TALLER VIRTUAL
COMBUSTIBLES SOSTENIBLES DE AVIACIÓN

SAF EN LA REGION CLAC

PROGRAMA DE CAPACITACIÓN MEDIOAMBIENTAL DE LA CONFERENCIA EUROPEA DE AVIACIÓN CIVIL (CEAC)

Taller virtual CLAC, 7 de Julio de 2022

Contenidos

- **¿Qué son los SAF?**
- **Cómo se pueden producir**
- **¿Qué son los *electro-combustibles*?**
- **Comprender los criterios de sostenibilidad de la OACI**
- **Desarrollos de SAF en Europa**

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¿Qué son los SAF?

- No existe una **definición única** de SAF:

➢ **ICAO Annex 16 Vol IV (CORSIA):**

- *CORSIA sustainable aviation fuel: A **renewable or waste-derived aviation fuel that meets the CORSIA Sustainability Criteria** under this Volume*

➢ **UK SAF mandate consultation (2021):**

- *'SAF' refers to **alternative, sustainable jet fuel replacements that could be blended into existing aircraft** without significant engine modifications (Should meet the DEF STAN 91-091 specification, and mandatory sustainability criteria).*

➢ **ReFuel EU Aviation proposal (2021):**

- *'SAF' means **drop-in aviation fuels that are either synthetic aviation fuels, advanced biofuels** as defined in Article 2, second paragraph, point 34 of Directive (EU) 2018/2001, **or biofuels** produced from the feedstock listed in Part B of Annex IX to that Directive, **which comply with the sustainability and greenhouse gas emissions criteria** laid down in Article 29(2) to (7) of that Directive and are certified in accordance with Article 30 of this Directive;.*

¿Qué son los SAF?

- Pero todas las definiciones tienen en común:
  - **SOSTENIBLE:** Necesidad de **cumplir con Criterios de Sostenibilidad específicos**, en función del marco normativo aplicable.
  - **COMBUSTIBLE DE AVIACIÓN:** Necesidad de cumplir con los **mismos requisitos de calidad que los combustibles convencionales**, por lo que puede ser utilizado en flotas de aeronaves existentes con el mismo nivel de estándares de seguridad (*drop-in fuels*).

¿Qué son los SAF?: Sostenibles

- Existen diferentes requisitos a nivel global:
  - **OACI:** El Consejo aprobó el 10 de noviembre de 2021 los PRIMEROS criterios globales de sostenibilidad aplicables a la bioenergía, incluidos los criterios medioambientales y socioeconómicos
  - **EU RED:** Directiva sobre energías renovables
  - **Consulta del Reino Unido:** propone criterios específicos

¿Qué son los SAF?: Combustibles de Aviación

- SAF debe garantizar el mismo nivel de uso seguro en los vuelos que los combustibles de aviación actuales:
  - **2009**: La **Sociedad Americana de Pruebas y Materiales (ASTM)** Internacional, emitió la **ASTM D7566** para combustible de turbina de aviación que contiene hidrocarburos sintetizados
  - **Sigue siendo el estándar de referencia** para las nuevas tecnologías SAF
  - La UE (EASA) y el Reino Unido **están desarrollando actualmente procesos de calificación SAF** similares al ASTM (concepto "*Cleraring House*").

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Cómo se pueden producir

- Hoy en día **se han aprobado nueve vías tecnológicas para producir SAF**

BLEND

ASTM INTERNATIONAL

D7566

1. Annex A1: **Fischer Tropsch (FT) Synthetic Paraffinic Kerosene** (**FT SPK**), approved in 2009
2. Annex A2: **Hydro-processed Esters and Fatty Acids** (**HEFA SPK**), approved in 2011

→ Up to **50%**

3. Annex A3: **Hydro-processed Fermented Sugar** (**HFS-SIP**) approved in 2014

→ Up to **10%**

4. Annex A4: **SPK plus aromatics** (**FT-SPK/A**), approved in 2015
5. Annex A5: **Alcohol to Jet** (**ATJ-SPK**), approved in 2016 for isobutanol feedstock and updated in 2018 for ethanol feedstock.
6. Annex A6: **Catalytic Hydrothermolysis Synthesized Kerosene** (CH-SK, or CHJ), approved in 2020

→ Up to **50%**

7. Annex A7: **Hydroprocessed Hydrocarbons, Esters and Fatty Acids Synthetic Paraffinic Kerosene** (HHC-SPK or HC-HEFA-SPK), approved in 2020

→ Up to **10%**

D1655

8. Annex A1: **co-processing** of fats and oils in a conventional refinery, approved in 2018
9. Annex A1: **co-processing** of Fischer Tropsch Biocrude, approved in 2020

→ Biogenic input **up to 5 vol%** of fossil fraction.

