete Choice Experiment embedded within a structured online survey. This approach operationalizes qualitative insights from our previous study into testable trade-offs, which simulate realistic flight booking scenarios to elicit passenger

preferences for sustainable flight options bundled with incentives. The survey instrument was programmed using Sawtooth Lighthouse Studio (version 9.8), ensuring mobile optimization and responsive design options.

The data collection is conducted over a period of several weeks, commencing mid of March 2026 until the planned participant numbers (N=1250) is achieved. The data collection starts with a pretest and corresponding adjustments to the survey instrument. Participants access the survey via personalized email links (frequent flyer segment) or panel invitations (non-frequent flyers). Quality controls are included into the survey with minimum interview duration checks, straight lining detection, open ended response validation (manual coding of two open questions), and data cleaning. Frequent field progress reports ensure quota adherence, with final availability of data sets to be expected in May 2026.

### *Participants and sampling*

The present study is conducted in cooperation with a large European airline group, comprising a high share of overall passengers from / to / in Europe. Our target population comprises passengers who recently booked a continental Economy Class route. This ensures contextual relevance and recall accuracy. A dual segment quota sample totals N=1250 completed surveys. The study is stratified to ensure adequate statistical power within subgroups:

Segment 1 (frequent flyer programme members):
N=750 from Germany, Austria, or Switzerland (DACH), drawn from the airline group customer databases. Eligibility required a continental flight within the last 3 months. Stratification was enabled by loyalty status (base: ca. 50%; advanced: ca. 30%; premium: ca. 20%) preventing underrepresentation of high-status respondents, whose existing privileges (e.g., priority services) might interact with tested incentives.

Segment 2 (**not** frequent flyer programme members):
N=500, recruited via a leading ISO certified online access panel targeting DACH residents with continental Economy class flights in the last 12 months with the relevant airline group. A longer recency window accommodated lower incidence rates (20-30%), is balancing the feasibility with memory validity.

Screening rigor ensures precise validation of travel behaviour across segments. For frequent flyer members, eligibility drew on automated cross-checks against actual available flight data, confirming continental Economy Class usage within the past 3 months. Non-members progressed through a sequential filter cascade, beginning with general travel history, followed by flight frequency and regional destinations, Economy Class confirmation, and specific airline usage. This multi-layered approach excluded long-haul travellers, premium cabin users, and those without qualifying flights, achieving high specificity with a screen-out rate of expected 40%. Participant from the panel (segment 2) were financially incentivized for participation. Unbranded survey-invitations for non-members eliminated self-selection bias prior to participation. Final quotas balanced gender, age distribution, and geographic representation.

### *Survey structure and measures*

The questionnaire spans ca. 10 minutes and comprises five blocks with mainly mandatory responses:

1. Screening: Automated for segment 1 (demographics: age, gender, status, residence); manually asked in the questionnaire for segment 2 (demographics, travel recency, flight modes, regions, Economy class, airline validation, frequent flyer exclusion). Screen outs were redirected with debrief.

2. Travel context: This block captured travel purpose (business/private), business travel policies if applicable (e.g., budget caps, airline mandates), booking channel (self/employer/travel agency), cost bearer, and ticket price (numeric, expected mean to be around 300€). Moreover, respondents recalled details of their most recent qualifying flight, contextualized by randomly displaying one airline from their verified flight history (e.g., "Please think of your last Economy Class flight with airline A").

3. DCE: Choice Experiment (six choice sets, detailed below).

4. Attitudes: Represents standalone sustainability measures and attitudes of the participants: booking likelihood for unbundled green options, willingness to pay thresholds, open ended green motivators, six item Likert scale agreement on sustainability relevance/responsibility; airline green offer awareness (SAF familiarity).

5. Socio demographics: Residence, personal net income, occupation, education, age, sex, etc.

A differentiated survey layout for each of the two participant segments mitigated unwanted side effects: an airline group branded survey layout was displayed for segment 1 (frequent flyer programme members); a neutral and white label layout is used for segment 2 (non-members) participants.

