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EVALUATION

Interim Evaluation of the Horizon Europe Framework Programme for Research and Innovation (2021 - 2024)

Accompanying the document

Communication from the Commission to the European Parliament and the Council

Horizon Europe: Research and Innovation at the heart of competitiveness

{COM(2025) 189 final}

Annex 13: Evaluation of Clean Aviation JU

Annex to the Commission's interim evaluation of Horizon Europe

Contents

The Horizon Europe (HE) Clean Aviation partnership is a public-private partnership between the European Union (EU) and the European aeronautics industry and research organisations. It builds partly on the work of its predecessors, Clean Sky and Clean Sky 2, with the Clean Sky 2 programme continuing to run until 2024.

1. Effectiveness

Overall, the Horizon Europe Clean Aviation partnership planning is in line with the objectives set out in Council Regulation, but it is too early to assess the extent to which they have been achieved. The programme and budget allocation, based on the EU funding set in Council Regulation, are structured into two phases.

Phase 1 (2022-2025) has an EU funding allocation of around 806 million EUR. Twenty-eight large-scale, industry-led projects with interdependencies were launched through two open calls for proposals, with projects starting in 2023 and 2024. Small delays are expected mainly due to technical decisions that have impact on future market uptake. These 28 projects involve over 280 participants and aim to mature, integrate and demonstrate disruptive aircraft technological innovations able to lower net greenhouse gases emissions. The aim is to lower emissions by no less than 30% by 2030, compared to 2020 state-of-the-art technology, while paving the ground towards climate-neutral aviation by 2050. In line with the revised strategic research and innovation agenda (SRIA)[1], the projects are mainly focused on the regional and short-medium range aircraft segments, which account for approximately two thirds of the total aviation CO_2 emissions[2], affecting most of the EU aerial transportation in terms of travel and passengers.

While the main focus of the demonstration efforts will be on the ultra-efficient regional, ultra-efficient short-medium range, and hydrogen-powered aircraft concepts, the approach will involve a stepwise development and demonstration strategy. This will allow several opportunities for technology spin-off to other aircraft categories: towards commuter and vertical lift applications that can benefit from the hybrid-electric maturation of technology, and from the ultra-efficient SMR architectures towards long-range applications. Similarly, aircraft situated in-between the regional and SMR segments, such as large regional jets, will as well benefit from the technologies developed in these 2 thrusts. This is particularly important, as it will allow both a broad-based participation in the programme, and a much broader and deeper penetration of the overall air transport system with important additional environmental and climate-related benefits.

In terms of interim progress and preliminary results emerging from phase 1 ongoing projects, the following technical options by technical domain are worth mentioning at this stage (non-exhaustive list). These ongoing projects are also being aligned with the 'SRIA' as recently updated in July 2024.

[1] https://clean-aviation.eu/sites/default/files/2024-09/2024-Clean-Aviation-SRIA.pdf
[2] Clean Aviation's strategic and research innovation agenda: https://clean-aviation.eu/strategic-research-and-innovation-agenda-sria.

Small-medium range:

- SAF-based (target entry into service (EIS)[3] 2035): over 5 aircraft concepts are being explored covering engines Open Fan architecture to hybridisation concepts for ducted fan architecture targeting TRL5 2026 and improvements to wing and fuselage technologies.
- H2-based (EIS 2040+): 4 aircraft concepts are being explored (TRL3 2026).

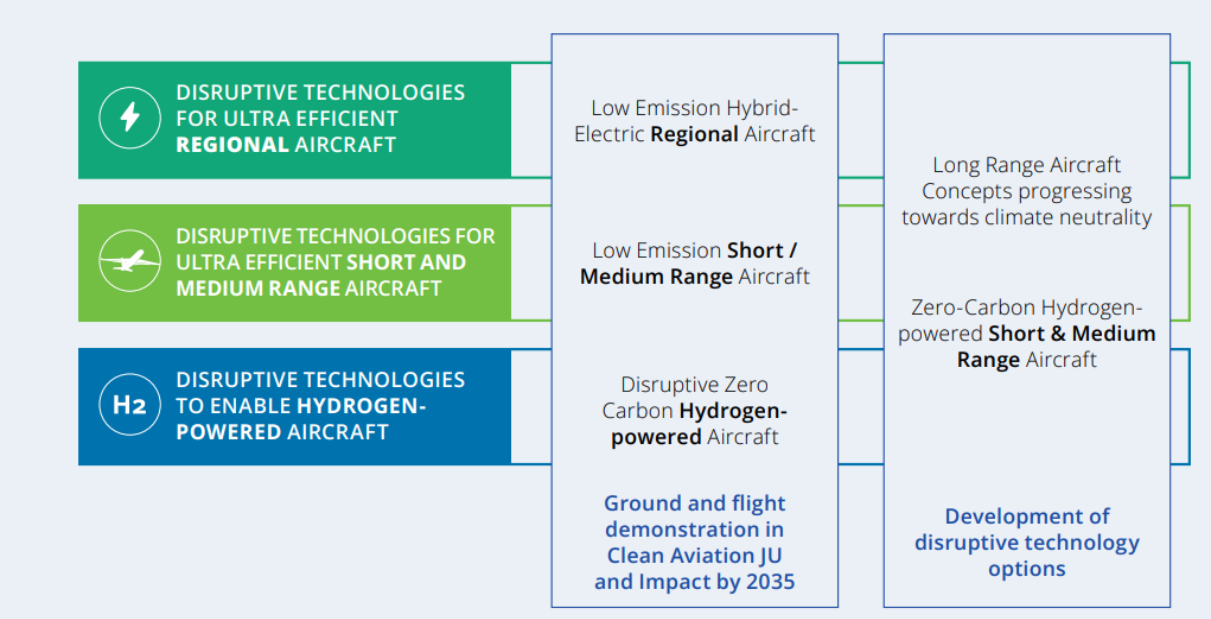
Hybrid-electric regional:

- MW hybrid-electric power train for regional aircraft (TRL5 by 2026 - EIS 2035).
- 800V HVDC network (techno-bricks up to TRL5-2026).
- 3 aircraft concepts at TRL4 by the end of 2026.

