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Transportation Research Procedia 00 (2018) 000–000

Transportation Research Procedia

www.elsevier.com/locate/procedia

World Conference on Transport Research - WCTR 2019 Mumbai 26-31 May 2019

An investigation on potential measures for reducing air transport emissions in Europe

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Abstract

The purpose of this investigation is to analyse the structure and evolution of the air transport CO2 emissions in the European Union. Two different regulations are further explored in this study. Firstly, the potential implementation of a mandatory biofuel blending percentage is analysed. Its effect on the Spanish air transport is also commented. Secondly, a general research regarding the evolution of the Emission Trading Scheme (ETS) is also conducted and some potential forecasts analysed.

The findings of this investigation will allow assessing the efficiency of regulatory measures in the European Union such as the ETS in place from 2012, and the feasibility of achieving the net zero growth after 2020 established by ICAO in 2016 in the shape of the new market based mechanisms.

The investigation offers thus insights to stakeholders in the aviation industry, providing unpublished data helping regulators to evaluate the results of their potential measures and providing airlines with efficiency data they can use to estimate the effect of future regulations.

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Keywords: air transport; Carbon Neutral Growth; biofuel; blending; ETS

1. Introduction

Temperatures in the Earth are rising and the scientific community's concern regarding climate change has also raised in the last years. In a Business As Usual scenario and if no measures are taken in order to reduce the emissions of GreenHouse Gases (GHG), the global temperature could rise even 7ºC in the XXI century (UNEP, 2015).

With the aim of reducing this increase, the energy, transport and heating industries should change their way of working and, if these changes are not expected to be carried out by themselves, mandatory measures should be imposed. The graph in Figure 1 shows the past and potential evolution of GreenHouse Gases (GHG) emissions in two different scenarios.

Within the transport sector (ATAG, 2016), air transport represents the 12% of CO2 emissions (2% of the total emissions in 2015) and this quantity is growing (Aminzadeh et al., 2016). For this reason, IATA is leading a global plan to react to this trend (IATA, 2016). It aims to achieve a CNG from 2020 onwards, meaning that the emissions should be capped at 2020 levels. In addition, a reduction to the 50% respect to that level is aimed for 2050. Apart from technology, operations efficiency and infrastructure improvements, this reduction is expected to be achieved via biofuels and radical technologies as well as enforcing economic measures or incentives (Alonso et al., 2014).

Among all the possible incentives that have been carried out in different countries and industries, as stated in (Mohd Noh et al., 2016), the approach that seems to be the most suitable is the combination of a mandatory blending percentage with subsidies through tax management or offset mechanisms. In the following sections these two measures are described and analyzed.

