Chile's Actions to Enable Sustainable Aviation

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Introduction

In line with ICAO's Long-Term Aspirational Goal (LTAG) of achieving net-zero CO_2 emissions from international aviation by 2050, and with the global vision and the Global Framework for Sustainable Aviation Fuels (SAF), Lower Carbon Aviation Fuels (LCAF) and other Aviation Cleaner Energies, adopted at the Third ICAO Conference on Aviation and Alternative Fuels (CAAF/3), Chile is advancing a forward-looking, collaborative strategy to reduce emissions and promote sustainable development in its civil aviation sector.

In 2022, Chile submitted its first State Action Plan (SAP) to the International Civil Aviation Organization (ICAO). This document was jointly developed by the Directorate General of Civil Aviation (DGAC); the Civil Aeronautics Board (JAC) of the Ministry of Transportation and Telecommunications; the International Economic Relations Undersecretary of the Ministry of Foreign Affairs; the Ministry of the Environment; and the Ministry of Energy, with the participation of the *"Vuelo Limpio"* (Clean Flight) program.

This report highlights the implementation of sustainability initiatives and standards across air operations, airport infrastructure and operations, and air traffic management. It also recognizes the potential of green hydrogen (H_2V) to decarbonize aviation, and describes how Chile, through the *Vuelo Limpio* program, is supporting the creation of a collaborative public-private alliance to develop this industry and advance the sector's energy sustainability. In addition, the report reflects Chile's ongoing engagement with ICAO capacity-building initiatives and regional dialogue on CORSIA, and highlights the development of a national study to assess the potential impacts and implementation pathways related specifically to the offsetting phase of the mechanism. It also acknowledges the growing involvement of national air operators in voluntary sustainability efforts.

Progress since the first State Action Plan

The *Vuelo Limpio* program

Since the publication of the SAP, *Vuelo Limpio* has consolidated itself as a leader program in the Chile´s sustainable air transport landscape. The *Vuelo Limpio* program promotes initiatives to decarbonize air transport through public-private collaboration in the sector. Led by the Energy Sustainability Agency, the Civil Aeronautics Board, and the Ministry of Energy, the program engages with the three main national airlines, as well as smaller companies including helicopter operators, and other associated organizations such as airports, aviation fuel distributors, and academia.

One of its key action areas is the promotion of energy efficiency through the development of a baseline for fuel consumption and CO_2 emissions per each air operator company. This baseline corresponds to the first year of reporting and it is monitored on a yearly basis to assess the sector's performance. The program also encourages operational improvements by identifying energy efficiency opportunities, promoting best practices, and facilitating participation in the *"Vuelo Verde"* (Green Flight) working group, a space for public-private cooperation.

In parallel, it fosters the development and adoption of SAF (Sustainable Aviation Fuel) through the creation of the SAF 2050 Roadmap, which addresses five key areas: capacity building, regulation, market development, technology, and the SAF ecosystem. These focus areas are designed to overcome both supply- and demand-side barriers in the market.

Operational – Air Navigation Domain

The DGAC and IATA have established the Vuelo Verde Working Group to promote collaborative decision-making on operational matters. Members include DGAC, JAC, IATA, the *Vuelo Limpio* program, Santiago airport concessionaire, the Chilean Association of Airlines (ACHILA), and national airlines JetSMART, LATAM and SKY Airline. This group has achieved notable outcomes:

- **Simultaneous Approaches Using RNP T:** The implementation of simultaneous approaches using Required Navigation Performance Tango (RNP T) technology at Santiago Airport (SCL) has optimized arrivals from the south, reducing deviations, flight times, fuel consumption, and CO_2 emissions. This initiative has yielded an estimated annual savings of 570,000 kg of fuel and 1,800 tonnes of CO_2, while improving punctuality and operational efficiency. Based on this success, new procedures are being developed to enable simultaneous approaches and departures on both runways, further enhancing operational sustainability amidst increasing air traffic. It is worth noting that during 2024, 99,2% of international and 43,2% domestic commercial flights operate from/to SCL Airport.
- **Airport Efficiency Publication:** A dedicated aeronautical publication was developed to implement an airport efficiency program at SCL. It focuses on reducing aircraft separation between arrivals and departures and optimizing runway occupancy times. This will also lower GHG emissions from aircraft idling during takeoff sequences.
- **Enhanced Airway Navigation:** Continental airway requirements have been updated to incorporate RNP 2 navigation specifications alongside the existing RNAV 5. This enables aircraft to maintain their routes during ATS surveillance system failures (e.g., radar), thanks to improved navigational precision. It also facilitates unrestricted use of all flight levels, enhancing airspace efficiency.
- **Noise Mitigation Adjustments at SCL:** Noise mitigation measures at Santiago Airport that previously restricted nighttime operations on runway 17R have been revised. New limitations based on aircraft noise levels were implemented in line with current environmental regulations. As a result, 17R can now operate 24/7, increasing operational capacity—especially for quieter, more efficient aircraft—while reducing noise impact.
- **Advanced RNP (A-RNP) Implementation:** Chile is progressively implementing Advanced RNP technology at airports, adapted to its mountainous geography. This technology enables more precise departure paths, lowering fuel consumption and enhancing efficiency. It also helps air traffic controllers anticipate flight paths, optimizing airspace capacity without compromising safety. A-RNP approaches have already been implemented in Concepción and Atacama, with upcoming deployments in La Serena and Iquique.