Hydrogen:

- Mega Watt fuel cell power train - TRL4 end 2026 for EIS 2025.
- H2B: first trial executed - application to SMR aircraft with EIS beyond 2035.

The chart below maps the research thrusts against aircraft categories and concepts.



Phase 2 (2025-2030) has an EU funding allocation of around 854 million EUR. While the preparation and launch of phase 2 is well under way, the focus is expected to be on the integration and demonstration of the most promising disruptive technologies of around four targeted European aircraft concepts and one scalable demonstration concept. This approach is in line with the programme aircraft integrated approach. These concepts serve as reference aircraft concepts targeting the expected impact as defined in Article 57.2 of Council Regulation for the integration and demonstration of impactful technological innovations supported under Clean Aviation, as well as for other relevant innovations supported by other EU, national, and regional programmes. It is also worth mentioning the expected launch as part of Clean Aviation phase 2 of a 'fast-track' mechanism to support in parallel to the large-scale topics and activities,

smaller projects to quickly mature additional or alternative disruptive technologies and solutions for possible uptake and integration at aircraft concept level. This new mechanism will also strengthen the ability to be flexible and quickly respond to new programme needs.

The European Commission's departments follow closely the technical preparations and have every reason to believe that the objectives of the industry-led partnership will be achieved towards the end of the programme.

Regarding the Horizon 2020 Clean Sky 2 partnership, the objectives set out in the Regulation[4] have been achieved, delivering innovative technological solutions contributing to reduce CO_2, NOx and noise levels by 20 to 30% compared to a state-of-the-art aircraft entering service in 2014. Thirty-four flagship demonstrators, more than 106 other demonstrators contributing to the flagship demonstrators, and more than 1000 technologies have been delivered by the end of the programme[5]. While major ones directly focus on the environmental benefits, all will enable better energy efficiency (and environmental benefits) while boosting the competitiveness of the EU aviation sector.

As highlighted in the 2023 Annual Activity report[6] of the Joint Undertaking (JU), Clean Sky 2 activities also triggered in total 581 patent applications and almost 2 100 scientific publications (only peer-reviewed and technical papers) between 2014 and 2023, reflecting the excellence of the programme.

Horizon Europe Clean Aviation partnership is impact driven and a lot of effort is put on the selection of technologies with potential to market uptake. Horizon Europe Clean Aviation focuses on aircraft technological innovations for a radically new next generation of regional and short-medium range aircrafts with a target entry into service by 2035 that will be at least 30% more energy efficient while reducing CO_2 emissions by at least 30% at aircraft level. At the same time, Clean Aviation also aims to support the longer-term objective for a climate neutral aviation by 2050. With its high level of ambition and focus on impact, Clean Aviation is instrumental for the European aviation industry to lead the global transition towards a 'Net-Zero' climate-neutral aviation system by 2050, setting new standards for safe, reliable, affordable and environmentally friendly air transport for the public. Accelerating this transformation is crucial as air travel demand has rebounded following the COVID-19 pandemic (2020-2022) and is projected to double by 2050. This strongly amplifies the urgency to tackle aviation's emissions and their impact on our environment and climate.

Delivering disruptive aircraft technological innovations, such as in more efficient propulsion systems equipped with high-performance light-weight batteries, hydrogen technologies and/or electric systems, by 2030 and supporting a subsequent fleet replacement with the next-generation of low-emission 'Clean Aviation' aircrafts are necessary steps for decarbonising Europe's aviation sector. This includes the introduction of new single-aisle aircraft, new regional aircraft, and small electric aircraft on intra-European routes over the next decade, combined with up-scaling of SAF and hydrogen production and the deployment of new airport

[4] https://clean-aviation.eu/sites/default/files/2021-12/SBA_FINAL_published%2030.11.2021_CELEX_32021R2085_EN_TXT.pdf
[5] https://www.clean-aviation.eu/sites/default/files/2022-03/CS2DP-October-2021.pdf; page 33.
[6] https://clean-aviation.eu/sites/default/files/2024-07/CAJU-GB-2024-06-20-AAR-2023.pdf; page 143 and 144.

infrastructure. The next-generation of commercial passenger aircraft to be developed over the next 10 years holds the potential to unlock a step-change improvement in energy efficiency of no less than 30% facilitating the transition to net carbon neutrality and in turn strengthening the competitiveness of the sector. This will also contribute to boosting European industrial leadership in aviation at global level, as well as European competitiveness and technological sovereignty of the aviation sector by reducing strategic dependencies and securing the European supply chain.

