



Public attitudes to biofuel use in aviation: Evidence from an emerging tourist market



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ABSTRACT

Aviation generates substantial carbon footprint which is projected to increase due to the continuous growth in international tourism, especially in emerging markets. This carbon footprint should be mitigated to bring the tourism industry towards its sustainability goals. Within a portfolio of prospective carbon mitigation measures, biofuels represent a technological innovation which holds substantial potential to reduce the carbon significance of aviation. The success of technological innovations often depends on public opinion. The role of public opinion is particularly relevant in the aviation context, where safety considerations of technological innovations may determine consumer choice. Focusing on Poland, an emerging tourist market in Europe, this study explored public opinion on biofuel use in aviation. It found that public understanding of the perspectives of aviation biofuel technology, including its safety, is limited and needs to be reinforced. Public distrust in the national institutions of power and the industry sector representatives in Poland calls for educational and public awareness-raising campaigns to be delivered by the 'third sector' organisations.

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1. Introduction

The greenhouse gas (GHG) emissions from aviation have been growing steadily in recent decades and this trend is set to continue (Peeters and Eijgelaar, 2014). This is primarily due to the rise in international tourism, where air travel represents the mainstay of tourist demand for transportation between the source and host regions (Scott et al., 2010). Being a major driver of air travel, tourism makes a substantial economic contribution to the global and national economies (UNWTO, 2015). Geographically, 'traditional' or 'established' destinations in Western Europe and North America are forecast to retain their strategic importance in terms of tourist demand. Concurrently, the rapid acceleration of tourist flows is envisaged in so-called 'emerging' destinations, such as those in East-Central Europe and Asia (UNWTO, 2015). Given that tourism growth correlates with air travel, these 'new' tourist markets are likely to contribute significantly to the continued rise of the GHG emissions from aviation (Meng et al., 2016).

The problem of the disproportionately high carbon impacts

associated with flying has been recognised (Scott et al., 2016) and a number of policy-making and managerial interventions have been designed to minimise the carbon significance of air travel. To maximise the positive outcome, these interventions have targeted the aviation industry and its customers, thus embracing both the supply and demand sides (Schwanen et al., 2011). They have employed a range of voluntary and mandatory instruments to facilitate more carbon-benign business operations and to architect more responsible consumer choice (Gössling et al., 2009).

The interventions have been applied with varying degrees of success (Gössling et al., 2007). There is evidence to suggest that voluntary changes in consumer behaviour cannot be considered a viable, stand-alone tool for reducing the carbon footprint of air travel in a short-term perspective (McKercher et al., 2009). Consumers fail to link flying to carbon impacts (Hares et al., 2010). Furthermore, despite growing public environmental awareness, the substantial GHG emissions from aviation do not yet represent a sufficient determinant for tourists to change their travel behaviour towards less carbon-intense holidaying patterns (Cohen and Higham, 2011). This underlines the importance of other instruments, such as technological advancements, regulatory measures and financial (dis)incentives, as means of facilitating progress

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of the air transport sector towards the goal of environmental sustainability (Kivits et al., 2010). Although technological advancements in aviation do not always deliver their aspirational carbon reduction targets (Peeters et al., 2016), when combined with other mitigation approaches, most notably with voluntary behavioural changes, they can bring about substantial carbon savings (Gössling et al., 2009).

Among technological innovations developed to reduce the GHG emissions from air travel, biofuels play a substantial role. They are both operationally feasible and hold recognised potential to effectively decarbonise the global transportation industry, including its sector of aviation (Krammer et al., 2013). Although, in the short-term (i.e. before 2020), biofuels cannot compete with traditional, fossil based jet fuels (Kousoulidou and Lonza, 2016), oil price volatility and increasing public and political pressures on the industry drive the long-term biofuel adoption in aviation (Gegg et al., 2014).

Biofuel technology has a number of limitations. These are attributed to such issues as feedstock availability; production costs; land use changes; the ‘food versus fuel’ dilemma; lifecycle carbon footprint; and logistics of continuous supply and distribution (see Hari et al., 2015 for a detailed overview). Despite their drawbacks, biofuels hold substantial potential to be employed in aviation, especially given the advent of advanced generation biofuels (Kivits et al., 2010). Subject to steady demand, political support and balanced business models, these can reduce costs and address some of the other challenges of biofuel production, thus making biofuels a feasible alternative to conventional jet fuel (Nair and Paulose, 2014).

