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Study of the current incentive rules and mechanisms to promote biofuel use in the EU and their possible application to the civil aviation sector

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ABSTRACT

This paper deals with the need of introducing biofuels for the use of the civil aviation sector, and the different possibilities of application of incentive mechanisms if the existing market conditions do not allow their direct commercialisation. After an introduction on the main features of the civil aviation impact on climate change, a historical review of the European Union regulations to promote the energy extraction from biological resources is presented. The different incentive policies around the world are revised and compared and some indications are offered on the most recommendable procedures that might be carried out in the near future.

Introduction

Air transport is one of the most rapidly grown transport sectors. Forecasts give future air traffic yearly growth rates of 4% (EUROCONTROL, 2015; IATA, 2012). Despite of the benefits from that growth, there are concerns about the increase in aviation greenhouse gas emissions. CO_2 is considered the most important greenhouse gas emitted by aircraft, being aviation responsible for about 3% of global fossil fuel consumption and 12% of transportation-related CO_2 emissions (Simone et al., 2013). Recent studies suggest that if the global economic growth continues, aviation CO_2 emissions are likely to experience a greater than three-fold increase between 2000 and 2050 (Alonso et al., 2014). Some industries, like long-haul tourism, depending strongly on air transport are especially concerned about the effect of this environmental impact on their future development (Vorster et al., 2012).

In response to concerns over the global environmental impacts of aviation, stakeholders have committed to strategies of mitigation related to efficiency improvement (fleet replacement, use of larger aircraft, increased density seating inside aircraft, improvements in Air Traffic Control and navigation procedures). The calculation of the practical consequences of all those elements is rather complicated, but according to IATA the results show an average improvement in efficiency, measured in ton of fuel per RTK, around 1.9% yearly (IATA, 2013) for the IATA members, although other studies indicate lower figures (Peeters, 2013). The ICAO Council, in its climate change mitigation program, set an aspirational target for the World Air Transport sector of 2.0% yearly improvement until 2020. Fuel efficiency is not only important from an

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environmental point of view: the aviation industry outlook on future traffic does not look realistic in the light of future crude oil production, taken that the aviation fuel percentage of refinery output cannot be increased hugely (Nygren et al., 2009).

Sustainable, advanced-generation aviation biofuels will play a large role in reducing CO_2 emissions (Krammer et al., 2013). The European ETS Directive (EC, 2008) considers a zero emission factor for aviation biofuels, although assessments of life-cycle CO_2 emissions typically show a reduction potential compared to fossil jet fuel in the order of 30–90%, depending on feedstock and production processes (Stratton et al., 2010; Vera-Morales and Schäfer, 2009).

On the biofuel usage in aviation, most of the specification and operational questions have been already answered and no technological show-stopper is seen. However, the economic viability is still far from being made secure (Halog and Manik, 2011; Sims et al., 2011; De Gorter and Just, 2010; Demirbas, 2009).

Data suggest that the proportion of biofuels in total fuel consumption by commercial aviation was 0.5% in 2009 and will rise to 15.5% in 2024 in a ‘‘moderate” scenario, and to 30.5% in an ‘‘ambitious” scenario (Sgouridis et al., 2011). In the European Union, the European Commission have launched the ‘‘European Advanced Biofuels Flightpath”, an industry-wide initiative to speed up the market uptake of aviation biofuels in Europe. It provides a roadmap to achieve an annual production of two million tonnes of sustainably produced biofuel for aviation by 2020 (EC, 2011). This target was one of the goals of ITAKA program and, after realizing the huge difficulties existing, it was delayed to year 2030.

The work presented in this paper provides a review analysis on the background and current incentive rules and mechanisms to promote biofuel use in different parts of the world and particularly in the European Union, with especial attention to the applications to the air transport industry. First, a description of the initiatives to mitigate the contribution of aviation to climate change is given, highlighting the role of biofuels in that aim. Then, the different directives released during the last fifteen years by the European Union to regulate the use of biofuels are presented, followed by an analysis of the development of biofuels in aviation and the problems being faced. The following section provides a review of incentive policies being applied in different parts of the world, particularly in the United States and in the European Union. Finally, a discussion on the effectiveness of those policies is presented.

Aviation and climate change: the role of biofuels

In chronological terms, the international work on a regulatory limitation of the greenhouse gas emissions from civil aviation started in December 1997, when the third meeting of the Conferences of the Parties (COP/3), held in Kyoto, failed to allocate international aviation emissions to specific countries and decided to tackle this task from a global perspective with the help of the International Civil Aviation Organization (ICAO), who will take care of the analysis of the problem and look for the most adequate instruments to solve it (Benito, 2012).

Under the patronage of ICAO, the International Panel on Climate Change performed an exhaustive study titled *Aviation and the global atmosphere* (IPCC, 1999), published in 1999, covering all the civil aviation impacts on the atmospheric environment. Main conclusions of the analysis quantified the civil aviation effect on atmospheric warming in 3% of all the man-made activities impact (anthropogenic contribution). As the growth rate of civil aviation is high, in absence of specific actions, that participation may go up to 5% in 2050, according to the most likely scenarios contemplated in this study.

The main reason of this increase was due to the historical fact of air transport growth rate being higher than the efficiency improvements of this transport mode, including the three basic elements: vehicles, operation and infrastructures. While historical global consumption figures are difficult to link with transportation volumes, some recent research (Azzam et al., 2010) shows efficiency gains, measured as fuel consumption per Revenue tonne-kilometre (RTK), of 1.5–2.0% per year. As the number of RTKs has been increasing at 4.5–5.0%, the net result offers an increase of 3% in yearly CO_2 emissions, if standard kerosene continues to be the only used fuel.

Looking for a solution that permits the reduction of climate change contribution without taking drastic measures of demand reduction, ICAO adopted the so called *Four Pillar* policy (IATA, 2009; Benito, 2007), recommending to the Member States the adoption of four groups of actions:

(a) New technology developments
The aeronautical industry is one of the highest R&D investment sectors but, as all the technologically leading sectors, project maturation periods are long and basic technology research cost are extremely high. The economic life of the products is, by consequence, very long (Jiang, 2013).
The irruption of climatic change as a priority target in the development of new prototypes has put additional pressure in the programs to reduce fuel consumption, already very important for market competitiveness reasons. ICAO is collaborating in this effort by introducing a new requirement of CO_2 emissions certification for new civil aircraft models. The applicable procedures were approved by ICAO 38 General Assembly in October 2013 (ICAO, 2013a) and the values not to be exceeded will be included in the Annex 16 to the Chicago Convention by 2016, with the aim of a year 2020 application.
The implications of new aviation technologies in infrastructure, i.e. airports are also important (Kivits et al., 2010).
The development of biofuels, more specifically drop-in biokerosene (a type of kerosene of biological origin, the specification of which is very similar to oil-derived kerosene and can be mixed with it without any difference in its use), is being fostered through the ICAO Global Framework for Aviation Alternative Fuels (IGFAAF) and has been