Cómo se pueden producir

- Actualmente hay **rutas adicionales en el proceso de certificación ASTM**

- Some will not need blending with fossil

Current Fuels in the D4054 Qualification Process

The table below shows the pathways actively pursuing certification at various stages in the process.

ASTM Progress	Pathway	Feedstock	Task Force Lead
ASTM Balloting			
Phase 2 OEM Review			
Phase 2 Testing	Hydro-deoxygenation Synthetic Kerosene (HDO-SK)	Sugars and cellulosics	Virent (inactive)
	Hydro-deoxygenation Synthetic Aromatic Kerosene (HDO-SAK)	Sugars and cellulosics	Virent
Phase 1 OEM Review	High Freeze Point Hydroprocessed Esters and Fatty Acids Synthetic Kerosene (HFP HEFA-SK)	Renewable FOG	Boeing
	Integrated Hydropyrolysis and Hydroconversion (IH^2)	Lignocellulosics	Shell
Phase 1 Research Report			
Phase 1 Testing	Alcohol-to-Jet Synthetic Kerosene with Aromatics (ATJ-SKA)	Sugars and lignocellulosics	Swedish Biofuels, Byogy
	Alcohol-to-Jet (ATJ)	Sugars	Global Bioenergies

Source: CAAFI

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¿Qué son los *electro-combustibles*?

Es una tipología específica de SAF

- Permite que la **energía renovable sea almacenada en líquidos**

- ✓ **Power to Liquid (PtL)**
- ✓ **Synthetic fuels**
- ✓ **e-fuels**

→ **Mismos conceptos** →

- ✓ Utiliza **CO_2 como materia prima** (ilimitada)
- ✓ Necesita una **gran cantidad de energía** para ser producida
- ✓ **Puede reducir el 100% de las emisiones** (si la energía es 100% renovable)

¿Qué son los *electro-combustibles*?

RENEWABLE POWER

H_2O

HYDROGEN ELECTROLYSIS

O_2

H_2

CO_2

FISCHER-TROPSCH

Heat

SAF

H_2O

¿Qué son los *electro-combustibles*?

- Las actuales políticas Europeas los promocionan fuertemente para el medio plazo
- **Desafíos clave**
  - ✓ Alto uso de la energía: competencia con otros usos
  - ✓ La tecnología aún no está madura: aún no hay producción comercial
  - ✓ Altos costos de producción

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Criterios de Sostenibilidad de CORSIA

Origen:

- ***Desde 2013, la Asamblea de la OACI ha reconocido múltiples dimensiones de la sostenibilidad (ambiental, social y económica)***

Resolution A40-18 (reaffirmed from A38-18(2013) and A39-2 (2016))

Acknowledging the need for such fuels to be developed and deployed in an economically feasible, socially and environmentally acceptable manner…
(…)
The Assembly:
(…)
24. Requests States to:
d) recognize existing approaches to assess the sustainability of all fuels in general, including those for use in aviation which should achieve net GHG emissions reduction on a life cycle basis, contribute to local social and economic development; competition with food and water should be avoided *(…)*

RESOLUTIONS
ADOPTED BY THE ASSEMBLY

ASSEMBLY – 40th SESSION
Montréal, 24 September—4 October 2019

Criterios de Sostenibilidad de CORSIA

Alineación con otros enfoques globales existentes

- ***Los criterios de sostenibilidad de CORSIA se adhieren estrechamente a los enfoques de sostenibilidad existentes, incluido el trabajo desarrollado por otros organismos de las Naciones Unidas***