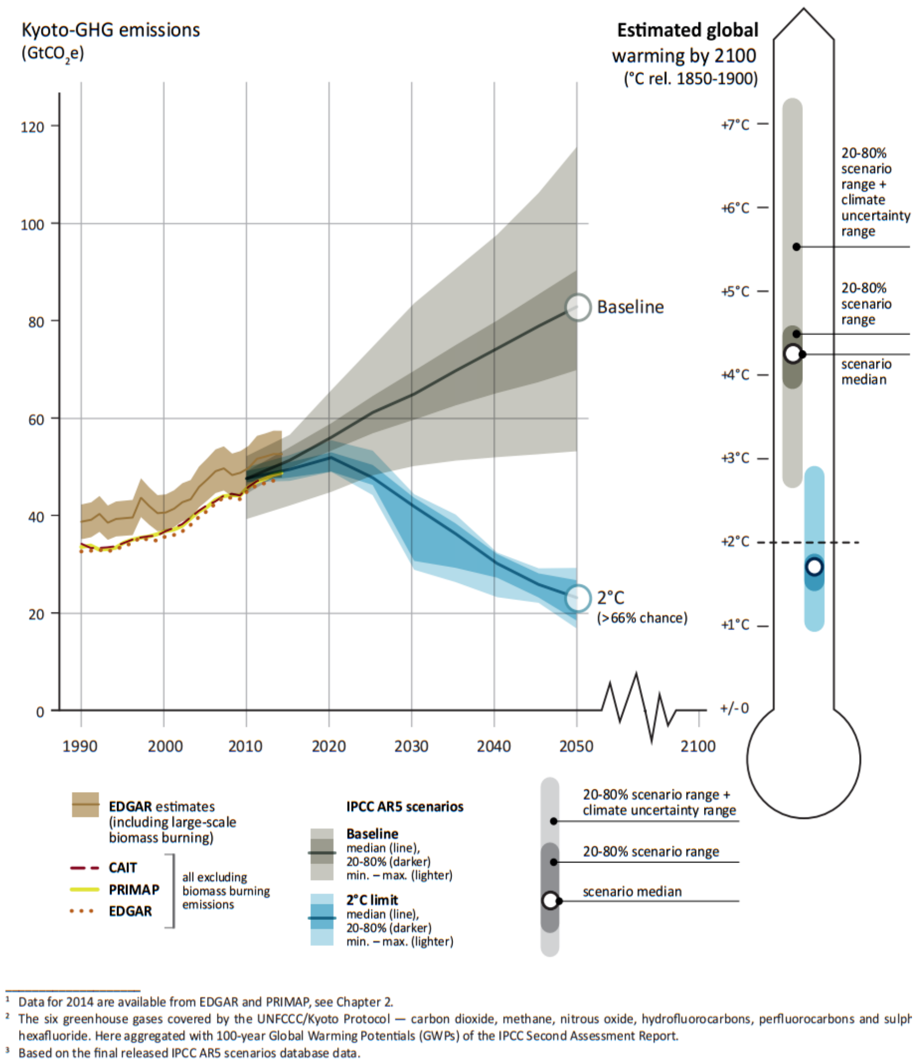

Figure 1 Historical GHG emissions and projections until 2050. Source: UNEP (2015).

2. Mandatory blending

Medium-short term biofuels analyzed in this study are designed as drop-in fuels. This means that the can be used within the current aircraft technology without any changes in the fuel and engines systems. In fact, these biofuels can be used mixed with traditional kerosene. This is what happened in the most of the flights that have been already flown using biofuels. The reasons are the flight safety and the biofuel stock availability.

In this case, this regulation has been simulated by means of a certain percentage that is applied to the whole mass of fuel burnt. Depending on the different scenarios analyzed this percentage is forced to grow faster or slower in order to fit the CNG for the desired year. This way, the impact on the carriers' economy will be higher or lower thus the regulation or financing measures should be developed accordingly to this needs.

In this section, as carried out in (Lopez-Lazaro et al., 2018), the blending percentage that should be imposed in order to achieve the CNG from 2020 onwards is calculated. Firstly the traffic obtained from AENA and EUROCONTROL databases is projected using a forecast made by EUROCONTROL Then, the needed biofuel for the CNG is computed.

Data from 2016 was gathered from AENA (2016) and EUROCONTROL (2016). There, route-level for Spanish carriers could be processed and merged. The airlines included in the study were: Iberia, Vueling, Iberia Express, Air Nostrum, Air Europa, Volotea, Evelop, Alba Star, Privilege, Plus Ultra, Wamos, Binter, Naysa, Canair and Canaryfly.

In order to be used as base to project the 2016 data onwards, the forecast made in EUROCONTROL (2017) is showed in Table 1. The agency uses three different scenarios for their estimations: High (optimistic), Baseline and Low (pessimistic). It is worth to remark that for the pessimistic scenario, in 2019 and 2021 a decrease (negative AGR) is forecast for the EU flights.

Table 1. Forecast for Annual Growth Rate (AGR) in Europe for three different scenarios. Source: EUROCONTROL (2017).