The strategic cooperation[7] between European Union Aviation Safety Agency (EASA) and Clean Aviation to anticipate certification requirements and prepare new certification and standardisation rules for disruptive technologies contributes to the timely implementation of results, allowing for an effective market up-take from 2035. For example, the new 'Certification Readiness Level' (CRL) scale developed in the Clean Aviation phase 1 project 'CONCERTO[8]' aims to provide a standardised process to regularly assess the progress towards certification of disruptive technologies and has been taken up and introduced by EASA under its innovation services. Besides substantially reducing fuel consumption and fostering green technologies by design, the policies and actions being implemented will contribute to establishing the European aviation sector as the global leader in the sustainable aviation transition.

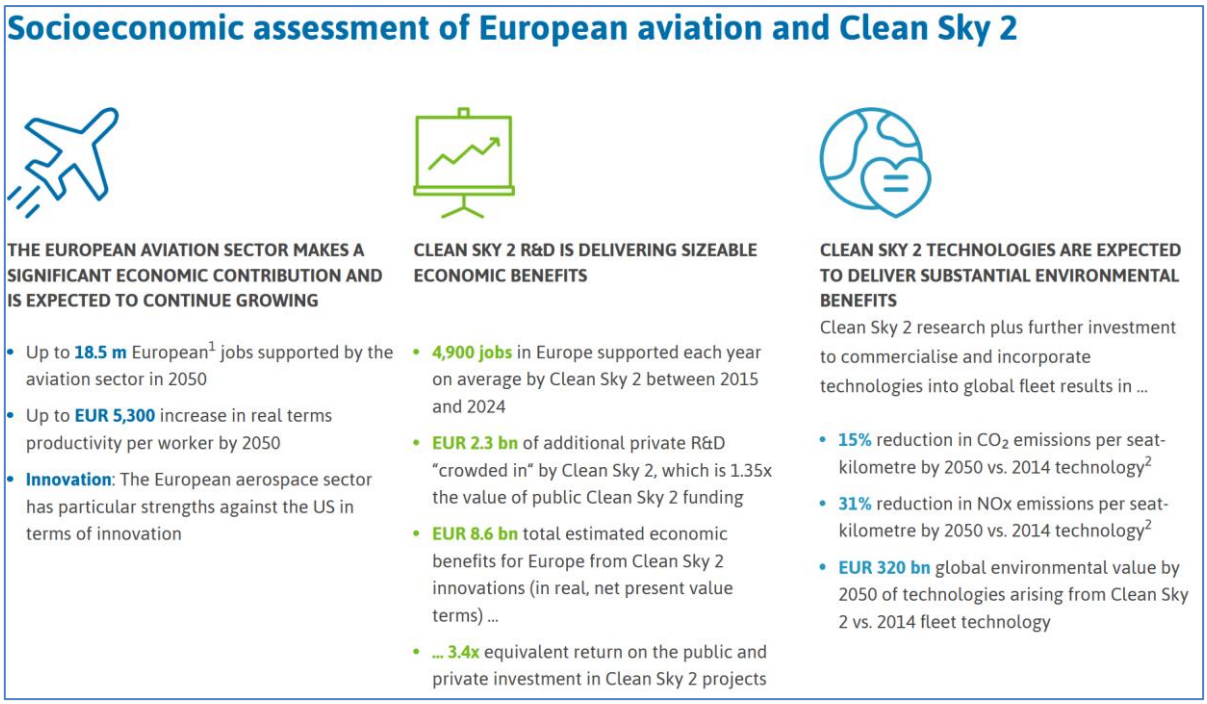
Ensuring the availability of future aircraft by 2035 requires additional investments to prepare for market uptake and the introduction of technologies into other aircraft segments (such as hydrogen for short-medium and long-range aircraft). Clean Aviation provides well-structured European cooperation and sets out a framework to accelerate the creation of disruptive technologies leading to a 'skip a generation' outlook in terms of future generation of aircraft replacement from 2035. It also provides a clear strategic R&I agenda to be implemented in close coordination with other European and national/regional R&I programmes to align on joint technical roadmaps, to create links and secure available funding.

A true European coordinated approach, aligning strategies and coordinating efforts made at European, national, and regional level for aviation R&I is needed to achieve a climate-neutral aviation system which is well beyond the capability and investment capacity of the private sector acting alone or of an EU country acting alone. As highlighted in the SRIA, the overall research and innovation effort needed to meet this challenge under the Horizon Europe timeframe is likely to exceed around 12 billion EUR. 'This effort can stimulate a product development in this sector worth over €50 billion. This stimulus could finally lead to an overall private investment in product deployment of more than €5 000 billion by 2050[9].'

Under Horizon 2020, the first global assessment of the Clean Sky 2 Technology Evaluator[10] estimated that by 2050 the technologies and solutions developed under the Clean Sky 2 programme (CS2) could contribute to reducing global aviation CO_2 emissions per seat kilometre by around 15% and NOX emissions by around 31% compared to 2014 technology. 'The cumulative environmental value of this emissions reduction alone out to 2050 is estimated

[7] https://clean-aviation.eu/media/news/easa-clean-aviation-enhance-cooperation-on-research-and-innovation-in-aviation.
[8] https://www.clean-aviation.eu/media/news/easa-has-introduced-a-new-certification-readiness-level-crl-scale-in-aviation
[9] https://clean-aviation.eu/strategic-research-and-innovation-agenda-sria
[10] https://cleansky.paddlecms.net/sites/default/files/2021-10/TE-FGA-TR_en.pdf

as at least €320 billion globally[11]' according to an independent study on the socioeconomic impact of the Clean Sky 2 programme. This study, commissioned by the CS2JU, also estimated an economic benefit of EUR 8.6 billion of the Clean Sky 2 programme. This represents a return of 3.4 times of the total public and private investment in the programme. A summary of the potential socioeconomic benefits of the CS2 programme is set out in the chart[11] below:



2. Additionality

The funding streams for the Horizon Europe Clean Aviation (2022-2031) are as follows:

- Horizon Europe: EUR 1.7 billion;
- Private members: at least EUR 2.4 billion.

