Journal of Air Transport Management 71 (2018) 130–137

Contents lists available at ScienceDirect

Journal of Air Transport Management

journal homepage: www.elsevier.com/locate/jairtraman

"Problematizing" carbon emissions from international aviation and the role of alternative jet fuels in meeting ICAO's mid-century aspirational goals

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ARTICLE INFO

Keywords:
Alternative jet fuels
Policy analysis
Weak sustainability
International aviation
Climate change

ABSTRACT

Alternative jet fuels are one of the four mechanisms by the United Nations International Civil Aviation Organization (ICAO) to limit and reduce carbon emissions from international aviation. By using Carol Bacchi's *what's the problem represented to be?* method of discourse analysis, the objective of this paper was to identify and understand the premises and effects of the problem-solving paradigm underlying ICAO's alternative jet fuel strategy. As a result, three problem representations were identified, from which two out of four underlying assumptions have reinforced ICAO's weak sustainability approach to international aviation's growth and have led to a number of discursive, subjectification and lived effects. The selected method also allowed the authors to identify several options to disrupt those premises in favor of the implementation of more aggressive mitigation and adaptation strategies without constraining air travel demand, including: (i) raising awareness of the environmental impacts of aviation beyond the tailpipe emissions, (ii) improving the understanding of the effects of climate change on the air transport sector, and (iii) reassessing the sectoral approach to the Sustainable Development Goals so as to gain consistency with the aims of the UN *2030 Agenda for Sustainable Development*.

1. Introduction

In 2014, the aviation sector contributed with 3.5 percent of the global gross domestic product (GDP), supported 62.7 million direct, indirect, induced and catalytic jobs, and in 2017, transported over 4 billion passengers (ICAO, 2018; WEF, 2017; ATAG, 2016a). Conversely, domestic and international flights currently account for ~2 percent of the total carbon dioxide (CO_2) emissions from anthropogenic origin (IATA, 2015; Penner et al., 1999), a contribution that can be as high as 4.9 percent when the radiative forcing effect of greenhouse and non-greenhouse gas emissions at cruise altitude are accounted for (Moore et al., 2017; Novelli, 2011; Lee et al., 2009; Penner et al., 1999). Although aviation's contribution to climate change appears to be small, the lower end is comparable to the total greenhouse gas emissions (GHGs) of Germany, ranked within the top ten largest global emitters (FCCC/CP/2015/10).

Whereas the emissions reductions from domestic aviation are governed by the Paris Agreement, emissions from international aviation are addressed by Member States to the United Nations International Civil Aviation Organization (ICAO) through their national Action Plans, to operationalize the targets adopted in 2010 in ICAO's 37th Assembly resolution A37-19 (ICAO, 2014); consisting of:

I An average 2% annual improvement in fuel efficiency from 2009 until 2020[1],
II Carbon-neutral growth[2] from 2020, and
III Halving the sector's CO_2 emissions by 2050 relative to 2005 levels.

Although these aspirational targets are ambitious, they are insufficient to meet those of the Paris Agreement, as they do not appropriately account for the required carbon reductions to limit global warming to 1.5–2 °C. According to Pidcock and Yeo (2016), by 2050 carbon emissions from international aviation will still represent 12% of the 205Gt remaining global CO_2 budget even if technological and operational efficiencies are maximized and the total demand for conventional jet fuel is met with alternatives.

This contribution can rise up to 20% should alternative jet fuels not become available in sufficient quantities to replace the demand for conventional jet fuel in its entirely (Staples et al., 2018; Pidcock and Yeo, 2016). In the past, the EU has suggested more aggressive carbon reduction targets for international aviation to be consistent with the 1.5–2 °C global aspirational goal, with sectoral reductions needed

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[1] The original target set in 2009 by IATA was a 1.5 percent average annual increase in fuel efficiency (ATAG, 2012).

[2] The international aviation community defines carbon-neutral growth as an absolute decoupling of greenhouse gas emissions from economic sectoral growth.

https://doi.org/10.1016/j.jairtraman.2018.06.001
Received 2 January 2018; Received in revised form 22 May 2018; Accepted 2 June 2018
Available online 09 July 2018
0969-6997/

between 64% and 91% by 2050 compared to 2005 levels (Cames et al., 2015).

By using Carol Bacchi's (2009) *what's the problem represented to be?* (WPR) method of discourse analysis (a detailed description is presented in Section 3), this paper aims to contribute to a better understanding of ICAO's strategy on alternative jet fuels (AJF), as they are perceived by the aviation community to hold the greatest potential to meet ICAO's international goals (CAAF/2-SD3; ATAG, 2012).

The WPR is a six-step method to examine the premises and effects of the problem-solving paradigm underlying ICAO's work on environmental protection so as to identify its material and symbolic impacts on people and the environment. Most importantly, it is a useful method to challenge current problem representations in favor of policy interventions more consistent with the goals of the Paris Agreement and of the United Nations *2030 Agenda for Sustainable Development.*

2. Background

In addition to the aspirational targets adopted in 2010, ICAO's 37th General Assembly endorsed the *Program of Action on International Aviation and Climate Change* to develop a global framework consisting of operational, technological, market-based measures, and the use of alternative fuels to address CO_2 emissions from international aviation (ICAO, 2013a).