Year	**13**	**14**	**15**	**16**		**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**CAGR (17-25)**	**Total (25/16)**
EU AGR [%]	-1.1	1.7	1.6	2.8	**High**	4.3	3.1	3.7	3.9	3	3	3	3	3	3.3	34.3
					Base	2.9	1.9	1.8	2.1	1.4	1.6	1.6	1.6	1.6	1.8	17.8
					Low	1.5	0.6	-0.2	1.2	-0.1	0.2	0.2	0.2	0.2	0.4	3.9

Once the traffic is forecast until year 2025, the calculations for the CNG are carried out. The methodology followed for the amount of fuel burned can be found in Harris (2005). The reference used for the biofuel emissions calculations is de Jomg et al. (2017). The feedstock used for this calculus is camelina as it is expected to be the most feasible solution in the mid-term (Moser, 2010). The results of this analysis are shown in Figure 2.

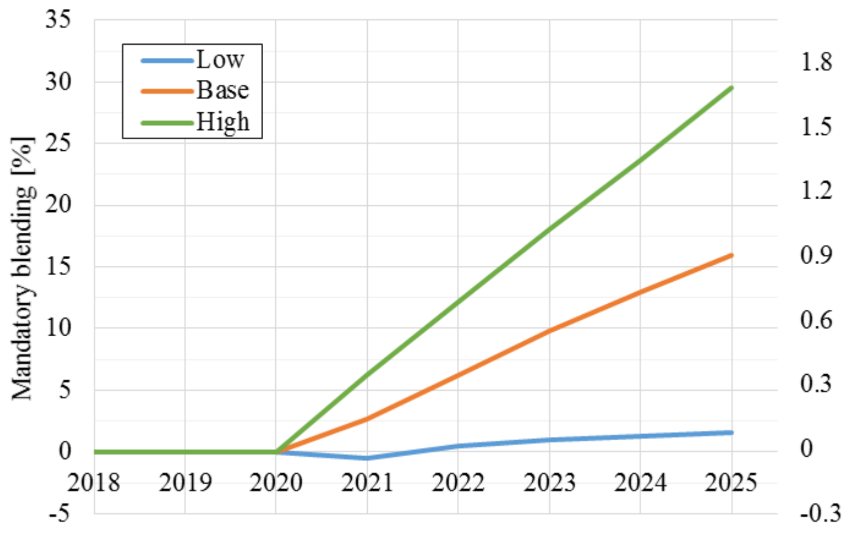

Figure 2 Mandatory blending and biofuel Mton needed for the CNG.

As it can be observed in Figure 2, the blending percentage that should be imposed suffers from great deviation depending on the traffic scenario that is considered: from almost a plain evolution in the pessimistic case to and sharp increase (c. +6% yoy) in the optimistic. In the Base case, the annual growth rate is c. +3% yoy.

In terms of tons of biofuel needed, for the three scenarios the volumes are 0.1, 0.9 and 1.7 Mton for the last year (2025) and each scenario respectively. This evidences the potential issues that could arise regarding mass-scale production and harvesting (Herr et al., 2016; Smith et al., 2017).

3. Emissions surcharge

During the year 2005, the EU launched the so-called EU Emissions Trading System (ETS). This scheme is based on a cap-and-trade principle: each participant is assigned a cap limit for its GHG emissions and then the surplus or lacking emissions are traded in a secondary market through the so-called European Allowances (EUAs). This program has been divided into different phases which are been designed on the fly:

- Phase I (2005-2007). At the beginning (European Commission, 2005), only CO2 from industries such as energy production, mining and processing of ferrous metals were included into the scheme.
- Phase II (2008-2012). In the following years, more activities and gases were attached to the system and more countries joined it. In fact, aviation was included in 2012.
- Phase III (2013-2020). During this period some changes, explained below, to the program were proposed due to the lack of effectiveness of the program and the fall of the EUAs' price.
- Phase IV (2021-2028). This phase is expected to increase the pace of emissions cuts in order to achieve the EU 2030 target (40% emissions reduction from 1990) agreed in the 21th Conference of Parties (COP) held in Paris in 2015.