After the first two call for proposals, 28 Clean Aviation grants were signed with a total value of EUR 806 million, triggering a total planned in-kind contribution of EUR 1 287.44 million for the period 2022-2026. This equals a leverage factor of almost 1.6 (only from members) and exceeds the minimum expected leverage factor of 1.41 calculated as the ratio between 'private side' contribution over EU's contribution. This significant contribution from private members and the European aviation industry from the outset of the Clean Aviation programme shows their strong commitment to transforming the sector to a climate-neutral system.

In Horizon 2020 Clean Sky 2, the EU's contribution was EUR 1 716 million while private members (Leaders and Core Partners or their affiliated entities) should provide at least EUR 965.25 million. At the end of 2023, the JU incurred 98% of the total programme expenditures, whereas private members already provided 115% of the expected total in in-kind contributions, with an IKAA rate of 146%[12]. Assuming that the planned/reported values for 2023 and for

[11] https://clean-aviation.eu/media/publications/socioeconomic-impact-of-the-clean-sky-2-programme
[12] https://clean-aviation.eu/sites/default/files/2024-07/CAJU-GB-2024-06-20-AAR-2023.pdf; page 102.

previous years will be fully validated, private members will exceed the overall EUR 2 155.00 million in-kind contribution (IKC) obligation as required by the Council Regulation.

3. Transparency and openness

R&I activities under Horizon Europe Clean Aviation partnership are selected via open calls for proposals. Phase 1 has already implemented two calls, and the 28 contracts were rewarded to over 280 participants from 24 countries (including associated countries and non-EU countries), while 14% of the participating entities are SMEs.

In phase 2, up to three more open calls will be implemented between 2025 and 2027, expecting to accelerate the creation and integration of selected technologies and support them towards demonstration. The calls are also expected to increase the overall participation and technical contributions mentioned in the programme.

Horizon 2020 Clean Sky 2 partnership launched 11 open calls for proposals as a complementary mechanism to support the (broader) activities of the Integrated Technology Demonstrators (ITDs), the Innovative Aircraft Demonstrator Platforms (IADPs) and the Transverse Activities in CS2, which were operating under a specific Grant Agreement for private members. CS2 was able to successfully create a broad eco-system[13] involving over 900 entities. Over 330 were SMEs, from 30 countries (including associated countries and non-EU countries, such as Canada and the US) and over 110 European regions where over 550 grants were awarded by the JU.

Horizon Europe Clean Aviation partnership has already expanded its membership, which includes leading EU aviation industry and academia (RTOs and universities) from EU countries and countries associated to Horizon Europe.

Twelve associated members were selected through a call for expressions of ideas / potential embers[14] launched by DG RTD end of 2020. During its first Governing Board meeting in December 2021, these 12 associated members were approved and added to the 27 founding members, allowing them to join the CAJU establishment and operations from the outset.

Horizon Europe Clean Aviation partnership was also the first JU under Horizon Europe to launch a call for expression of interest for new associated members[15], complementing the competences and capabilities relevant to implement the programme and its objectives.

After the successful launch and implementation of this call, the number of private members has increased from 39 founding and associated members to 59 (as of December 2023 and including two entities from the UK). Most of the Clean Aviation private members are from industry (54%), followed by public research organisations (22%), universities (14%) and SMEs (10%).

[13] https://clean-aviation.eu/clean-sky-2/facts-and-figures; https://clean-aviation.eu/clean-sky-in-your-country; https://clean-aviation.eu/sites/default/files/2021-09/Clean-Sky-Infographic-2021-v2.pdf.
[14] https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/call-future-clean-aviation-partnership-2020-08-26_en
[15] https://clean-aviation.eu/clean-aviation/participation/call-for-expression-of-interest-for-associated-members

Horizon 2020 Clean Sky 2 partnership was composed of 16 leaders[16] plus 31 participating affiliates which undertook to achieve the programme's full research and demonstrator activity. After the successful launch of four calls for core partners over the lifespan of the CS2 programme, CS2JU involved almost 180 core partners[17] (including participating affiliates). The core partners came from the entire supply chain (large industry and SMEs) as well as from academia (universities and RTOs) who had brought substantial long-term commitments, key competences, and technical contributions to the programme. Both leaders and core partners form the CS2 private members, with the Commission representing the public part of the CS2 membership.

There are open and transparent processes for consulting all relevant stakeholders and constituent entities in the identification of priorities and one of the key tasks of the Horizon Europe Clean Aviation Technical Committee (TC) is to propose technical priorities and research actions to be included in the work programme and the research topics for open calls for proposals. While open and transparent, the sheer number of members in the TC makes the decisions lengthy and complex. As technologies have to converge to a meaningful number of platforms for market uptake, it is clear that the decision-making process is based on transparent performance indicators (which in some cases are difficult to define in detail). In addition, in such a highly competitive market, intellectual property rights and company decisions are not shared fully in the open domain.

