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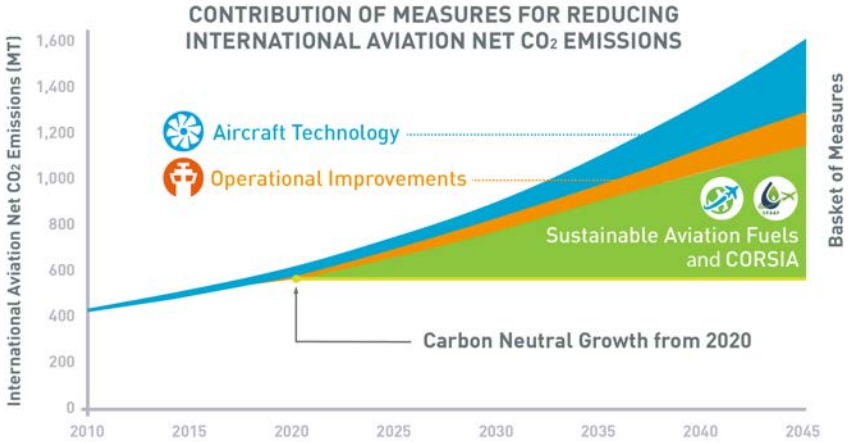
Approaching aviation's climate ambitions

- **2010**: the International Civil Aviation Organization (**ICAO**) and its Member States adopts Resolution A37-19 establishing two global aspirational goals for the international aviation sector:

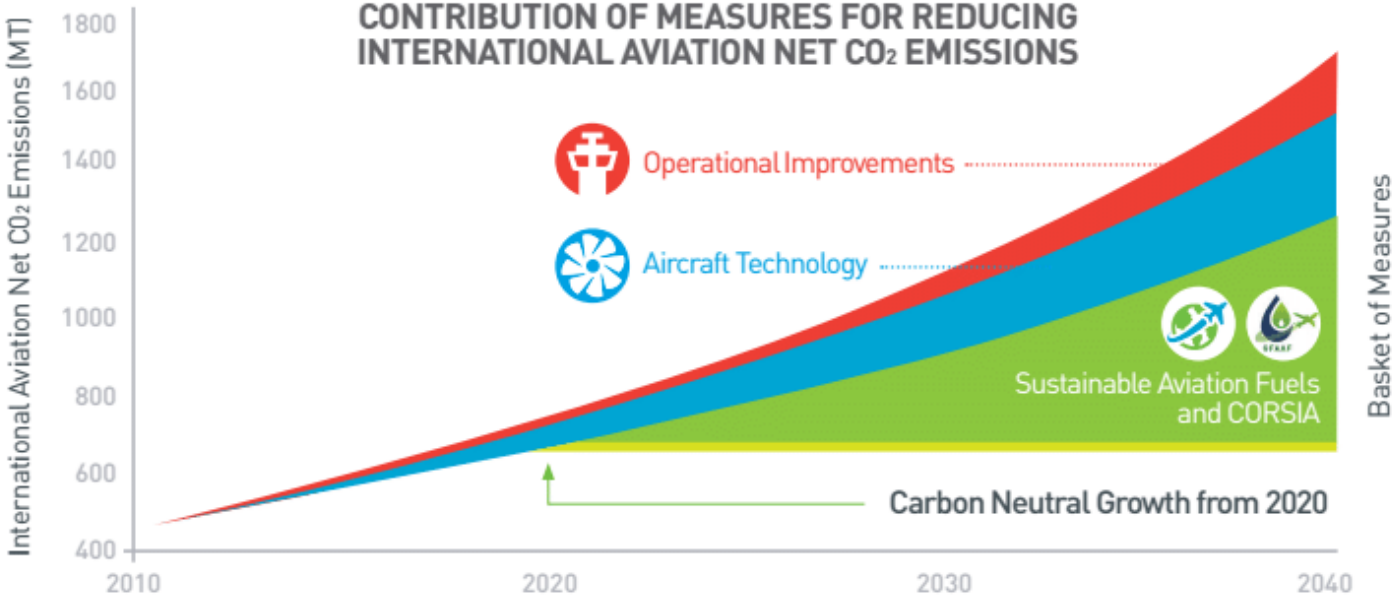
  - **2% annual fuel efficiency improvement through 2050,** and