	EXISTING APPROACHES TO SUSTAINABILITY									
CAEP-Proposed Themes	UN FAO SAFA	GBEP	ISO	EU RED	ISPO	RFS2	Bonsucro	ISCC	RSB	RSPO
3. Water	X	X	X	X	X	X	X	X	X	X
4. Soil	X	X	X	X	X	X	X	X	X	X
5. Air	X	X	X	X	X	X	X	X	X	X
6. Conservation	X	X	X	X	X	X	X	X	X	X
7. Waste and Chemicals	X	X	X	X	X	X	X	X	X	X
8. Human and labour rights	X	X	X	X	X		X	X	X	X
9. Land use rights and land use	X	X	X	X	X		X	X	X	X
10. Water use rights	X		X				X	X	X	X
11. Local and social development	X	X		X	X	X	X	X	X	X
12. Food security	X	X	X	X		X		X	X	
Total of Themes Covered	**10**	**9**	**9**	**9**	**8**	**7**	**9**	**10**	**10**	**9**

Criterios de Sostenibilidad de CORSIA

Capítulo 1: APLICABLE AL COMBUSTIBLE PRODUCIDO **ANTES DEL 1 DE ENERO DE 2024**

Chapter 1: CORSIA SUSTAINABILITY CRITERIA APPLICABLE FOR BATCHES OF CORSIA ELIGIBLE FUEL PRODUCED BY A CERTIFIED FUEL PRODUCER BEFORE 1 JANUARY 2024

Theme	Principle	Criteria
1. Greenhouse Gases (GHG)	Principle: CORSIA eligible fuel should generate lower carbon emissions on a life cycle basis.	Criterion 1.1: CORSIA eligible fuel will achieve net greenhouse gas emissions reductions of at least 10% compared to the baseline life cycle emissions values for aviation fuel on a life cycle basis.
2. Carbon stock	Principle: CORSIA eligible fuel should not be made from biomass obtained from land with high carbon stock.	Criterion 2.1: CORSIA eligible fuel will not be made from biomass obtained from land converted after 1 January 2008 that was primary forest, wetlands, or peat lands and/or contributes to degradation of the carbon stock in primary forests, wetlands, or peat lands as these lands all have high carbon stocks.
		Criterion 2.2: In the event of land use conversion after 1 January 2008, as defined based on the Intergovernmental Panel on Climate Change (IPCC) land categories, direct land use change (DLUC) emissions will be calculated. If DLUC greenhouse gas emissions exceed the default induced land use change (ILUC) value, the DLUC value will replace the default ILUC value.

Dos **criterios iniciales** de sostenibilidad acordados sobre la reducción de CO_2 para la **fase piloto** de CORSIA (SAF y LCAF)

- ✓ Reducciones netas de emisiones de GEI de al menos el 10% sobre una base de ciclo de vida
- ✓ No hay materia prima de las zonas deforestadas

Guidance on the application of sustainability criteria

a) Compliance with Themes 1 and 2 is granted on the basis of independent attestation by Sustainability Certification Schemes included in the ICAO document "CORSIA Approved Sustainability Certification Schemes" which is available on the ICAO CORSIA website.
b) A fuel producer can produce batches of CORSIA eligible fuels for 365 calendar days after it has been certified by an SCS for compliance with the CORSIA Sustainability Criteria, after which the fuel producer shall be re-certified for compliance with the sustainability criteria applicable at the time of re-certification.
c) CORSIA Sustainability Criteria for CORSIA Eligible Fuels does not set a precedent for, or prejudge the outcome of negotiations in other fora.

Criterios de Sostenibilidad de CORSIA

Tema: Tema cubierto por la norma

Principio: Requisito acordado para una producción sostenible

Criterios: Describir las condiciones específicas que deben cumplirse y evaluarse para alcanzar los principios

Orientación: Documentación e información que un SCS puede revisar de un productor, así como parámetros potencialmente aplicables que un SCS puede usar para demostrar el cumplimiento

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Criterios de Sostenibilidad de CORSIA

Capítulo 2: APLICABLE PARA **SAF** PRODUCIDO **A PARTIR DEL 1 DE ENERO DE 2024**

Para las próximas fases de CORSIA:

- ✓ 10 temas adicionales aprobados para SAF:
  - ➢ Medioambientales: Agua; Suelo; Aire; Conservación; Residuos y productos químicos;
  - ➢ Socioeconómicos: Derechos humanos y laborales; Derechos de uso de la tierra y uso de la tierra; Derechos de uso del agua; Desarrollo local y social; y Seguridad alimentaria