Despite the fact that inter-EU flights were included in this scheme in 2012, long-haul routes departing or arriving EU were not surcharged in order to avoid overlaps with counterpart mechanisms and other trust issues. This decision, also known as stop-the-clock, has caused a lot of controversy in the industry along the years and it has been revised several times. In fact, recently in July 2017, its revocation delay has been backed by the EU Panel until 2021. At that time, another meeting will be carried with the aim of discuss the stop-the-clock revocation if global carbon markets (which are expected to be developed by aviation international organizations by that time) are not on the expected way or do not achieve their desired effectiveness regarding emissions surchargement and reduction.

With the goal of estimate the future prices of the EUAs, an analysis of historical values and forecasts from different experts is carried out in the following paragraphs. Historical values of the EUAs come from EEX (2002) and are represented in Figure 3.

Figure 3 Historic price of EUA [EUR/tCO2]. Source: EEX (2002).

This low prices are the consequence of the backward movement of the economy since the 2008 crisis; industry decreased their GHG production hence causing an excess of EUAs in the market.

Forecast carried out during the Phase II of the EU ETS (Koop, 2011) expected a major increase of the prices. Analysts predicted different situations in those years. One possibility was the scenario where the EU ETS were to be ended in 2020 without a Phase IV; in that case the prices of the EUAs were expected to fall to zero price in 2018. In the other possibilities, all of the outlooks (depending on the measures adopted by the EC; short or long term) expected a biggest growth of prices than the one that has been produced in the actual prices (more than 10 EUR/tCO2 by 2017 and more than 20 EUR/tCO2 by 2028).

Other example of these forecasts that was not accurate enough is shown in Figure 4. There, the author (19), reflected 5 different scenarios considering Business as Usual (BAU) or different potential developments of the energy and market indexes (high and low for each one). In any case, none of them was able to predict the prices of the 2014-2016 period.

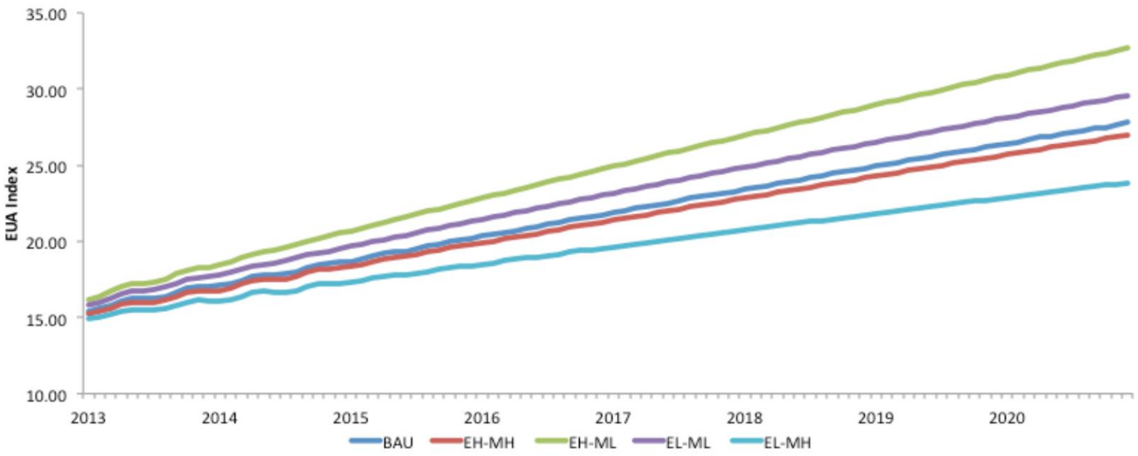

Figure 4 EUAs' price forecast. Source: Chen (2012).

EU is trying to recover levels around 20 EUR/tCO2 via two market policies: backloading and Market Stability Reserve (MSR). The first one consists in a delay of EUAs sales. During the 2013-2015 period, 900 million EUAs were withheld from auctions in the primary market. These are expected to be reintroduced in 2019-2020 auctions. In fact, as analyzed in ICIS (2016), this policy did had an impact in 2014-2015 when volume of traded EUAs decreased and their price increased, see Figure 5. Nevertheless their value has returned to 2013 levels in 2016 (as already seen in Figure 3).