  - **Carbon neutral growth from 2020 onwards;**



Approaching aviation's climate ambitions

- SAF is a fundamental element of the ICAO basket of measures to reduce aviation emissions:



Approaching aviation's climate ambitions

2022: A key milestone

- 41st session of ICAO Assembly (27 September to 7 October 2022) > Ambitious **international aviation decarbonisation global goal:**

  - *ICAO and its Member States are encouraged to work together to strive to achieve a collective long-term global aspirational goal for international aviation (LTAG) of* ***net-zero carbon emissions by 2050****, in support of the Paris Agreement's temperature goal…*

Approaching aviation's climate ambitions

2023 ECAC DGs decision on taking SAF Policy Action

- Directors General of Civil Aviation of ECAC Member States **agreed at its DGCA/160 meeting** (23 May 2023) that **each State will strive to adopt policy measures for the promotion of Sustainable Aviation Fuels as soon as possible**

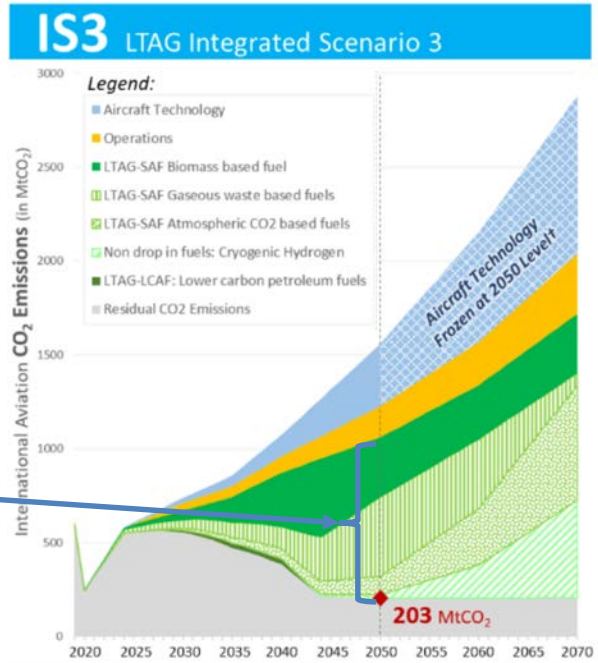
  - They will **incorporate SAF policy roadmaps in the next update of the national section of their State Action Plans**, preferably by the end of June 2024 as per ICAO Resolution A41-21 request