3. Water	Principle: Production of CORSIA SAF should maintain or enhance water quality and availability.	Criterion 3.1: [illegible] implemented to quality. Criterion 3.2: [illegible] implemented to avoid the deplet resources beyond
4. Soil	Principle: Production of CORSIA SAFs should maintain or enhance soil health.	Criterion 4.1: [illegible] management pra or residue colle maintain or en physical, chemic
5. Air	Principle: Production of CORSIA SAF should minimize negative effects on air quality.	Criterion 5.1: A limited.

6. Conservation	Principle: Production of CORSIA SAF should maintain biodiversity, conservation value and ecosystem services.	Criterion 6.1: CORSIA SAF will not be made from biomass obtained from areas that, due to their biodiversity, conservation value, or ecosystem services, are protected by the State having jurisdiction over that area, unless evidence is provided that shows the activity does not interfere with the protection purposes.
		Criterion 6.2: Low invasive-risk feedstock will be selected for cultivation and appropriate controls will be adopted with the intention of preventing the uncontrolled spread of cultivated alien species and modified microorganisms.
		Criterion 6.3: Operational practices will be implemented to avoid adverse effects on areas that, due to their biodiversity, conservation value, or ecosystem services, are protected by the State having jurisdiction over that area.
7. Waste and Chemicals	Principle: Production of CORSIA SAF should promote responsible management of waste and use of chemicals.	Criterion 7.1: Operational practices will be implemented to ensure that waste arising from production processes as well as chemicals used are stored, handled and disposed of responsibly.
		Criterion 7.2: Responsible and science-based operational practices will be implemented to limit or reduce pesticide use.
8. Human and labour rights	Principle: Production of CORSIA SAF should respect human and labour rights.	Criterion 8.1: CORSIA SAF production will respect human and labour rights.
9. Land use rights and land use	Principle: Production of CORSIA SAF should respect land rights and land use rights including indigenous and/or customary rights.	Criterion 9.1: CORSIA SAF production will respect existing land rights and land use rights including indigenous peoples' rights, both formal and informal.
10. Water use rights	Principle: Production of CORSIA SAF should respect prior formal or customary water use rights.	Criterion 10.1: CORSIA SAF production will respect the existing water use rights of local and indigenous communities.
11. Local and social development	Principle: Production of CORSIA SAF should contribute to social and economic development in regions of poverty.	Criterion 11.1: CORSIA SAF production will strive to, in regions of poverty, improve the socioeconomic conditions of the communities affected by the operation.
12. Food security	Principle: Production of CORSIA SAF should promote food security in food insecure regions.	Criterion 12.1: CORSIA SAF production will, in food insecure regions, strive to enhance the local food security of directly affected stakeholders.

- ✓ Trabajo en curso sobre temas adicionales para LCAF (Capítulo 3)

Criterios de Sostenibilidad de CORSIA

Una amplia gama de criterios garantiza la sostenibilidad **medioambiental**, **social** y **económica** de los combustibles elegibles en CORSIA

Temas de sostenibilidad	
1. Gases de efecto invernadero (GEI)	Temas de reducción de carbono
2. Reservas de carbono	
3. Agua	Temas ambientales
4. Suelo	
5. Aire	
6. Conservación	
7. Residuos y productos químicos	
8. Derechos humanos y laborales	Temas socioeconómicos
9. Derechos de uso de la tierra	
10. Derechos de uso del agua	
11. Desarrollo local y social	
12. Seguridad alimentaria	

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Desarrollos de SAF en Europa

- En 2021 ocurrieron desarrollos de políticas muy relevantes:

European Commission

Law

Sustainable aviation fuels – ReFuelEU Aviation

Commission adoption

FEEDBACK: OPEN

Feedback period
16 July 2021 - 18 November 2021 (midnight Brussels time)

The Commission would like to hear your views.

This adopted act is open for feedback for a minimum period of **8 weeks**. All feedback received will be summarised by the European Commission and presented to the European Parliament and Council with the aim of feeding into the legislative debate. Feedback received will be published on this site and therefore must adhere to the feedback rules.