Airport Domain

Significant progress has been made in integrating sustainability criteria into the design and construction of airport infrastructure. Specific plans require contractors to use renewable energy, sustainable materials, and responsible waste management to reduce emissions and improve energy efficiency.

At SCL Airport, 400 Hz systems have been installed at all passenger boarding bridges, allowing aircraft to receive electrical power from the ground. This reduces fuel consumption, emissions, and noise while enhancing operational efficiency and supporting sustainable aviation.

Air Operators

There is growing commitment among national air operators to sustainability, as demonstrated through the implementation of concrete measures. Airlines such as JetSMART, LATAM Airlines and SKY Airline, have adopted strategies to improve operational efficiency, renew their fleets with lower-consumption aircraft, and employ cleaner technologies, resulting nationwide in one of the world's youngest fleets (6,2 years old on average).

These companies also actively participate in the *Vuelo Limpio* program, submitting annual fuel consumption data and implementing actions to improve energy efficiency. As a result, they received national recognition with the "Vuelo + Limpio" certification in 2024.

Research and Development

Green hydrogen (H_2V) is being promoted as a key resource for decarbonizing aviation sector. Led by CORFO (Chile's

Production Development Agency), several initiatives include international financing, technology programs, and the creation of a Technology Center in the Patagonia Region. Efforts are also underway to develop human capital and strengthen international positioning through events such as the Green Hydrogen Summit, establishing Chile as a regional leader.

Current projects have an expected production capacity exceeding 300,000 tons annually. According to the Ministry of Energy (2024), demand will grow toward 2050, driven mainly by international markets, while domestic demand will be led by transport, followed by mining and industry from 2030 onward.

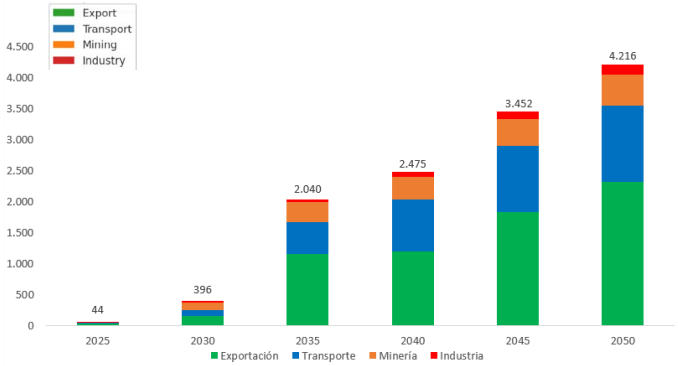

FIGURE 1: Projection of demand for H_2V (kTon H2), by destination, in a scenario consistent with carbon neutrality by 2050

CORSIA

Chile has not yet determined its voluntary participation in CORSIA's offsetting phase starting in 2027. In this context, the country is currently engaged in the ACT-CORSIA capacity-building program, supported by the United Kingdom, to evaluate the potential implications of such participation. This includes a comprehensive assessment of its expected impact on costs, air connectivity, and the competitiveness of the national aviation sector.

International Cooperation

Chile has established strategic partnerships with various countries to advance SAF development. A notable collaboration with the Netherlands focuses on joint research on e-SAF, launching pilot projects, and supporting the development of the Green Hydrogen Innovation Technology Center. It also facilitates information exchange on regulation, financial support, and investment.

In addition, partnerships have also been formed with Brazil and Colombia, strengthening regional integration.

The *Vuelo Limpio* program has actively participated in numerous initiatives, including working groups focused on pilot SAF and e-SAF projects, support for specialized human capital development, and promotion of R&D and innovation in Chile.