When applied in the context of air transport, biofuel technology has been investigated by a number of aviation operators who view it as an opportunity to fulfil the intensifying environmental regulations, address the growing shareholder expectations on the sustainability performance of business operations, and create a positive corporate image (Hari et al., 2015). As a result, since 2008, the different blends of biofuels and conventional aviation fuel have been tested by the airlines worldwide (see *Enviro Aero 2017* for a regularly updated inventory of biofuel-driven flights). With all trials being successful, the industry experts agree that aviation will become a considerable market for biofuels in the coming years (Chiaromonti et al., 2014). Furthermore, with increased production supported by policy-makers, industry professionals and consumers, biofuels have potential to become a financially-feasible alternative to conventional fuels in the longer term even though direct cost-benefit comparisons are difficult to derive due to the lack of published cost data on biofuels (Sims et al., 2010).

While the aviation industry has made considerable progress to-date in terms of feasibility research and the trial operational adoption of biofuel technology, little is known about public awareness of these industry's efforts. While public knowledge on, and public attitudes to, biofuel *in general* represent a sufficiently well-established object of scientific scrutiny (see, for example, Sawanidou et al., 2010), biofuel research has primarily been concerned with the use of biofuel technology in the road transport sector. Literature search returns scant results when looking for studies on aviation biofuels alongside public knowledge of and attitudes to their broader adoption.

There are a number of reasons for why public perception of aviation biofuels should be better understood. First, aviation biofuels are a relatively new, and yet rapidly developing, instrument of carbon impact mitigation (Noh et al., 2015). Evidence suggests that the speed of the market rollout and the overall adoption rates of a new technology are often dependant on the level of public knowledge and on the degree of public trust in it (Assefa and Frostell, 2007; Clothier et al., 2015; Schulte et al., 2004). These

variables are instrumental in enhancing the levels of social acceptance of a new technology, especially in the context of renewable energy generation (Ellabban and Abu-Rub, 2016; Ponce et al., 2016; Wüstenhagen et al., 2007), which signifies the importance of their better understanding. Second, while biofuel safety is a paramount issue which has been meticulously monitored by aviation regulators, industry experts and ‘third sector’ representatives, marketing research posits that consumers may be reluctant to accept the innovation interventions in the established and mature market environments, such as flying, due to the general fear and anxiety of the ‘new’ (Meuter et al., 2003). This reluctance, multiplied by the issue of safety, which has traditionally been a determinant of the public preparedness to fly (Hall, 2002), has to be minimised to ensure the success of those aviation business ventures that have chosen to implement biofuel technology. Given that airlines are particularly vulnerable to public opinion (Hamelinck et al., 2013), they should introduce innovations with care, and public opinions on a new technology, such as biofuels, should be diligently examined prior to its large-scale deployment (Greiner and Franza, 2003). Lastly, biofuels as a carbon footprint abatement tool are often seen as a means to showcase their adopters' good global citizenship, which holds true for the sector of aviation (Kowal and Henderson, 2015). However, such publicity can only become effective when consumers embrace the progress made by the industry and understand its potential (Hamelinck et al., 2013). The literature indicates that poor public knowledge on a new technological advancement alongside the advantages it has set to deliver can hamper its rapid market penetration; it can further confuse customers and detrimentally affect their purchasing decisions (Wegener and Kelly, 2008).

This paper contributes to knowledge by exploring public attitudes to the use of biofuels in aviation. It identifies the levels of public knowledge on the application of biofuel technology in the sector of air travel alongside the carbon mitigation benefits it offers. The issue of biofuel safety is also investigated given the relative ‘novelty’ of aviation biofuels and the important role played by safety considerations in consumer decision-making to fly. The project concentrates on Poland with its rapid growth in inbound and outbound air travel market (Burrell, 2011), which signifies the rising contribution made by this country to the carbon intensity of aviation, globally and in Europe. The focus on Poland is further because, to-date, the topic of the tourism's and aviation's GHG emissions has largely been explored from the ‘western’ and ‘developed countries’ perspective (Dillimono and Dickinson, 2015). The recent increase in tourist numbers outside the ‘western’ markets suggests that this scope should be re-considered and extended, with the ‘emerging’ tourist and air travel markets, such as those in East-Central Europe, calling for more research attention (Dickinson et al., 2013).

2. Background to research and the geographical context of analysis

2.1. Public opinion on (aviation) biofuels

Biofuels occupy a noticeable position in the international research agenda given the crucial role they are attributed to play in fulfilling the future world energy demand and reducing its carbon intensity (Demirbas, 2007). This is reflected in the growing number of literature outputs and research grant applications made on this topic in the last decade (Yaoyang and Boeing, 2013). While existing research on biofuels shows its truly global penetration, it also pinpoints the limited number of subject categories from the perspective of which the topic of biofuel technology has been scrutinised. Comprehensive literature reviews conducted by Mao

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