  - **Capacity-building needs** for the above-purposes will be addressed

ICAO EUR/NAT Environment (ENV) Task Force Seminar, 17-19 October 2023

Approaching aviation's climate ambitions

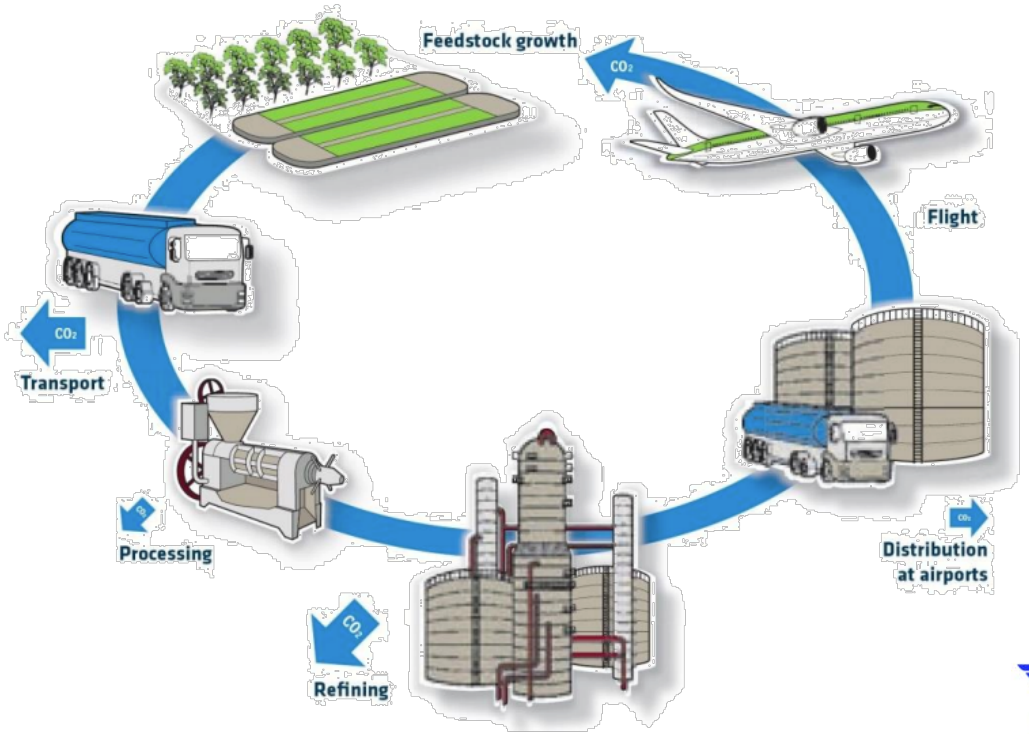
- ICAO A41 decision > based on a report on the feasibility of a LTAG, developed by its technical committee on environment (CAEP):
  - Drop-in fuels have the largest impact on residual CO_2 emissions



Source: ICAO report on the feasibility of a long-term aspirational goal (LTAG)

Approaching aviation's climate ambitions

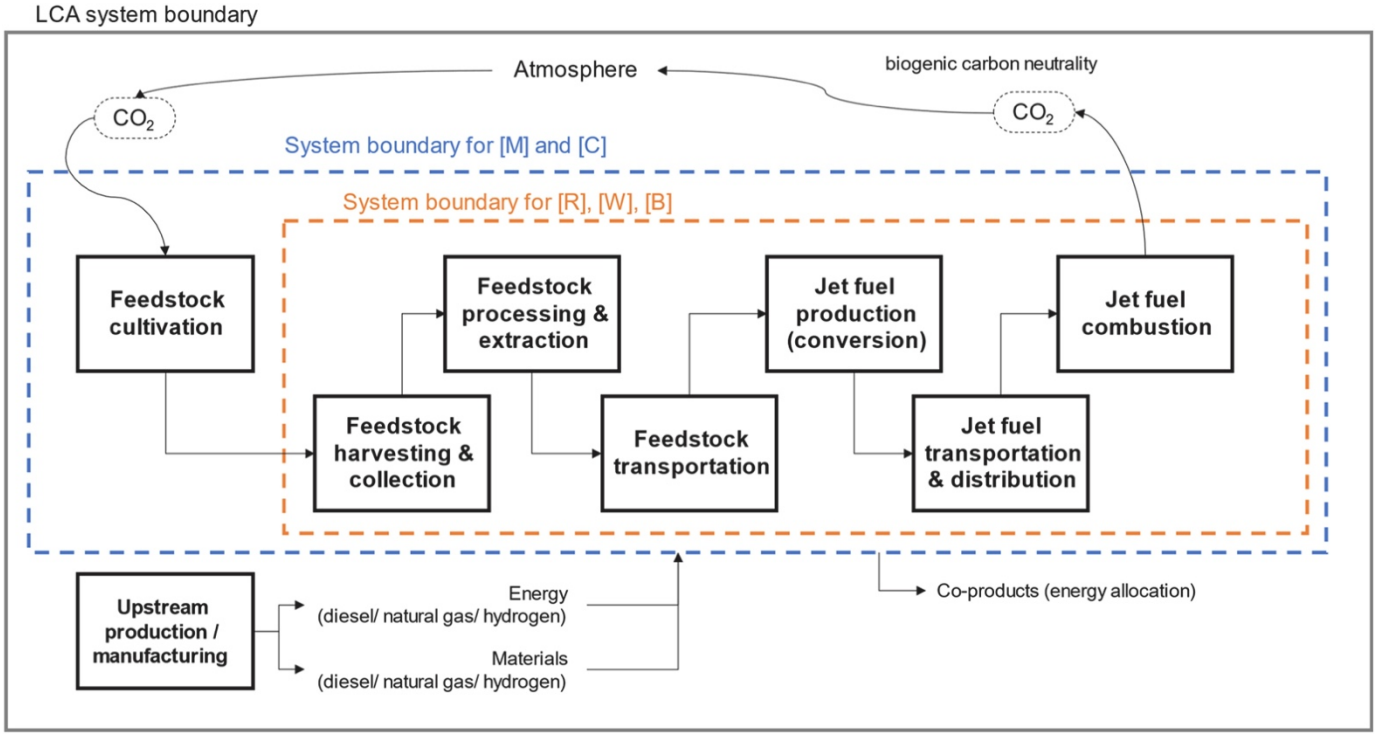
- ✓ SAF can offer significant reductions in GHG (expressed as CO_2eq) emissions **on a life-cycle basis** compared to conventional fossil jet fuel