THE WHITE HOUSE

BRIEFING ROOM

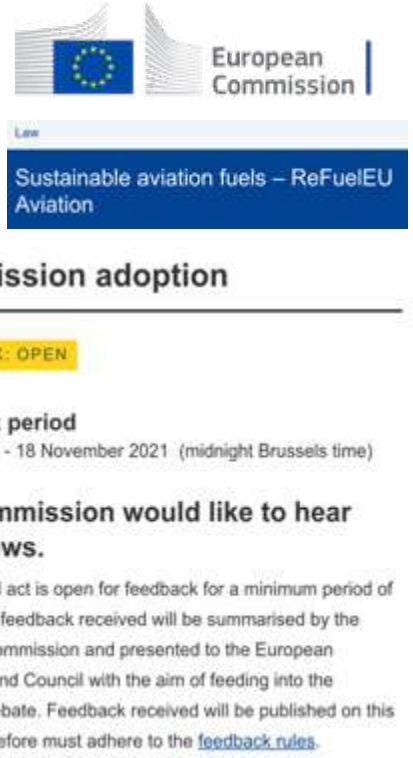
FACT SHEET: Biden Administration Advances the Future of Sustainable Fuels in American Aviation

SEPTEMBER 09, 2021 • STATEMENTS AND RELEASES

New Actions Aim to Produce Three Billion Gallons of Sustainable Fuel, Reduce Aviation Emissions by 20% by 2030, and Grow Good-Paying, Union Jobs

Desarrollos de SAF en Europa

- ReFuel EU Aviation Initiative:
  - Propuesta reglamentaria en negociación para los Estados de la UE
    - Obligación de **todos los proveedores de combustible** de distribuir SAF en cantidades crecientes a lo largo del tiempo;
    - Obligación de **todas las compañías aéreas** de repostar combustible de aviación mezclado con SAF **en los aeropuertos de la UE** (medida *anti-tankering*);



Desarrollos de SAF en Europa

- Otros Estados de la CEAC también establecen políticas de SAF:
  - Noruega: **Mandato** de suministro de SAF desde **2020**
  - Suecia: **Mandato** de suministro de SAF desde **2021**
  - Francia: **Mandato** de suministro de SAF desde **2022**
  - Reino Unido: Consulta para un **mandato de suministro de SAF** a partir de **2025**

SITUACIÓN DE SAF EN EUROPA:

The European Union

The ReFuelEU Aviation regulatory proposal

Netherlands

SAF **blending obligation by 2023** (if an equivalent European obligation is not put in place by this time)

Germany

Blending quota for PtL (Power to Liquid)-kerosene starting **from 2026**

United Kingdom

Consultation in 2021 on a **SAF mandate** (up to **10 % by 2030**) and second one in 2022

France

SAF mandate of 1% in in 2022 to be revised annually

Spain

Climate Change Law: **annual SAF targets in aviation** with focus on advanced biofuels and renewable fuels of non-biological origin

Denmark

At least **one 100 % green domestic route by 2025** and by **2030 all domestic aviation should be 100 % fossil-fuel-free**.

Norway

1st Global **SAF blending obligation of 0.5% from 1 January 2020**.

Sweden

GHG emissions reduction obligation for jet fuel suppliers. **SAF blend** ratios from **1% in 2021 to 30% in 2030**

Finland

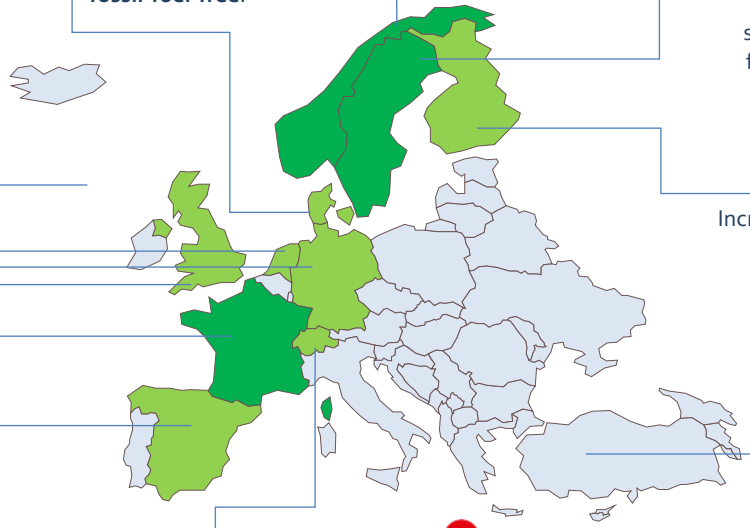
Increasing **SAF obligation** to reach **30% in 2030**.