The Commission is represented in all technical committee streams and the TC leaders are striking a very good balance between the openness and implementation. Open and transparent processes for consulting all relevant stakeholders and constituent entities in the identification of priorities, are also supported by the States' Representatives Group (SRG). The Horizon Europe Clean Aviation Governing Board is ultimately responsible for the approval of all technical and administrative decisions.

4. Efficiency

The table below shows the payment appropriations made by the JU covering the period 2014-2023 for both Horizon 2020 Clean Sky 2 and Horizon Europe Clean Aviation partnerships.

The following table includes the total **operational costs** (OC) (EU contributions; Validated IKOP; Financial contributions to operational activities by JU partners; Eligible project costs funded by non-JU members to project activities; Contribution from Member States and international organizations to project activities), **certified IKAA** and **running costs** (commitment appropriations EU voted budget and contributions from sources other than the EU) for the period 2014-2023. See also Annex 4.4.1 for a comparison of operational expenditure and administrative expenditure of Joint Undertakings and EIT KICs of the period 2014 -2023.

[16] https://clean-aviation.eu/sites/default/files/2024-01/Work-Programme-and-Budget-2024-2025-December-2023.pdf; page 120.
[17] https://clean-aviation.eu/sites/default/files/2024-01/Work-Programme-and-Budget-2024-2025-December-2023.pdf; page 122.

Operational and administrative expenditure - Clean Aviation and Clean Sky 2 JU (2014-2023)
source: CORDA

The table includes data for Clean Aviation and Clean Sky 2 Joint Undertakings. ***OC****: Operational Costs;* ***IKAA****: Certified IKAA;* ***RC****: Running Costs*

	2014 [EUR]	2015 [EUR]	2016 [EUR]	2017 [EUR]	2018 [EUR]	2019 [EUR]	2020 [EUR]	2021 [EUR]	2022 [EUR]	2023 [EUR]	Total
OC	773,145,315	30,802,661	98,831,054	89,647,093	149,117,783	523,950,567	455,072,816	3,267,561	856,443,256	217,312,353	3,197,590,459
IKAA	-	-	199,156,575	63,252,985	160,761,149	196,819,130	218,138,020	105,926,835	85,794,229	314,750,893	1,344,599,817
RC	6,351,078	7,827,522	7,335,134	6,953,084	8,324,000	7,525,000	8,523,900	8,666,967	9,918,000	9,520,769	80,945,454

The three efficiency indicators required by the Financial Regulation are time-to-pay (TTP) (Article 116.1 of the Financial Regulation), time-to-inform (TTI), and time-to-grant (TTG) (Article 194.2 of the Financial Regulation). The Clean Aviation's average values are as follows:

- TTP: in 2023, 96% of the payments were made on time;
- TTI: in 2022, there was only one call for HE (and no calls for H2020), with a time-to-inform of 2.7 months, the target being 5-6 months;
- TTG: in 2022, 99% payments were made on time.

The Horizon 2020 Clean Sky 2 average values for TTG and TTP including the breakdown per year for the period 2016-2020 are as follows:

Average time-to-grant (TTG) for CS2 call for proposals (in Horizon 2020) was ~90%

Year	Clean Sky 2 calls for proposals in Horizon 2020	TTG
2020	CfP[18] 10 + 11	86% / 100%
2019	CfP 08 + 09	73% / 96%
2018	CfP 06 + 07	97% / 97%
2017	CfP 03 + 04 + 05	83% / 98% / 100%
2016	CfP 01 + 02	80% / 82%

Average time-to-pay (TTP) was ~97% for CS2/H2020 (2016-2020)

