International Civil Aviation Organization

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WORKING PAPER

HIGH-LEVEL MEETING ON THE FEASIBILITY OF A LONG-TERM ASPIRATIONAL GOAL FOR INTERNATIONAL AVIATION CO_2 EMISSIONS REDUCTIONS (HLM-LTAG)

Montréal, 19 to 22 July 2022

Agenda Item 2: Means of implementation for a long-term global aspirational goal for international aviation

THE ROLE OF HYDROGEN IN THE DEVELOPMENT OF SUSTAINABLE FUELS (SAF)

(Presented by Chile)

SUMMARY

This paper seeks to demonstrate the potential of hydrogen as an input for the production of sustainable aviation fuels (SAF) and proposes to continue in-depth analysis of what States require to be able to promote the production of sustainable fuels, through a specific study demonstrating the potential of hydrogen.

1. INTRODUCTION

1.1 At its 40th session in 2019, the International Civil Aviation Organization (ICAO) Assembly requested that the ICAO Council explore the feasibility of a long-term aspirational climate goal for international civil aviation (LTAG)[2].

1.2 Accordingly, at the twelfth meeting of the ICAO Committee on Aviation Environmental Protection (CAEP/12) in February 2022, the technical report on the feasibility of an LTAG was approved. The report highlights the possibility to achieve a set of alternative, integrated scenarios for reducing

[1] Spanish version provided by Chile.
[2] ICAO Assembly Resolution A40-18, paragraph 9, 2019, https://www.icao.int/environmental-protection/Pages/LTAG.aspx

CO_2 emissions through measures available within the aviation sector, including technology, operations, and sustainable fuels (SAF).

1.3 The technical report forecasts that by the year 2050, the greatest overall CO_2 reductions will stem from sustainable fuels and clean energy sources. Indeed, the report states that,

> "*Drop-in fuels have the largest impact on residual CO_2 emissions driving the overall reductions by 2050. This is, to some extent, independent of the technology and operations scenarios*."

1.4 With respect to the contribution of hydrogen (as a drop-in fuel) to the global reduction of CO_2 emissions, the report indicates that,

> "*Hydrogen is not expected to have a significant contribution by 2050 (with only 1.9% of energy share in 2050) but this may increase in the 2050s and 2060s if technically feasible and commercially viable*."

1.5 Moreover, the report adds that,

> "*Hydrogen powered aircraft would exhibit worse energy efficiency, relative to aircraft operating on liquid fuels, noting that emissions reductions would come from life cycle emissions reductions from the hydrogen*."[3]

1.6 States agree that aviation technology based on hydrogen as a drop-in fuel, whether gaseous or cryogenic, is at an early stage of development. It is reasonable to believe that hydrogen used in this way may possibly play an important role a few decades from now.

1.7 Nevertheless, there is a relevant role that hydrogen can play, over the short- and medium-term, in mitigation efforts that may be implemented in the aviation sector. Indeed, page 10 of the Appendix M5 on Fuels[4] to the technical report states that hydrogen is now an input for the production of drop-in fuels (LTAG-SAF) from atmospheric CO_2 and gaseous waste CO_2:

> *"Production of drop-in fuels from atmospheric CO_2 and Waste CO_2 requires (1) a hydrogen source, (2) a CO_2 source, and (3) a conversion process for converting Hydrogen and CO_2 into jet fuel (and other products)."*

1.8 The following table, presented on page 4 of the report, shows that the contribution of LTAG-SAF may become significant, particularly in scenarios IS2 and IS3:

[3] ICAO (2022), Report on the feasibility of a long-term aspirational goal (LTAG) for international civil aviation CO_2 emissions reductions, https://www.icao.int/environmental-protection/LTAG/Documents/REPORT%20ON%20THE%20FEASIBILITY%20OF%20A%20LONG-TERM%20ASPIRATIONAL%20GOAL_en.pdf

[4] ICAO (2022), Report on the feasibility of a long-term aspirational goal (LTAG) for international civil aviation CO2 emissions reductions – Appendix M5 Fuels Sub Group Report, https://www.icao.int/environmental-protection/LTAG/Documents/ICAO_LTAG_Report_AppendixM5.pdf

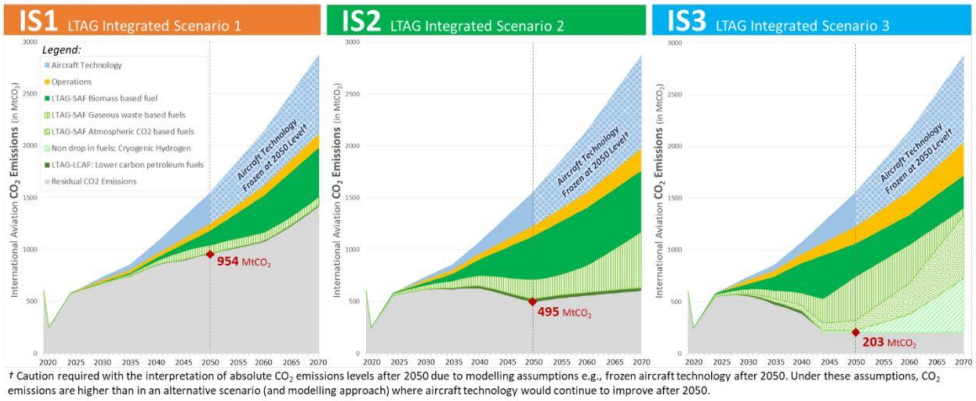

Figure 1. CO2 emissions from international aviation associated with LTAG Integrated Scenarios

1.9 On the other hand, page 11 of Appendix M5 on Fuels indicates that hydrogen can also be used to lower greenhouse gas emissions in the production of lower carbon aviation fuels (LCAF-LTAG):

> "*There are different opportunities to reduce the GHG emissions from the LTAG-LCAF supply chain and Figure 2.3 shows some examples of critical technologies that could contribute to the production of LTAG-LCAF. Those technologies include, but are not limited to, integration of renewable energy in operations, lower carbon hydrogen production, deployment of carbon capture and storage, minimization of flaring and venting emissions from upstream activities.*"

1.10 During the Global Aviation Dialogues (GLADs) on LTAG which took place from 28 March to 8 April 2022, various ICAO Member States presented observations on the contribution of hydrogen to climate change mitigation efforts. This, taking into consideration the increase around the world of projects to produce hydrogen-based LTAG-SAF fuels.

1.11 Keeping in mind the current global scarcity of sustainable aviation fuels and the likely increase in demand resulting from the adoption of an ambitious long-term aspirational goal for international civil aviation, the present paper proposes to assess the importance of hydrogen as a key input for the production of LTAG-SAF over the short- and medium-term on the basis of a specific analysis of hydrogen, with greater detail devoted to the development of hydrogen-based fuels. Therefore, we propose to continue in-depth analysis of what Member States require to be able to promote the early rollout of LTAG-SAF fuel production (through the use of hydrogen) and of how to approach these needs, through a specific study demonstrating the potential of hydrogen.

2. ACTION BY THE HLM-LTAG

2.1 The HLM-LTAG is invited to:

a) review the proposal set out in paragraph 1.11; and

b) adopt the measures it deems appropriate.

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