Source:

Approaching aviation's climate ambitions

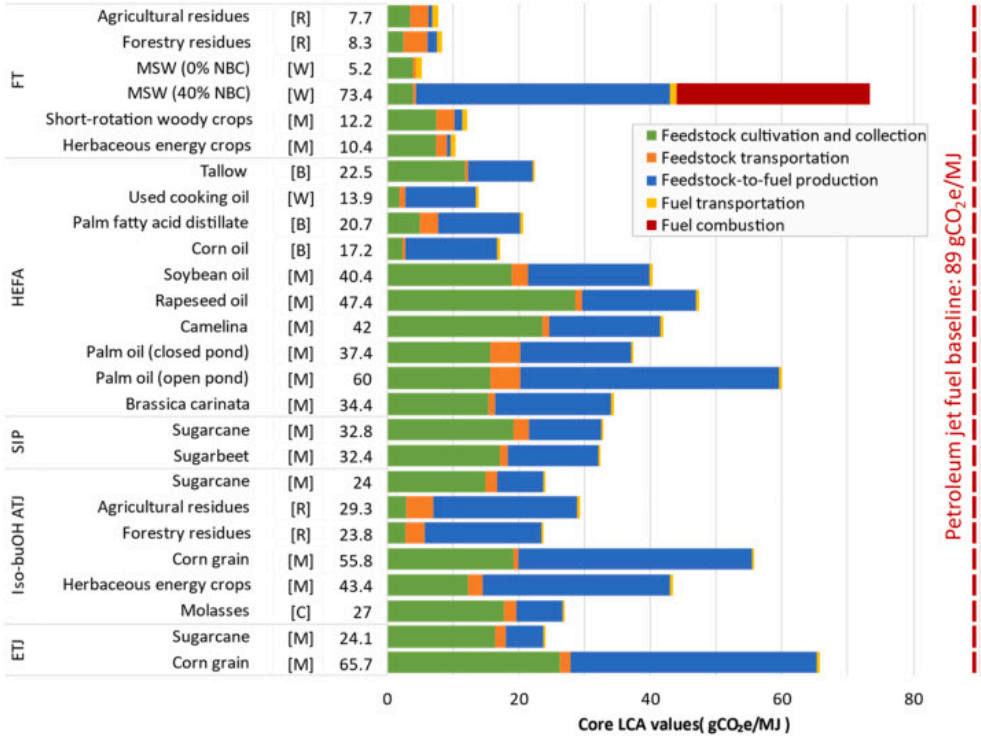
- ✓ The **GHG reduction benefits** of SAF from biological origin compared to fossil jet fuels are due to the **CO_2eq compensation of biomass growth**: CO_2 from fuel combustion is balanced by carbon uptake from atmosphere due to photosynthesis.