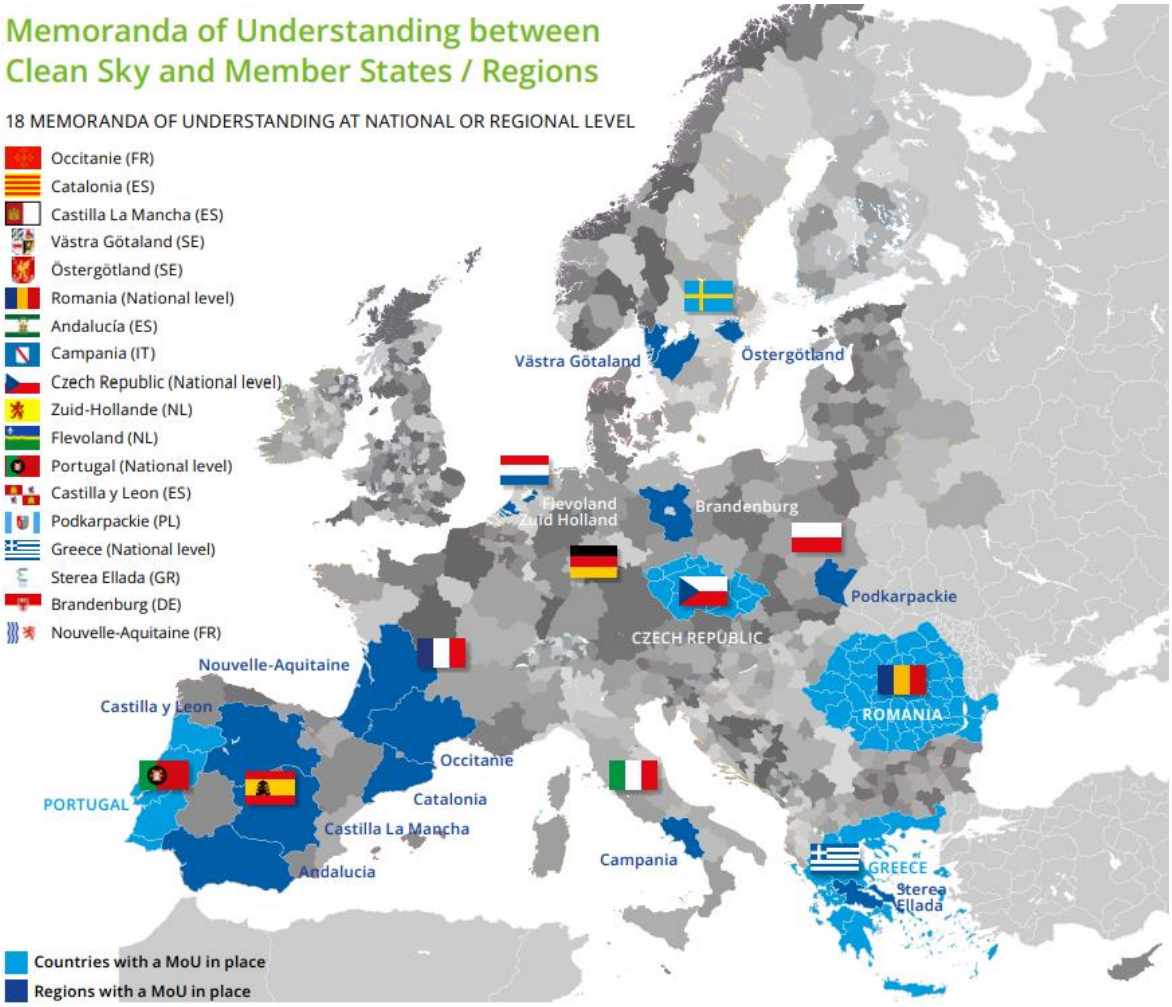
Year	TTP for Clean Sky 2/Horizon 2020
2020	99% (operations + administration)
2019	98% (operations + administration)
2018	98% (operations + administration)
2017	95% (operations + administration)
2016	95% (operations + administration)

[18] Call for proposals.

5. Coherence and synergies

The Horizon Europe Clean Aviation partnership plays a central role in the European 'innovation architecture'. It provides shared roadmaps and synergies within Horizon Europe (EU collaborative research and relevant HE PPPs), EU research programmes, national and regional research and innovation programmes, and cohesion policy funds such as the European Regional Development Fund (ERDF) and other financial instruments.

Synergies with private programmes as well as with European, national, and regional ones are fully exploited. The Horizon Europe Clean Aviation has created an ambitious plan to establish synergies with other programmes/partnerships with significant investment of effort.



In 2023, the Horizon Europe Clean Aviation partnership launched an action plan in cooperation the Commission to establish strategic cooperations based on synergies for 'Net-Zero' aviation with the key European Aeronautics Regions/Member States, mainly leveraging on Cohesion Policy funds / ERDF.

- Memoranda of Cooperation (MoC) were signed with Campania[19], Hamburg[20], Occitania[21] and Piedmonte[22], which collectively have put forward an ambition to contribute with up to EUR 300 million until the end of the operational programme to support project activities carried out in the region and contributing to the Clean Aviation objectives, based on an alignment of strategies (e.g. Smart Specialisation Strategies), technical roadmaps and work programmes/calls. A possible MoC with Andalusia is under negotiation.
- Regular strategic dialogues and interfaces with European countries having hundreds-of-million-sized national programmes targeted to Aeronautics R&I such as Germany (LUFO), France (CORAC), Spain (PTA/CDTI), as well as with the Netherlands (Luchtvaart in Transitie) and the UK (ATI).

Horizon 2020 Clean Sky 2 partnership has encouraged strategic collaborations with EU Member States and regions, largely by using synergies with the European Structural and Investment Funds (ESIF). Since the launch of this pilot programme in 2015, 18 Memoranda of Understanding (MoU) have been signed at national or regional level.

Through the 18 MoUs[23], 52 pilot projects were launched with a total additional budget of more than 50 million EUR. In addition, 12 Clean Sky Synergy Labels were awarded. These quality labels were awarded to complementary activities proposed by Clean Sky 2 beneficiaries, and they enabled those activities to be supported by ESIF funding. However, synergies between the JU and regions have been limited so far by difficulties in transferring cohesion funds to the JU to manage directly.

Horizon Europe Clean Aviation has established synergies to support and facilitate the achievement of the programme's high-level objectives.

- Memorandum of Cooperation[24] with European Union Aviation Safety Agency (EASA) to boost cooperation on aviation research and innovation.
- Memorandum of Understanding[25] with Clean Hydrogen JU to strengthen cooperation on research and innovation in hydrogen-powered aviation:

  In 2023, three projects contributing to the CAJU objectives on H2 powered aviation were launched by the Clean Hydrogen JU with a support of nearly EUR 35 million in

[19] https://clean-aviation.eu/media/news/clean-aviation-campania-region-step-up-collaboration-for-sustainable-aviation
[20] https://clean-aviation.eu/media/news/clean-aviation-hamburg-set-strategic-cooperation-to-accelerate-innovation-for-net-zero-aviation
[21] https://clean-aviation.eu/media/news/clean-aviation-occitanie-region-join-forces-to-accelerate-climate-neutral-aviation
[22] https://clean-aviation.eu/media/news/clean-aviation-piedmont-region-step-up-collaboration-to-deliver-disruptive-aircraft-technologies-for
[23] https://clean-aviation.eu/sites/default/files/2022-11/CleanAviation-synergies-report_en.pdf
[24] https://clean-aviation.eu/media/news/easa-clean-aviation-enhance-cooperation-on-research-and-innovation-in-aviation
[25] https://clean-aviation.eu/media/news/clean-aviation-clean-hydrogen-partnerships-strengthen-cooperation-on-research-and-innovation-in

EU funding (BRAVA/project ID: 101101409, NIMPHEA/project ID: 101101407 and COCOLIH2T/project ID: 101101404).