Turkey

The Turkish government is currently **planning obliged blend ratios** to deliver SAF

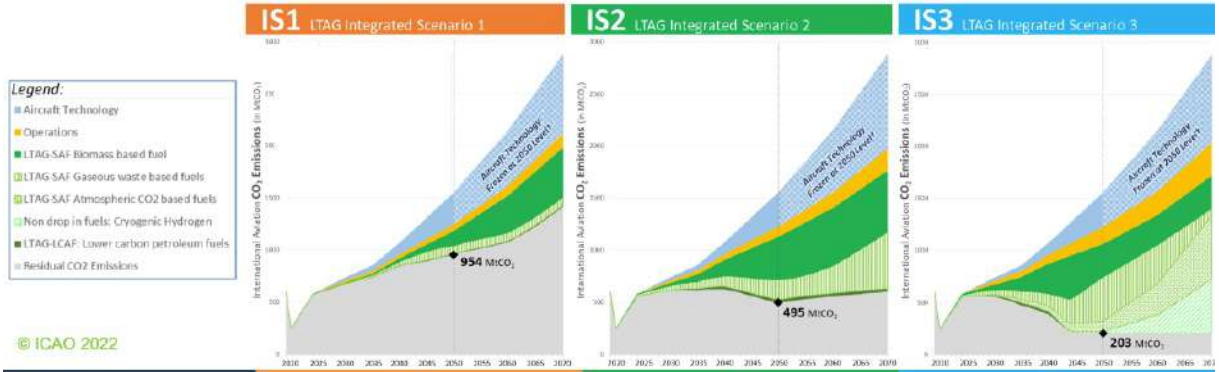
Switzerland

Legislative proposal in **consultation for a SAF quota**



Análisis de la OACI sobre objetivos aspiracionales a largo plazo

ICAO **Question 1:** **Reductions in CO_2 emissions from international aviation through in-sector measures through 2050 and beyond**



Metrics	IS1	IS2	IS3
CO_2 Emissions in 2050 after Reductions	≈950 $MtCO_2$ in 2050 *(160% of 2019 CO_2 emissions)*	≈500 $MtCO_2$ in 2050 *(80% of 2019 CO_2 emissions)*	≈200 $MtCO_2$ in 2050 *(35% of 2019 CO_2 emissions)*
Reduction in 2050 from the Baseline	**39% total** through: Technologies - 20%, Operations - 4%, Fuels - 15%	**68% total** through: Technologies - 21%, Operations - 6%, Fuels - 41%)	**87% total** through: Technologies - 21%, Operations - 11%, Fuels - 55%
Cumulative residual Emissions from 2020 to 2070	23 $GtCO_2$ (2020 to 2050) 23 $GtCO_2$ (2051 to 2070)	17 $GtCO_2$ (2020 to 2050) 11 $GtCO_2$ (2051 to 2070)	12 $GtCO_2$ (2020 to 2050) 4 $GtCO_2$ (2051 to 2070)

Fuels observations

- Drop-in fuels have the largest impact on residual CO_2 emissions driving overall reductions by 2050.
- Independent -to some extent- of technology and operations scenarios.
- Hydrogen is not expected to have a significant contribution by 2050 (with only 1.9% of energy share in 2050) but may increase in the 2050s and 2060s if technically feasible and commercially viable.

Fuente: **OACI, GLADS 2022**

Conclusiones

- Los Combustibles de Aviación Sostenibles (SAF): principal medio para descarbonizar el sector de la aviación a corto y medio plazo
- La sostenibilidad es un requisito clave
- Muchos desarrollos importantes están ocurriendo en todo el mundo: Europa está estableciendo mandatos de SAF
- Será un elemento clave de cualquier objetivo a largo plazo para la aviación

Gracias por su atención!

For more information

www.ecac-ceac.org

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