Emissions from international aviation are calculated based on fuel consumption, thus the proposed framework has aimed at increasing jet fuel savings. Carbon reductions from technological measures include: the use of lighter and recyclable materials, higher engine performance, fleet renewals, compliance with emissions certification standards – including ICAO's aircraft CO_2 standard –, improvements in aircraft aerodynamics, etc. Fuel savings from operational measures include improvements in air traffic flow management, dynamic and flexible routing, airport design and operations, performance-based navigation, etc. (ICAO, 2013b).

Whereas the fuel efficiency target has been met over the past years mainly as a result of technological and operational measures (ATAG, 2017), ICAO's assessments on fuel consumption and emissions show that the aggregate environmental benefit achieved by a combination of the technological and operational measures will be insufficient to attain carbon-neutral growth from 2020 (A39-WP/55). This, coupled with other factors analyzed later in this paper, make international aviation reliant on the use of alternative jet fuels to achieve greater carbon reductions.

Presently, there are five certified conversion pathways for alternative jet fuel production under ASTM D7566, four airports regularly distributing AJF and over 100,000 commercial flights that have used alternative fuels (ICAO GFAAF, accessed on October 24th and November 20th, 2017). However, regular production of alternative jet fuels remains limited, and volumes supplied through off-take agreements between airlines and fuel producers account for 0.9Mt per year (less than 0.006 percent of total jet fuel consumption by international aviation in 2010), making it difficult to predict their future contribution to meeting ICAO's aspirational goals (CAAF/2-WP/06).

In an effort from ICAO to accelerate the development and adoption of alternative jet fuels, Member States convened in Mexico City at the Second Conference on Aviation and Alternative Fuels (CAAF/2) in October 2017 to set short-to-long term volumetric targets for alternative jet fuels. However, no consensus amongst participant States on specific targets was reached and the Conference endorsed the *2050 ICAO Vision for Sustainable Aviation Fuels* without any quantitative goals for substituting conventional jet fuel nor any quantifiable carbon reductions resulting from the use of alternative jet fuels (CAAF/2-SD3).

Although ICAO's market-based measure was originally envisioned in 2010 as a complementary measure to further the CO_2 reductions achieved through improvements in technology and operations, in October 2016, ICAO's 39th General Assembly approved the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) to address *any annual increase* in the total CO_2 emissions from international aviation that exceed the 2020 baseline (Resolution A39-3).

3. Understanding policy governance as "problem" representations

Carol Bacchi's (2009) *what's the problem represented to be?* (WPR) methodological approach consists of a six-step method to examine how "problems" are represented in public policy to identify the material and symbolic impacts that problem representations have on the subjects of those policies.

Bacchi's method builds on much of the work by Michel Foucault on discourse analysis, the history of thought and the process by which thoughts are "problematized" or reflected in the form of socially-constructed "problems" and addressed in public policy (Foucault, 1984). According to Foucault, the nature, scope and type of solutions articulated through public policy will inevitably result from a specific form of "problematization" (Foucault, 1984).

Bacchi goes beyond the Foucauldian approach by proposing a method that challenges problematizations that have negative effects on policy subjects at the expense of others (Bacchi, 2009). Although her original scope is limited to the problem-solving paradigm underlying public policy in Western industrialized nations and international organizations, Bacchi's WPR approach is suitable for the analysis of policies in a variety of political regimes and institutions. Also, notwithstanding that it was originally designed and has been applied ever since for public policy analysis, the WPR is equally useful to analyze ICAO's alternative jet fuel strategy, where the novelty of this research paper rests.

The WPR method follows a set of six questions: [Q1] What is the "problem" represented to be in a given policy? [Q2] What assumptions underlie this problem representation? [Q3] How has this representation of the problem come to prominence? [Q4] What does this representation of the problem take for granted and leave unquestioned? [Q5] What effects are produced by this representation? [Q6] How and where is this representation of the problem produced, disseminated and defended? And how could it be challenged?

4. Debriefing the problem-solving paradigm underlying ICAO's alternative jet fuel strategy

ICAO's alternative jet fuel strategy supports and promotes the development and consolidation of supply chains of alternative fuels for international aviation through its Member States. It was originally developed within ICAO's *Program of Action on International Aviation and Climate Change* and it encompasses a broad range of activities including R&D, certification, financial assistance, monitoring, verification and evaluation (MRV), technology transfer, capacity building, etc. (CAAF/09-WP/24).

The exchange of information, worldwide initiatives, actions and best practices is facilitated by ICAO's Global Framework for Aviation Alternative Fuels (GFAAF), an online platform created in 2009 to help Member States accelerate the development and adoption of alternative jet fuels (CAAF/2-WP/4; CAAF/09-SD/3).

The following figure (Fig. 1) summarizes the findings for questions Q1-Q5, each of which is analyzed in separate sections. The findings and respective analysis for Q6 are presented later in the manuscript (Fig. 2).

[Q1] What is the"problem" represented to be? Three problem representations were identified in ICAO's alternative jet fuel strategy: (1) A *main* "problem" represented by the current and future