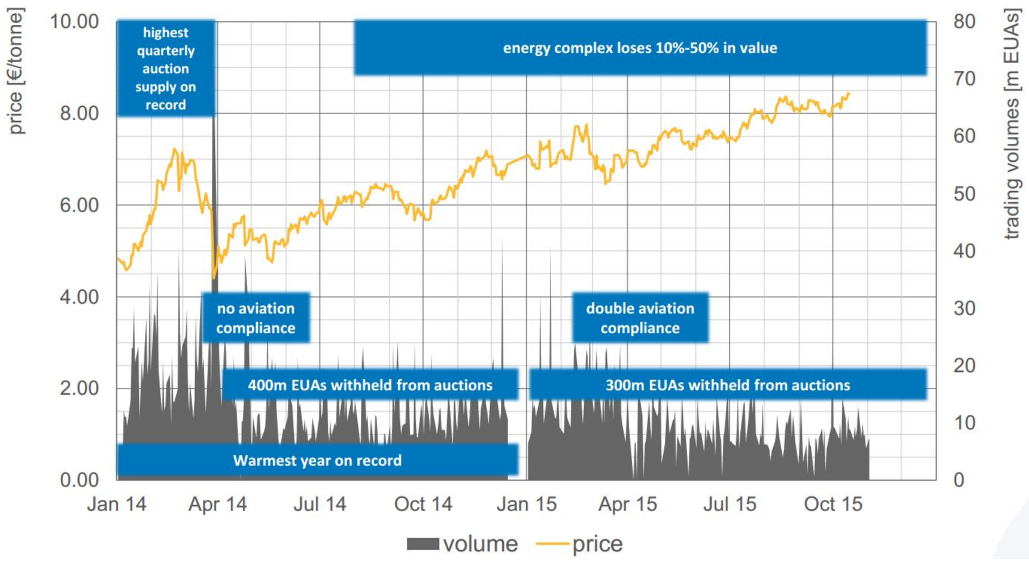

Figure 5 Backloading effect on EUAs price 2014-2015. Source: ICIS (2016).

The second measured planned by the EC to force an increase in the EUAs' price is the MSR, to be launched in 2019. It consists in reserving surplus EUAs within a special fund. The volume of this withheld allowances can be observed in Figure 6.