SOURCE: *CORSIA: The first internationally adopted approach to calculate life-cycle GHG emissions for aviation fuels*

Approaching aviation's climate ambitions

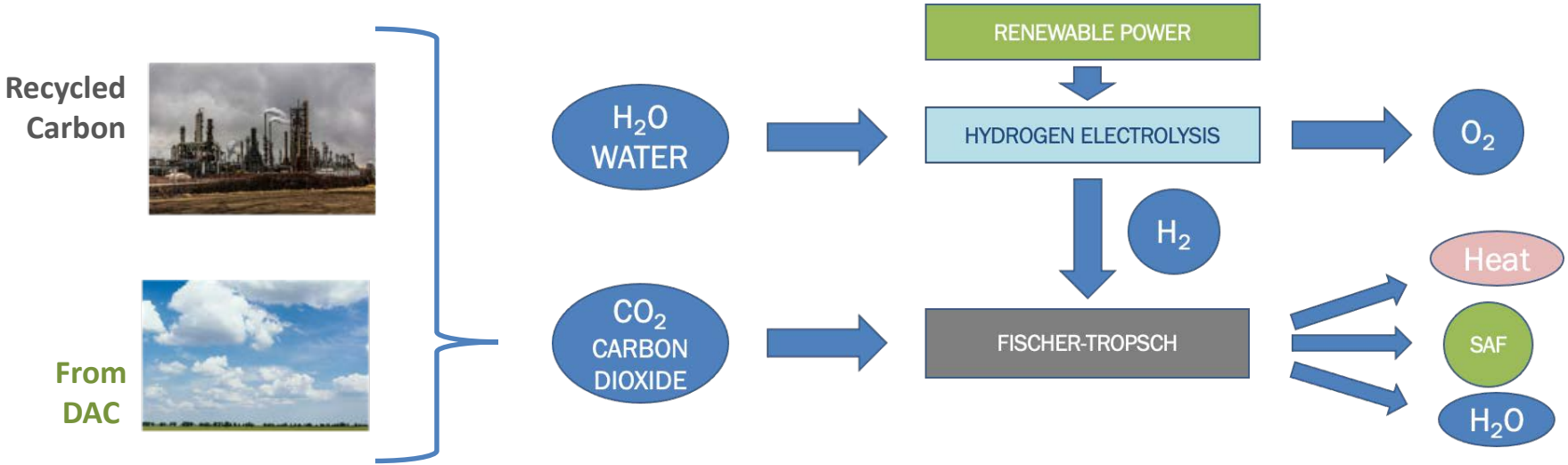
- ✓ It depends on the origin and **type of feedstock** and the **production technology option** used.



SOURCE: *CORSIA: The first internationally adopted approach to calculate life-cycle GHG emissions for aviation fuels*

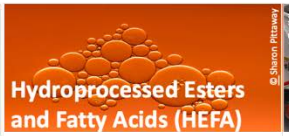
Approaching aviation's climate ambitions

- ✓ In the case of **SAF of non-biological origin**, the CO_2 from fuel combustion is balanced by **carbon uptake directly from the atmosphere** or by **carbon that would otherwise be released** to the environment, in the case of recycled carbon.



Approaching aviation's climate ambitions

- **Potentials of the current more mature SAF technologies** and according to the life-cycle values (LCA) estimated by ICAO's document *CORSIA Default Life Cycle Emissions Values for CORSIA Eligible Fuels*.