National Perspective from the SAF 2050 Roadmap

In 2024, Chile's aviation sector reached a historic milestone, exceeding 28 million passengers, with even more promising projections for the future. Fuel demand is expected to increase by 129% between 2019 and 2050, presenting a significant challenge for energy sustainability.

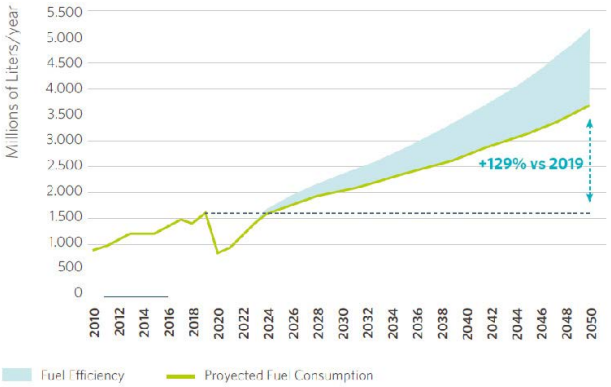

FIGURE 2: Projected aviation fuel consumption in Chile. Source: Chile's SAF 2050 Roadmap.

In this context, the energy transition toward SAF is essential. The SAF 2050 Roadmap, launched in 2024, stands as Chile's main public policy instrument for promoting SAF adoption, setting an aspirational goal of covering at least 50% of civil aviation fuel demand with SAF by 2050.The Roadmap aligns with key national climate policies, including the Long-Term Climate Strategy, the National Energy Policy, the National Green Hydrogen Strategy, and the Framework Law on Climate Change. Its development began in 2022, led by the *Vuelo Limpio* program and supported by the SAF Roundtable, a coalition of over 90 institutions from

national, international, and academic sectors, creating a robust foundation for SAF development in Chile.

FIGURE 3: National SAF Ecosystem

The SAF 2050 Roadmap is fully aligned with the global framework for cleaner aviation energies adopted at CAAF/3. It embraces guiding principles such as flexibility, inclusiveness, and country-tailored approaches to scaling up SAF production, while respecting national capacities and promoting social, economic, and environmental sustainability.

This roadmap not only reflects this conceptual alignment with the Global Framework, but also translates it into concrete milestones that showcase Chile's tangible progress towards the aviation energy transition.

Key milestones include:

- **First Public-Private SAF Agreement (2024):** This agreement brought together 48 organizations that committed to supporting SAF development through voluntary actions. Signatories include airlines, the aviation fuel value chain, academia, and associations, with commitments ranging from capacity building to infrastructure development and pilot plant creation.
- **Feasibility Study for SAF Production:** Funded by the Netherlands and conducted through ICAO's ACT-SAF program, this study will assess Chile's available feedstocks—such as agricultural and forestry biomass, green hydrogen, used cooking oil, and captured carbon—for SAF production. It will also evaluate infrastructure, economic and environmental factors, and the potential use of green hydrogen to produce e-SAF, a key solution for aviation decarbonization.
- **Study on International SAF Regulation:** Funded by Chile's Ministry of Transport and Telecommunications, this study will review SAF regulations in countries such as the United States, Singapore, Brazil, and the EU. It will focus on storage, import, production, distribution, and export of SAF.

Next Steps

In 2025, Chile will update its SAP with the aim of presenting a high-quality document aligned with ICAO guidelines, targeting the 42nd ICAO Assembly for sharing its outcomes. National stakeholders have already begun coordinating this work and developed a plan to strengthen both the content and scope of the SAP. Key actions include incorporating projections for international aviation emissions over the coming decades to establish a robust baseline for assessing mitigation impact. Additionally, the plan will seek to quantify the effect of implemented initiatives in terms of CO_2 reduction, enabling more precise planning aligned with national climate commitments. These developments will reinforce the SAP as a strategic tool for decarbonizing Chile's aviation sector.

Moreover, the development of SAF in Chile presents a promising outlook, with initiatives such as *Vuelo Limpio* and the SAF 2050 Roadmap guiding the path toward sustainable aviation. Future efforts will focus on consolidating the SAF ecosystem, enhancing cooperation, and expanding the Public-Private Agreement to accelerate SAF development and adoption. Based on the Feasibility Study results, a Business Implementation Study will be launched to assess the technical and economic viability of SAF production projects, including green hydrogen-based e-SAF options and financing strategies. Simultaneously, work will be carried out to design a regulatory framework that facilitates permitting processes and addresses existing gaps in the development of this emerging industry.

These efforts reaffirm Chile's commitment and contribution to the LTAG, and its alignment with the ICAO Global Framework for SAF, LCAF and other Aviation Cleaner Energies.