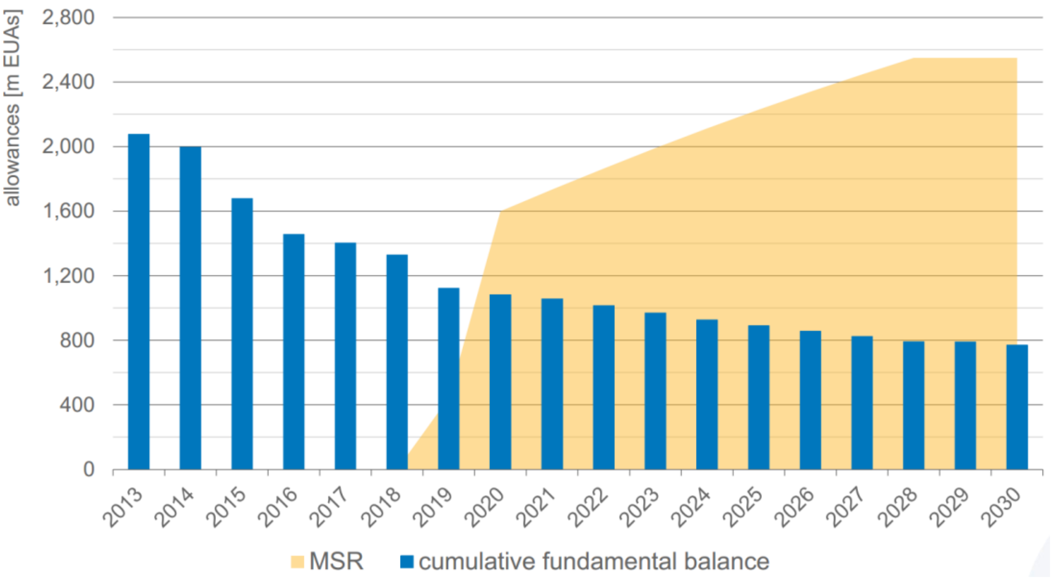

Figure 6 Market Stability Reserve (MSR) planned for 2019 onwards. Source: BOE (2007).

However, these strategies have not had a noticeable impact yet and the EUA's price remains considerably low to the EU expectatives. Perhaps due to this reason forecasts from past years were too optimistic in this regard and they are far from the actual current prices. For example, in (20), Figure 7, the rally caused by the backloading measure in 2014-2015 was expected to be continued and further accelerated in 2019 due to the MSR. Nevertheless, 2017 prices are far below the price in that estimation, around 12 EUR/tCO2.

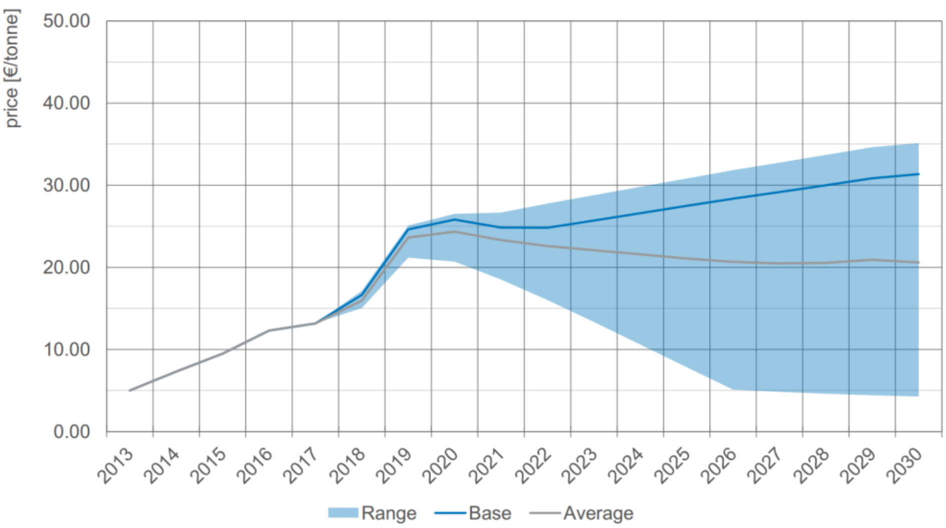

Figure 7 EUAs' price forecast. Source: ICIS (2016).

To sum up, forecasts found in the literature were outdated as explained before and the future evolution of this commodity is not easy to foresee. During the last years the EUA's value seems stabilized if compared against the huge fluctuations of the first ETS phases (2005-2012), see Figure 3. However measures such as the MSR are expected to force an increment in the EUA's price in the forthcoming years.

4. Conclusions

Taking previous analyses as baseline, it has been identified that the implementation of a mandatory biofuel blending percentage and the offset mechanisms such as the European Emissions Trade System (ETS) are the most feasible measures to be taken in order to achieve a Carbon Neutral Growth (CNG) from 2020 onwards.

Regarding the mandatory blending, this measure should be enforced since the gap between the common kerosene and current cost of biofuel production are too high. In addition, an analysis for the Spanish market showed that this percentage should be increased in the order of 3% yoy in the base scenario from 2020 onwards. However high dependency from traffic was also observed.

The European ETS is another tool to incentive airlines to reduce their carbon footprint. However, as analyzed, the price of the European Allowances (EUAs) has not been as high as desired because of the production decrease due to the 2008 crisis and the improvement in energy efficiency. On the other hand, the future measures such as the Market Stability Reserve (MSR) are expected to cause an increment in the EUAs price.

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