Sources: ICAO, Clean Skies for Tomorrow, SAF-TG	 Hydroprocessed Esters and Fatty Acids (HEFA)	 Fischer-Tropsch (FT)	 Alcohol-to-Jet (ATJ)	 Power-to-liquid (PtL)
Opportunity description	Safe, proven, and scalable technology	Significant potential in the mid-term, however, with techno-economic uncertainty		Proof of concept 2025+, primarily where cheap high-volume electricity is available
Technology maturity	Mature	Commercial pilot		In development
Feedstock	Waste and residue lipids, purposely grown oil energy plants. Transportable and with existing supply chains Potential to cover 5%-10% of total jet fuel demand	Agricultural and forestry residues, municipal solid waste, purposely grown cellulosic energy crops (e.g., poplar, miscanthus or switchgrass) High availability of cheap feedstock, but fragmented collection	Sugarcane, sugar beet, sawdust, lignocellulosic 2 Sustainable Aviation Fuel: Technical Certification residues (straw)	CO_2 and green electricity Unlimited potential via direct air capture Point source capture as bridging technology
% LCA* GHG Reduction vs. fossil jet fuel	**14-100%*** *Due to soil carbon capture as per ICAO methodology	**76-100%*** *Due to soil carbon capture as per ICAO methodology	**76-100%*** *Due to soil carbon capture as per ICAO methodology	**12-100%*** *Due to soil carbon capture as per ICAO methodology

Approaching aviation's climate ambitions

- SAF benefits are beyond CO_2

  - **Reducing air pollutant emissions around airports: I**t emits up to 90% less non-volatile Particulate Matter (nvPM) and up to 100% less sulphur (SO_X), compared to fossil jet fuel.

  - **Decrease aviation's climate impact from non-CO_2:** SAF can produce 50%-70% fewer soot particles, which could reduce the warming impact of contrails.

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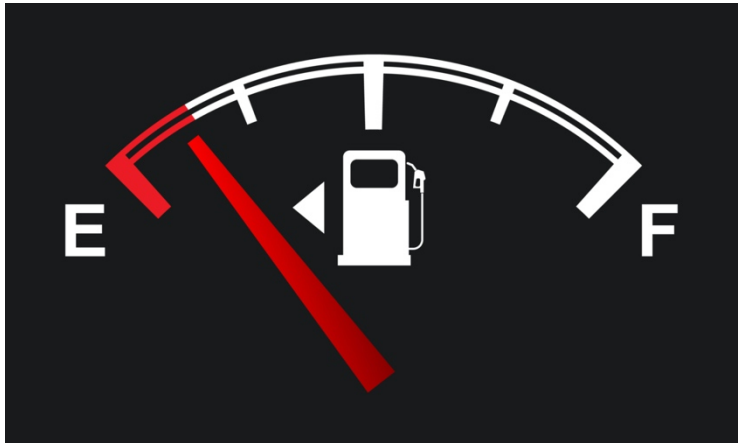
SAF as a means to reduce energy and fossil fuel dependency

- Energy security concerns have significantly increased globally:
  - **The role of renewable energy sources, including SAF**, as contributing to transforming the European energy system and reducing its energy dependency has given an additional relevance to its promotion.
  - The impact assessment for the ReFuelEU Aviation's proposal underlined that the net reduction in **energy imports in the EU resulting from its implementation would be substantial**.



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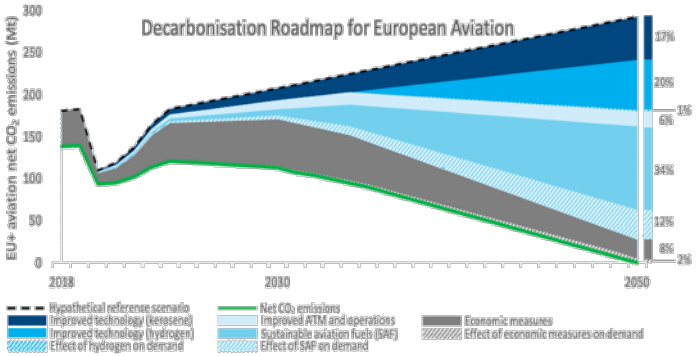
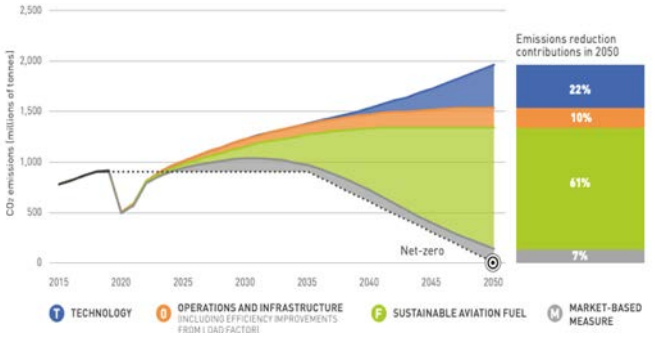
The European aviation sector climate roadmaps