- Close collaboration with the Batteries Partnership (BATT4EU PPP):

  A preliminary alignment was achieved in the Batt4EU SRIA and in the batteries topics relevant to aviation, i.e. HORIZON-CL5-2023-D2-02-01 and HORIZON-CL5-2024-D2-02-02. Both topics are under the Batt4EU Partnership but include objectives, KPIs and targets in line with the expected Clean Aviation requirements for batteries.

- Re-vitalised the strategic alignment with the SESAR 3 JU which is key to make the targeted Clean Aviation low-emission aircraft disruptive technologies and concepts compatible with their insertion into the Air Traffic Management (ATM) system, to foster the launch of disruptive new products and services and their entry into service by 2035.

- Under the Horizon Europe Cluster 5 work programme, the following projects have been identified as relevant: (i) HESTIA (project ID: 101056865); (ii) MYTHOS (project ID: 101096286); (iii) IMPACT MONITOR (project ID: 101097011); and (iv) PULSAR (project ID 101095395).

- Horizon Europe Cluster 5, Destinations 5 and 6, collaborative and fundamental aviation research complement the partnership's activities.

- There is an ongoing action, led by the Clean Aviation Governing Board, with the EU Innovation Fund to better connect the Innovation Fund to Clean Aviation goals. This action is part of the overall synergies action (at the wider EU budget (multiannual financial framework level) of CAJU with the ambition to connect all relevant EU programmes and resources aiming at a wider ‘impact’ and increased efficiencies.

6. EU added value

The main added value of the Horizon Europe Clean Aviation partnership is the focused joint strategic research and innovation agenda developed by the Commission and the European industry to integrate and demonstrate disruptive aircraft technologies in a (relatively) long-term framework. This avoids fragmentation of efforts in the European market and annual uncertainties in budget and orientations. It also allows for a real integration and creation of a European supply chain in the aviation sector, contributing to the sustainable competitiveness of the European aviation industry.

Furthermore, it ensures that industry's research and innovation activities are aligned with the EU’s policy priorities. It contributes to building Europe’s leadership in innovation and technology and to delivering jobs and economic growth throughout the transition to a climate-neutral Europe by 2050. The approach can offer future generations the promise of continued, affordable, and equal access to air travel, with all its social and economic benefits, and contribute to the UN’s Sustainable Development Goals.

The institutionalised partnership with the EU, aligning R&I efforts together with the sector, is a powerful platform for integrating elements from other EU-level R&I, Member States’ national research programmes and regional specialisation strategies. This partnership ensures continual

lose alignment with the Commission's policy leadership. This is instrumental in creating the regulatory and economic conditions to successfully deploy globally competitive new aircraft with disruptive performance gains, having the necessary environmental impact by 2050.

7. Relevance

Horizon Europe Clean Aviation partnership has substantially deviated from the two Clean Sky programmes under FP7 and H2020. The objectives were aligned to the EU Green Deal and industrial competitiveness goals. Interdependencies in the objectives were set, as independent CO_2 and NOx goals were replaced by 'decreased net emissions of greenhouse gases by no less than 30% by 2030, compared to 2020 state-of-the-art technology, while paving the ground towards climate-neutral aviation by 2050'.

Therefore, the objectives of the partnerships are still very relevant regarding the challenges and needs addressed by the framework programme. Beyond supporting the achievement of the EU's Green Deal targets, Clean Aviation contributes to European competitiveness and industrial leadership in innovation and technology in aviation, while impacting sectors such as hydrogen, electrification, advanced materials, and manufacturing. It also provides jobs and contributes to economic growth during the transition to a climate-neutral Europe by 2050.

Horizon 2020 Clean Sky 2 and Horizon Europe Clean Aviation are key elements for the aviation sector to become **climate neutral by 2050** as well as to boost the EU's global competitiveness and excellence in this sector. Therefore, the programmes are well aligned with the high-level objectives as set out in the Regulation[26]. The programmes outcome has and will continue to contribute to the high-level objective of Horizon Europe Cluster 5, which focuses on reducing greenhouse gas emissions in the energy and transport sectors. The outcome of the partnership work also lays the foundation of the Alliance of Zero-Emission Aviation (AZEA) which should ensure the development of the necessary framework conditions to successfully deploy the technologies developed through the partnership in Europe.

The members of the Clean Aviation JU have recently completed the revision of its Strategic Research Innovation agenda (SRIA) after the first publication of this strategic document in November 2021. The revised version defines phase 2 of the Clean Aviation programme, planned for 2025 to 2030, which is designed to build on the advancements of the large-size, industry-led projects from phase 1, focusing on maturing and demonstrating key aviation technologies to achieve high Technology Readiness Levels (TRLs). This ensure that the programme's vision and overall ambition remain aligned to the programme's objectives as set out in Council Regulation (EU) 2021/2085, maximising the impact of the programme.