### *Discrete Choice Experiment design*

The DCE tasks present hypothetical flight booking scenarios with three alternatives per choice set: two unlabelled alternatives present green bundles (green premium + emission reduced + randomized incentives), and one regular flight (regular fare, full emissions, and no incentives). Total air fares frame the booking realism (e.g., 200/205/215€/CHF), with green premiums varying 5 to 100€/CHF. The design includes six attributes (see table 1), captured in the previous qualitative study, with levels pretested for clarity and concreteness per best practices (no vagueness, realistic scopes).

| Attribute | Level | Description |
|---|---|---|
| **Add-on Services** | None | No add-on service |
| | Priority Boarding | Earlier boarding, reducing gate wait time by ca. 15 min |
| | Experience Voucher | Leisure voucher 10€/CHF at destination (e.g., museum) |
| | Complimentary Drink | Free alcoholic/non-alcoholic drink onboard |
| | Free Rebooking | One free change (fare difference may apply) |
| | Free High-Speed WiFi | Unlimited high-speed WiFi (e.g., for streaming) |
| **Visibility** | None | No visibility signal |
| | Green Luggage Tag | Green tag on checked baggage signalling sustainability |
| | Green Headrest Cover | Green headrest cover visible to passengers |
| | Cabin Announcement | Crew thanks sustainable passengers (aggregate count) |

| | | |
|---|---|---|
| **Time Savings** | 0 min | No time savings |
| | 15 min | Fast-track security (later airport arrival) |
| | 30 min | Priority baggage unloading (earlier claim) |
| | 45 min | Fast-track security + priority baggage |
| **Public Transport Voucher** | 0 €/CHF | No voucher |
| | 10 €/CHF | Voucher worth 10 €/CHF for local public transport |
| | 20 €/CHF | Voucher worth 20 €/CHF for local public transport |
| | 30 €/CHF | One-way train ticket (≤ 30 €/CHF, incl. long-distance) |

**Table 1: DCE attributes and levels**

Participants receive explicit scenario instructions framing choices as realistic bookings ("Imagine booking privately a European Economy Class flight with the respective airline group; displayed prices represent total fares including taxes and fees. Please decide which offer you would most likely choose"). With status members additionally informed that some e.g., time-saving incentives might overlap with existing frequent flyer privileges.

### *Data analysis plan*

Modelling of the collected data using the Multinomial Logit (MNL) model will subsequently derive individual-level preferences and willingness-to-pay estimates from DCE responses. Market simulations assess bundle viability across passenger segments, while subgroup comparisons and regression analyses explore preference heterogeneity.

### *Ethical considerations*

The study complied with all relevant ethical and data-protection standards, and ensured informed consent, anonymity, and exclusive use of data for research purposes. All procedures followed established professional guidelines, and no personally identifiable information was retained.

## 3. RESULTS AND DISCUSSION

The three hypotheses displayed in the above section reflect anticipated outcomes from the present study. They quantitatively validate qualitative findings from the previous study using the DCE outlined before. By hEART26 conference time, the data collection will be completed. The modelling will enable a presentation of MNL estimates for attribute effects from the experimental design. These analyses will reveal behavioural differences between frequent flyers and non-frequent flyers. They will also incorporate sustainability attitudes through a Latent Class and Latent Variable Model within a Hybrid Choice Framework. We propose presenting these comprehensive empirical findings at the hEART26 conference in September/October 2026.

## 4. CONCLUSIONS

Environmental protection as well as the contribution of aviation to global warming are mainly undisputed and recognized as major challenges of our time (IPCC, 2023). Choice architecture on air passenger behaviour could represent a high potential leverage alongside technological progress to reduce aviation emissions. Whereas nudges have already been extensively in the focus of research (Mello, 2024), incentive mechanisms as instrument to intervene in consumer choices still represent a research gap in aviation.

A first qualitative study conducted in 2025, has indicated the potential of incentive mechanisms to foster consumer behaviour changes in commercial aviation. Using quantitative methodology, we now validate the underlying hypothesis on incentive effectiveness on increasing passenger uptake of sustainable flight options. Increasing voluntary the uptake rates of air passengers on emission reduced flight options, could potentially strongly leverage absolute emission reductions without compromising personal comfort and habits. Using the collaboration with a large European airline group, we target to enable best possible and realistic results from our DCE.

This rigorous study design positions our research to potentially deliver generalizable insights into incentive driven green uptake, bridging behavioural theory with commercial aviation practice.

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