DESTINATION 2050



WAYPOINT 2050



- Bigger role of hydrogen-powered regional aircraft
- **SAF is the major contributor to reduce emissions** of the 2050 forecasted emissions

✓ Same goal, different regional/global roadmaps

- Hydrogen aircraft are not expected to have a significant contribution by 2050
- **61% emissions reduction contribution from SAF** of the 2050 forecasted emissions

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Major identified challenges to upscaling SAF

- Key challenges identified via workshops and discussions with European States are:
  - **Cost differential:** Currently, the largest barrier to wider SAF use is cost.
    - SAF production expenses result in market prices 2-6 times greater than traditional fossil jet fuel, depending on the production pathway used, limiting the potential for market-driven scale-up.
    - Regulation and economic incentives are required to help bridge this cost differential, drive demand, and generate greater predictability for investors and financiers.

Major identified challenges to upscaling SAF

- **Technological readiness:** it is necessary to make technological and feedstock production improvements allowing for the use of a broader range of feedstock types
  - New scalable production routes include alcohol-to-jet (AtJ), gasification/Fischer-Tropsch (G/FT) and power-to-liquid (PtL).
  - Critical investments in research, development and demonstration is needed.
- **Sectoral distribution:** Aviation is not the only transport sector that must decarbonise but it is one of the more difficult to abate
  - Road sector uses the majority of renewable fuels: Inter-sectorial coordination is needed.

Major identified challenges to upscaling SAF

- **Investment:** the transition to SAF requires major investments
  - Clear and stable SAF targets could provide sufficient predictability of future demand, helping to de-risk SAF production projects.
  - This is also an opportunity for attracting investors, generating new jobs and for the fuel suppliers to keep a market that would otherwise diminish due to the progressive electrification of other transportation modes
- **Level playing field:** It is essential to ensure a level playing field across the air transport markets when it comes to the use of aviation fuel
  - In the absence of a global mandate, progress is most likely at the national or regional level: competitive distortion should be avoided

Major identified challenges to upscaling SAF

- **SAF reporting and claiming under different jurisdictions and scopes:** Harmonisation of compliance requirements is needed
  - Different sustainability criteria schemes (SCS) under different jurisdictions/regulations: complexity, lack of flexibility & cost [i.e. CORSIA vs ETS)
  - Compatibility of claims unclear (e.g. RED vs ReFuel vs ETS, scope 3 claims..)
  - Recordkeeping & avoiding double counting: Sustainability certificates submitted for one claim (i.e. fuel producer) cannot be handled for any other 'compatible' claims (AO), different competent authorities

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The need for policy intervention

- **Public policy** has played a pivotal role in scaling renewable energy markets such as wind and solar electricity and developing biofuels for road transport: **Additional policy- support** is now is needed for SAF
  - **Domestic and international policies** are both necessary
    - A joint global SAF supply objective and international consensus through ICAO would be optimal to increase their uptake: **ICAO CAAF/3 Conference** in November 2023 will be a major milestone
    - Domestic aviation normally comes under national laws, while the International Civil Aviation Organization (ICAO) oversees international aviation: Coherent policy is needed
  - **The value of regional and global harmonisation:** national and regional policies should seek to align with and steer international sustainability standards
    - Lack of policy and regulatory harmonisation risks leading to a patchwork of systems and requirements

Thank you for your attention!

For more information

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