8. Directionality

Horizon Europe Clean Aviation is contributing to the EU climate goals, European competitiveness both in terms of securing highly-qualified jobs and growth in Europe and for the European technological sovereignty of the aviation sector, which is faced with strong governmental support by their counterparts in the US and China. The Clean Aviation

[26] OJ L 427, 30.11.2021.

partnership does this by supporting European-led innovation for the next generation of aircraft products and service by 2035 and by reducing the strategic dependencies from non-EU countries and securing the supply chain. By following a common strategy endorsed and supported by the European aviation industry and major aviation stakeholders including RTOs, Academia and SMEs and with significant level of private investments being triggered and being aligned to the programme, Clean Aviation is therefore showing strong European leadership and directionality both in terms of strategy and path to be followed. The recent revision of the SRIA in July 2024 confirmed both Hydrogen and Hybrid Electric as viable routes for the future new aircraft concepts type by 2035, as also confirmed by the recent 'AZEA vision document' published by the Commission in June 2024.

Clean Aviation plans to develop within its lifetime (31 December 2031) new disruptive aircraft technologies integrated and demonstrated at aircraft level (regional and small-medium range aircrafts types) which will ensure the capacity to deliver net greenhouse gas reductions of no less than 30%, compared to the 2020 state-of-the-art scenario. The technological and industrial readiness needed to deliver new products to market should accelerate the deployment of new aircrafts with this performance level by 2035; therefore, supporting 75% of the civil aviation fleet renewal by 2050.

In phase 2 (starting from 2025) the main focus will be on integrating and demonstrating a number of selected disruptive technological innovations around four targeted European aircraft concepts and one scalable demonstration concept. These concepts serve as reference aircraft concepts targeting the expected impact as defined in Article 57.2 of Council Regulation for the integration and demonstration of impactful technological innovations within Clean Aviation, as well as for relevant innovations supported by other EU, national, and regional programmes. This shows the programme's focus on impact and its ability to encourage coordination and alignment with other relevant programmes. The results will enable the aviation sector to progress towards the common objective to become sustainable and 'net-zero' by 2050, while supporting EU industrial leadership and technological sovereignty in this sector.

The move towards climate-neutral aviation requires a coordinated and efficient approach supporting aircraft technological innovations from 'research to market', as well as the timely availability of the required infrastructures and sustainable fuels (SAF and/or hydrogen) to respectively operate and power the next generation of low-emission aircraft as of 2035.

In this context, this goal is achievable if an effective integrated framework combining various existing EU instruments is proposed to accelerate the transition towards climate-neutral aviation by 2050. However, this will be highly dependent on the level of public support at EU and national level, and on the evolution of the operating framework to ensure a joint and coordinated effort.

9. International positioning

In phase 1 of the Clean Aviation partnership, secured the participation of entities from the UK in the technical activities selected from the two calls for proposals. These UK entities are supported by EUR 77.53 million of UK funding obtained under the Transitional Agreement.

Among the new associated members selected though the CEI in 2023, two UK entities (ZeroAvia and the University of Nottingham) joined the JU membership as well as one company from Türkiye, complementing the list of associated countries (Norway) actively involved in the programme as members.

Several projects also attracted the participation of international partners from non-EU countries such as Brasil, Switzerland and the US. The programme's first 28 projects[27] are developing key disruptive technological innovations critical to enable cleaner (hybrid-electric) regional and short-medium range aircraft, while also exploring hydrogen-propulsion solutions. The projects are geared towards European-industry-led initiatives driven by major players, such as Airbus's (ZEROe), ATR, Leonardo, Safran, Rolls Royce, MTU. Thanks to collaborations with non-EU countries, these projects are also contributing to the international positioning of European aviation. CAJU as the leading EU R&I aviation programme, combining excellence and innovation and being at the forefront of aviation R&I, is seen as a valuable partner on the global stage.

10. Phasing-out preparedness

According to the Single Basic Act[28], all Joint Undertakings have the legal obligation to adopt a plan for the phasing-out of the partnership from Horizon Europe funding by the end of 2023. The aim of the plan is to ensure a smooth continuation of the JUs' activities in the scenario of no funds available under the next Framework Programme. In this perspective, JUs are asked to perform an in-depth reflection on a phasing out strategy leading to a lesser dependence from the Union contribution.

In December 2023, Clean Aviation JU's Governing Board adopted a preliminary phasing out plan. It included administrative and operational adaptations, which should allow the JU to proceed its activities in case of no Union funding under the next Framework programme. In detail, the adaptations concern several aspects, such as legal status, staffing, accounting and cashflow, procurement, logistic and IT, follow up of the grant agreement obligations after the end of projects.

The drafting of the updated phasing out plan is currently ongoing and it is planned to be adopted in 2025. It should include concrete reflections on short- and long-term targets, strategic alignment, and financial sustainability. The aim is to develop a strategy enabling the JU to obtain the objectives beyond the duration of the Union's participation.

In the case of Clean Aviation JU, this is relevant to secure the 2030 and 2050 targets for a sustainable aviation, enabling the aviation sector to become net-zero in terms of carbon emissions by 2050 and maintaining its industrial leadership.

[27] https://www.clean-aviation.eu/sites/default/files/2024-09/Clean-Aviation-Daring%20projects-Infographie-Dec-2023.pdf
[28] Council Regulation (EU) 2021/2085 establishing the Joint Undertakings under Horizon Europe.